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RESEARCH ARTICLE

COMPARISON OF SERUM LIPIDS AND BLOOD PRESSURE IN PATIENTS WITH AND WITHOUT DIABETIC RETINOPATHY

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ABSTRACT

Objective: To evaluate the serum lipids and blood pressure in patients with and without diabetic retinopathy.
Subjects and Methods: A total of 200 subjects of both gender and age ranging 35 – 65 years, were recruited and divided into three groups. Group A include 100 healthy subjects as controls, group B include 50 diabetic subjects with no retinopathy and group C consists of 50 diabetic patients with retinopathy. Diabetic retinopathy (DR) was graded clinically by dilated Opthalmoscopic examination by a qualified ophthalmologist. In all study participants, we measured systolic and diastolic blood pressures along with serum lipid profile. Statistical analysis was performed using one way analysis of variance (ANOVA).
Results: There significantly increased levels of serum cholesterol, triglycerides, LDL-C and VLDL among three groups ($p<0.01$) while HDL-C levels showed significant difference when compared to healthy control ($p<0.05$). Similarly, both systolic and diastolic blood pressures showed statistically significant higher values in DR and without DR groups as compared to control group ($p< 0.01$).
Conclusion: We found significantly elevated blood pressure and dyslipidemia in diabetic retinopathy group. It is suggested that strict blood pressure monitoring along with glycemic and lipid control would be helpful in delaying the onset of complications.

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INTRODUCTION

Diabetes mellitus is a complex metabolic disorder, characterized by hyperglycemia resulting from defects, when the body is unable to produce enough insulin or cannot use it effectively, so glucose is unable to enter cells to produce energy. (American Diabetic Association. 2014) The latest estimates showed worldwide prevalence of 382 million people with Diabetes in 2013, which is expected to rise to 592 million by 2035. (International Diabetic Federation. 2015) According to World Health Organization, Pakistan has 5.2 million diabetic subjects and this number will reach to 13.9 million making it the fifth highest by 2030 (Niazi *et al.,* 2010).

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The chronic hyperglycemia leads to complications like retinopathy, nephropathy and neuropathy. Hypertension, dyslipidemia and abnormalities of lipoprotein metabolism are often found in people with diabetes mellitus (American Diabetic Association. 2004). Diabetic Retinopathy is a microangiopathy affecting the retinal precapillary arterioles, capillaries and venules. (Cukiernik *et al.,* 2004) and is the most frequent microvascular complication of type 2 diabetes mellitus causing blindness in a large number of people every year which could be prevented.(Fong *et al.,* 2004) The global prevalence for diabetic retinopathy is 34.6%. (Yau *et al.,* 2012) In Pakistan, prevalence in adults older than 30 years is 15.7 % (Khan *et al.,* 2010). Dyslipidemia and increased blood pressure may contribute in the development of atherosclerosis in the microvasculature of retina leading to retinopathy (Rizk *et al.,* 2013).

In diabetes, increased flux of glucose and free fatty acids leads to formation of reactive oxygen species (ROS) and inflammatory cytokines, thus causing oxidative stress that contributes in endothelial dysfunction of retinal micro vessels and formation of retinal hard exudates due to lipid peroxidation leading to disturbance in vision. (Landmesser *et al.,* 2000) Optimum control of blood glucose, blood pressure and possibly blood lipids remains the corner stone for reduction of risk in retinopathy development and progression. (Armitage and Bowman. 2004) Data about atherogenic dyslipidemia and role of blood pressure in the development of retinopathy in diabetic patients is still lacking in the local population of Karachi. The objective of this study was to evaluate the serum lipids and blood pressure in patients with and without diabetic retinopathy.

MATERIALS AND METHODS

This cross sectional, observational study was conducted in a tertiary care hospital during January 2014 to February 2015. The study was approved by the Institutional Ethical Committee of Basic Medical Sciences Institute of Jinnah Postgraduate Medical Center, Karachi, Pakistan. A total of 200 subjects were recruited from diabetic eye clinic with duration of diabetes more than three years and were divided into three groups,

Group A: included 100 healthy individuals taken as controls,
Group B: consisted of 50 diabetic patients without retinopathy and
Group C: included 50 diabetic patients with retinopathy. Verbal and written consent was taken from all subjects, duly signed or thumb printed.

The patients with T1DM, taking lipid lowering drugs, oral contraceptives, corticosteroids and hormone replacement therapy, patients having familial hypercholesterolemia and hyperlipidemia, diagnosed patients of chronic liver disease, chronic kidney disease and cardiovascular disease. Subjects having history of any eye surgery within last six months or any ocular condition which hinders the fundoscopic as well as retinal examination (hard cataract, corneal opacity or highly inflamed conjunctivitis) were also excluded from this study. A preformed questionnaire was filled with information about age, sex, educational level, marital status, smoking, occupation and past medical and surgical ailments along with duration of diabetes and current medication taken.

