Original Article

Atherogenic Index of Plasma in Normotensive Adults with Type 1 Diabetes Mellitus

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ABSTRACT

Objective: Type 1 diabetes is an organ specific autoimmune disease characterized by a progressive cell-mediated destruction of beta cells of the pancreas which leads to an absolute dependence on insulin for survival and maintenance of health. The present study was designed to look at the levels of atherogenic index of plasma (AIP) in normotensive adults with type 1 diabetes mellitus. The study was also intended to look for the difference, if any, in AIP levels between type 1 diabetics and the control healthy group.

Study Design: Observational and comparative study.

Place and Duration of Study: This study was conducted at Department of Biochemistry and Clinical Chemistry, Khyber Medical College, Peshawar from July 2006 to December 2006.

Materials and Methods: In this study 30 patients with Normotensive Type 1 Diabetes Mellitus and 30 healthy control individuals were included. Blood samples of patients and control individuals were collected and analyzed for glucose, lipid profile and AIP was evaluated.

Results: The age and the body mass index (BMI) were having no significant statistical difference between the patient and the control group. Blood glucose, lipid profile and AIP were found to be significantly higher in normotensive type 1 diabetic patients when compared with control subjects.

Conclusion: The study emphasizes that the determination of Atherogenic index of plasma as a routine measure can be used as an early predictor of atherosclerotic complications in diabetes mellitus.

Key Words: Atherogenic Index of Plasma, AIP, Dyslipidemia, Type 1 Diabetes Mellitus, Diabetes Mellitus.

INTRODUCTION

Type 1 diabetes is an organ specific autoimmune disease characterized by a progressive cell-mediated destruction of beta cells of the pancreas which leads to an absolute dependence on insulin for survival and maintenance of health[1]. The global number of individuals with diabetes in 2000 was estimated to be 171 million (2.8% of the world's population), a figure projected to increase in 2030 to 366 million (6.5%), 298 million of whom will live in developing countries[2].

Although most attention has focused on the increase in type 2 diabetes, a parallel rise in type 1 has occurred. A type 1 diabetic has always been known as disease of childhood, but more recent epidemiological studies have indicated that the incidence of type 1 diabetes is comparable in children and adults[3]. In the younger type 1 diabetes mellitus patients acute complication such as hyperglycemia and ketoacidosis are the main causes of death while renal and cardiovascular disease are responsible for the majority of deaths in the older population[4]. As in persons with type 2 diabetes and the general population, dyslipidemia is a significant risk factor for coronary heart disease (CHD) for type 1 diabetic patient. Dyslipidemia is a preventable major risk factor for coronary heart disease[5].

Diabetic dyslipidemia is generally characterized by increased plasma triglyceride (TG) and decreased high density lipoprotein – cholesterol (HDL-C) concentrations, a preponderance of small, dense low density lipoprotein (LDL) and an increased apolipoprotein B concentration[6]. The level of dyslipidemia predicts macrovascular complication such as coronary heart disease in patients with type1 diabetes mellitus[7]. Identification of risk factors, such as dyslipidemia is considered of great importance in terms of avoiding chronic micro and macro vascular complications[8].

Atherogenic index of plasma (AIP) is defined as logarithm of plasma triglyceride concentration to the concentration of high density lipoprotein cholesterol[9]. AIP provides information about the atherogenicity of plasma and quantifies the response to therapeutic intervention[10]. It is also considered as a significant predictor of coronary heart disease[11]. This study evaluates the level of atherogenic index of plasma in normotensive adults with type 1 diabetes mellitus.

MATERIALS AND METHODS

A total of 60 subjects were included in this study. Thirty previously diagnosed Type 1 diabetic patients and equal number of control (non-diabetic) healthy individuals having no history of taking lipid lowering drugs , multivitamins especially antioxidant vitamins and not suffering from coronary heart disease, hypertension or any other disease participated in this study.

The study was conducted in Department of Biochemistry and Clinical Chemistry, Khyber Medical College Peshawar. Blood samples were collected from

normotensive Type 1 diabetic adult patients as well as from the control subjects in the morning after an over night fast. Serum was separated after blood was allowed to clot by centrifugation at 2500 rpm for 15 minutes. Estimation of serum glucose determination was done immediately. Blood glucose, triglycerides, cholesterol and HDL-c were analyzed by enzymatic colorimetric method, using kits supplied by Randox Laboratories Ltd. Ardmore, United Kingdom. LDL-c and VLDL-c were calculated by Friedewald's formula[12] and Wilson's formula[13] respectively. Atherogenic Index of Plasma (AIP) was calculated as log (TG/HDL-C)[14].
The results were expressed as mean ± SD. Statistical significance was evaluated by Students t-test was applied and differences among two groups were considered significant at $P<0.05$.