All subjects underwent general and systemic examination. Height was taken in centimeters and weight in kilogram. BMI was calculated from the formula, Body mass index (BMI) = Weight in kilograms / Height in meter square. BMI was categorized as normal (< 22 kg/m^2), overweight (> 22 and < 25 kg/m^2), and obese (> 25 kg/m^2).(William *et al.,* 2002) Both systolic and diastolic blood pressure was recorded by standard mercury sphygmomanometer after five minutes rest. Hypertension was defined following JNC 7 criteria. Normal: < 120 / 80 mmHg, borderline: 130-139 / 85–89 mm Hg. Hypertensive: ≥ 140 / 90 mm Hg. (Chobanian *et al.,* 2003).
Comprehensive dilated eye examination of all diabetic patients was done by a senior ophthalmologist and were graded according to International Clinical Diabetic Retinopathy Disease Severity Scale. A diagnosis of diabetic retinopathy was established if the subject has a minimum of one micro aneurysm in any field, or showing hemorrhages (dots and blots, or flame shaped) or maculopathy with or without clinically significant edema. (Zhang *et al.,* 2012). The blood samples were collected after an overnight fast of 8-12 hours. Ten ml of blood was drawn after all aseptic measures in upright position, after centrifugation serum was separated and stored at -70ºC until assayed. Before analyzing serum was thawed and allowed to attain room temperature. Serum lipid profile was measured by enzymatic colorimetric method, included total cholesterol, triglyceride and HDL-C. LDL-C and VLDL was calculated by Friedewald's formula: (LDL-C = TC - HDL-C – TG/5). Dyslipidemia was defined as NCEP ATP lll guidelines: total cholesterol ≥ 200 mg/dl; LDL cholesterol ≥ 100 mg/dl; TG level ≥ 150 mg/dl; HDL cholesterol ≤ 40 mg/dl. (NCEP ATP lll guidelines. 2002). Data was analyzed using the Statistical Package for Social Sciences software version 20. Continuous data was expressed as mean ±standard deviation (SD). Comparison of variables between 3 groups was done using One – way Analysis of Variance (ANOVA) and post hoc tukey test for continuous / quantitative variables.

RESULTS

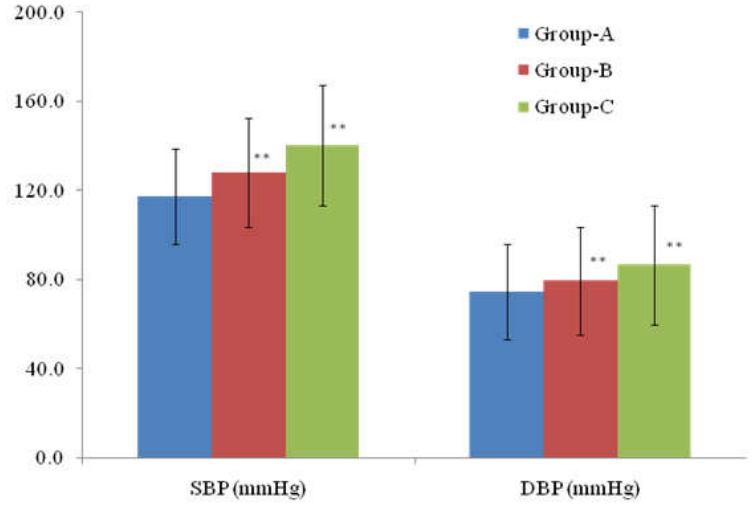
The baseline characteristics of all study participants are summarized in **Table 1**. The mean age was 50 years. No significant difference was found in the mean age among the three groups. Gender based distribution showed Group A comprises of 100 healthy individuals out of which 40% were males and 60% were females. Group B consists of 50 diabetic individual without retinopathy, out of which 28% were males while 72% were females. Group C comprises of 50 diabetic patients with retinopathy, out of which 34 % were males and 66 % were females. No significant difference was seen in gender distribution when all three groups were compared. This table also showed anthropometric measurements, height showed no significant difference, while in weight statistically significant difference was observed when compared to group A with $p<0.05$. Statistically significant difference was also seen in the Body mass index (BMI) when diabetics with retinopathy group were compared to group B and group A with $p<0.01$.

Figure 1 showed the comparison of systolic and diastolic blood pressures among the three groups. Statistically significant difference were observed in the mean systolic and diastolic blood pressures when group C was compared with group B and group A with $p<0.01$. Figure 2 showed the lipid profile variables among the three groups. Statistically significant difference was seen in lipid profile. Serum cholesterol, triglyceride, LDL-C and VLDL showed significant higher values when group C was compared with group B and group A with $p<0.01$. Statistically significant difference was Comment [K4]: Plz Note the changes done here Comment [K5]: Note corrections made here Comment [K6]: Note correction also observed in serum HDL-C levels when compared with group A healthy controls with $p < 0.05$.

Table 1. Baseline characteristics of all study participants

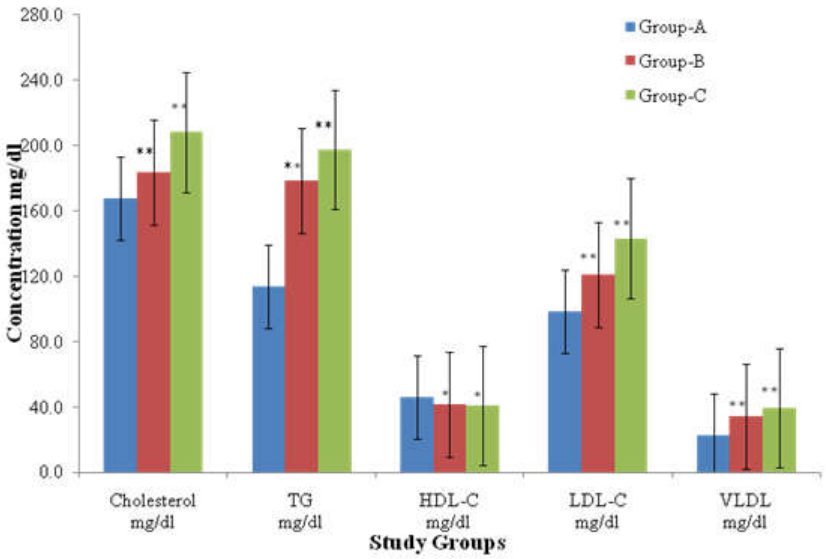
Variables	Group A (Control group) (n=100)	Group B (DM without retinopathy) (n=50)	Group C (DM with retinopathy) (n=50)
Age (years)	50.05±6.37	51.80±7.46 NS	50.68±5.73 NS
Gender			
Male	40%	28% NS	34% NS
Female	60%	72% NS	66% NS
Height (cm)	162.72±6.61	162.42±8.12 NS	161.40±6.35 NS
Weight (Kg)	65.41±5.73	75.6±7.94*	76.04±9.01*
BMI (Kg/m^2)	24.72±1.96	28.73±3.38**	29.30±3.92**

Values are expressed as mean±SD.
* Statistically significant as compared to group A p < 0 .05
** Statistically significant when diabetic patients with retinopathy were compared to group B and group A p < 0.01.
NS = No significant difference was found in mean age, gender and height among the three groups.



Values are expressed as mean±SD.
** Statistically significant when diabetic patients with retinopathy were compared to group B and group A p < 0.01.

Figure 1. Comparison of systolic and diastolic blood pressure among study groups



Values are expressed as mean±SD.
* Statistically significant as compared to group A p < 0 .05
** Statistically significant when diabetic patients with retinopathy were compared to group B and group A p < 0.01.
TG =Triglyceride, HDL-C = High Density Lipoprotein Cholesterol, LDL-C = Low Density Lipoprotein Cholesterol, VLDL = Very Low Density Lipoprotein.

Figure 2. Comparison of lipid profile variables among study groups

DISCUSSION

Type 2 Diabetes mellitus is associated with dyslipidemia that causes lipid infiltration into the retina leading to formation of retinal hard exudates and macular edema, that leads to blindness. (Gnaneswaran *et a*l., 2013) In the present study statistically significant difference was found in all the variables of lipid profile among the three groups. In our study we observed statistically significant difference between Total Cholesterol, Triglyceride, LDL-C, HDL-C and VLDL levels in diabetic patients with DR when compared to without DR and healthy controls. Similar findings were also reported by Gnaneswaran *et al*., 2013 who observed significant difference in Total Cholesterol and LDL-C but not in TG, VLDL and HDL-C. (Gnaneswaran *et al*., 2013) Data from the Chennai urban Rural Epidemiology study (C.U.R.E.S.) showed mean Cholesterol, TG and Non-HDL levels were higher in diabetic patients with DR than without DR, these findings were in accordance with our study.(Rema *et al*., 2006).

The proposed reasons for these lipid alterations could be the increased free fatty acid entry along with insulin deficiency leads to enhanced synthesis of triglycerides. The mobilization of free fatty acid from adipose tissue and their uptake by the liver increases cholesterol synthesis, thus responsible for raised plasma cholesterol (Kareem *et al*., 2004) In our study we did not found any significant difference in the mean age but females were slightly predominant in this study. Hussain *et al*., 2013 who also reported slight predominance of females but also found significant difference in the mean age of study subjects (Hussain *et al.,* 2013).

In the current study we also found statistically significant difference in the systolic and diastolic blood pressures of the study subjects. These findings were similar with Van Leiden *et al*., 2002 who suggested that retinopathy, not only disturbed glucose metabolism but also lipid metabolism and blood pressure. The reason may be increased capillary permeability, microaneurysm formation and retinal ischemia. Rema *et al*., 2006 and Agroiya *et al*., 2013 also observed statistically significant association of Systolic blood pressure and Diastolic blood pressure with the severity of diabetic retinopathy. (Rema *et al*., 2006, Agroiya *et al*., 2013)

Conclusion and Recommendations

In Pakistan diabetes mellitus is increasing day by day, due to dietary habits and sedentary lifestyle along with other risk factors. This study found statistically significant association of systolic and diastolic blood pressures and serum lipid levels with diabetic retinopathy. Effective monitoring, dilated eye examination and strict glycemic and lipid control would be beneficial in delaying the onset of complications, but above all this, most important is patient education and change in lifestyle.

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