RESULTS

The study population consisted of 30 known cases of type 1 diabetes mellitus and 30 healthy controls. The mean values of age in case of type 1 diabetes mellitus (34.47 ± 5.34 yrs), the control group (35.37 ± 4.33 yrs) and the mean values of BMI in case of type 1 diabetic group (21.73 ± 3.72 Kg/m^2), control group (22.97 ± 1.67 Kg/m^2), were all indifferent statistically.

Table No. 1: Blood Glucose, Lipid Profile and Atherogenic Index of Plasma of control subjects and Normotensive Adult Type-1 Diabetic Individuals

	Control (n=30)	Normotensive Adult Type-1 Diabetic (n=30)
Glucose (mg/dl)	91.87 ± 6.32	201.10 ± 46.64 *
Triglycerides (mg/dl)	131.70 ± 13.29	174.70 ± 30.09 *
Cholesterol (mg/dl)	179.53 ± 23.68	225.47 ± 30.66 *
HDL-c (mg/dl)	51.87 ± 8.74	34.83 ± 4.63 *
LDL-c (mg/dl)	101.37 ± 26.80	155.62 ± 27.18 *
VLDL-c (mg/dl)	26.33 ± 2.73	35.00 ± 6.10 *
AIP	0.05 ± 0.08	0.34 ± 0.09 *

P < 0.001 as compared to Control subjects

Comparison of serum glucose and lipid profile between normotensive type 1 diabetic adult patients and healthy control subjects is shown in Table 1. Fasting serum glucose, total cholesterol, triglycerides, LDL-C were found significantly high ($P<0.001$) in normotensive type 1 diabetic adult patients when compared with non diabetic subjects, on the other hand the levels of HDL-C was found to be significantly lower ($P<0.001$) in type 1 diabetic patients as compared to control group. Plasma atherogenicity (Atherogenic index of plasma) was found significantly high ($P<0.001$) in normotensive type 1 diabetic adult patients when compared with (non diabetic) healthy control group.

DISCUSSION

Diabetes is a chronic illness that requires continuing medical care and ongoing patient self-management education and support to prevent acute complications and to reduce the risk of long-term complications[15]. Patients with diabetes mellitus develop atherosclerotic vascular disease earlier with great severity than non-diabetic subjects. Approximately 35% of patients with insulin dependant diabetes mellitus die of coronary artery disease by the age of 55 years[16]. Although the prognosis of the type 1 diabetes mellitus has improved considerably over the past 50 years, it is still exceeds that of general population[4]. The present study reveals increased concentration of triglycerides, total cholesterol, low-density lipoprotein cholesterol and very-low-density lipoprotein cholesterol; whereas the high-density lipoprotein cholesterol levels were significantly lower in normotensive Type1 Diabetic adults as compared to the healthy non-diabetic control subjects.
Torres-Tamayo and colleagues[17] noticed increased triglycerides and total cholesterol levels in Type1 Diabetic patients. A group of research workers also reported significantly higher serum total cholesterol and apolipoprotein B levels in Type1 Diabetic group of patients[18]. In a study by Perez et, al. comparison of adult Type 1 diabetics with non diabetic patients showed a higher LDL-C , total triglyceride and low HDL-C levels in 16%, 5%, and 20% of patients and 13%, 6%, and 9% of controls, respectively . Diabetic women showed more hypercholesterolemia than non-diabetic women[19]. EURO DIAB IDDM complication study on type 1 diabetic adults reports the prevalence of LDL hypercholesterolemia in 45% in men and women while hypertriglyceridemia was observed to be 12% in men and 8% in women[20]. Sarman and group showed significant higher levels of serum total cholesterol and apolipoprotein B in type 1 diabetic patients as compared to non diabetic subjects[18].
AIP indicates a balance between the actual concentration of plasma triglyceride and high density lipoprotein, which predetermine the direction of cholesterol transport in an intravascular pool is the flux of newly produced cholesteryl esters by lecithin cholesterol acyl transferase (LCAT) towards atherogenic LDLs or beneficial HDLs[21]. The atherogenic index of plasma has recently been proposed as a marker of plasma atherogenicity because it is increased in people at higher risk of coronary heart disease and is inversely correlated with LDL particale size. AIP values of - 0.3 to 0.1 are associated with low coronary artery disease (CAD) risk, 0.1 to 0.24 medium and above 0.24 high risk[22].

CONCLUSION

The study emphasizes that the determination of Atherogenic index of plasma as a routine measure can be used as an early predictor of atherosclerotic complications in diabetes mellitus.

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