ORIGINAL ARTICLE

Biochemical Evaluation of Effects of Diabetes Mellitus on Excretory Functions of Liver

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ABSTRACT

Fifty subjects were selected for the present study. These were divided into two groups. Group A included 20 normal controls and Group B included 30 subjects with diabetes mellitus. Serum cholesterol, bilirubin, gamma GT and alkaline phosphatase were measured by commercially available kits. Qualitative detection of Isoenzymes of alkaline phosphatase were done by electrophoretic method. Serum cholesterol levels, Serum GGT and Serum alkaline phosphatase levels were significantly raised in patients with diabetes mellitus as compared to controls. There was significantly positive correlation between hyperglycemia and alkaline phosphatase in patients with diabetes mellitus. Predominant Intense, deep blue bands of hepatic isoenzymes of alkaline phosphatase were present in patients with diabetes mellitus by electro-phoretic method.

Key words: Cholesterol, Diabetes Mellitus, Excretory functions, Alkaline Phosphatase, Gamma GT

INTRODUCTION

Diabetes mellitus (DM) is a generalized, chronic metabolic disorder manifesting itself in its fully developed form, by hyperglycaemia, glycosuria, increased protein break down, ketosis and or acidosis (2007)[1]. DM is frequently associated with hepatomegaly which in type I is related with increase in the glycogen content, while in type II it is associated with fatty change of large droplet type[2,3].

Zimmerman et al (1950) [4] studied correlation between biopsy findings and functional changes in liver in diabetes mellitus. Biopsies revealed in some of the patients increased intracellular glycogen content and in others fatty change. In the former, associated increased hyperglycemia was noted. Most of these patients revealed bromosulphthalein (BSP) retension. Camerini et al (1962)[5] noted that a large group of diabetics showed increased BSP retension and high alkaline phosphatase levels.

Clinically enlarged and tender liver has been seen in diabetics[6]. Bloodworth (1960) [7] observed that by increasing the duration of disease with the help of modern therapy the incidence of cirrhosis is increased in diabetics. Falchuk and Conlin (1983) [8] and Miller et al (1979)[9] observed a picture resembling alcoholic hepatitis without polymorph infiltration in type II DM. Sando et al (1980)[10] studied that hepatic excretion of insulin was decreased in obese diabetics of maturity onset diabetes mellitus. Sadika et al (1987)[11] detected low HDL cholesterol in diabetics which showed increased hepatic triglyceride lipase activity.

In diabetes mellitus the glucose out put is increased due to increased activity of glucose 6-phosphatase which facilitates the release of glucose into the blood. On the contrary, glucokinase activity is decreased, and thus the liver continues to produce glucose even in presence of severe hyperglycemia[12]

METHODOLOGY

Fifty subjects, male and female (30 diagnosed patients of diabetes mellitus and 20 non diabetic healthy controls) were divided into groups given below.

Patients suffering from hepatic disorders, significant alcoholism or other substance abuse, pregnancy or use of oral contraceptives (in cases of female subjects) were excluded from study.

Seven ml of blood was drawn very gently and slowly from the antecubital vein of the patients and controls. Five ml of blood was immediately shifted to clean dried centrifuge tubes, allowed to clot and the tubes were centrifuged at 3000 rpm for ten minutes. The serum was separated and stored in properly labeled serum capsules at 4^0C till analyzed.

RESULTS

The study was performed on 50 subjects, age and sex matched which were grouped as under. Subjects were divided into groups A & B. Group A included 20 age, sex and socio-economically matched normal controls. Group B included 30 subjects with diabetes mellitus (Table 1 & 2).

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Table 1: Serum cholesterol, alkaline phosphatase and GGT in control group and patients with diabetes mellitus

Tests	Group A	Group B	Level of Significance
Serum cholesterol	143.5±4.81	235.8±7.21	A vs B (HS) (p<0.01)
Serum alkaline phosphatase	140.8±4.32	395.3±16.18	A vs B (HS) (p<0.01)
Serum GGT	29.0±1.91	90.3±5.24	A vs B (HS) (p<0.01)

Table 2: Electrophoretic patterns of alkaline phosphatase isoenzymes in subject with diabetes mellitus (Group B) (n=30)

Alkaline Phosphatase Isoenzyme	=n	%age
Hepatic only	25	83.3
Predominantly hepatic & faint intestinal	05	16.7

DISCUSSION

The role of liver in diabetes mellitus has long been recognized because of its important place in carbohydrate metabolism. Diabetes mellitus leads to changes in liver related to both its functions and morphology. Diabetes mellitus is frequently associated with hepatomegaly which in type 1 is related with increase in the glycogen content[3] (Hildes et al., 1949). While in the type II it is associated with fatty change of large droplet type[2] (Creutzfeldt et al, 1998).

Serum Cholesterol Level: In this study, serum cholesterol level in subjects with diabetes mellitus (Group B) was elevated comparing with control group (A) and difference was highly significant (p<0.01) statistically. This increased cholesterol in diabetic patients may be due to increased hepatic triglyceride lipase activity which results in decreased HDL Cholesterol and thus increased the cholesterol level. My study is in favour of the results of Sadika et al (1987)[11] and Sherlock (1985)[12] who also observed these elevated levels of cholesterol in patients of diabetes mellitus.

In this study, serum alkaline phosphatase level in subjects with diabetes mellitus (Group B) was elevated when comparing with control group (A) and difference was highly significant (p<.0.01) statistically. The increase in serum alkaline activity in the diabetic state could be as a result of an increased call for energy through alkaline phosphatase activity rather than the glycolytic and oxidative pathway of glucose 6 phosphate. It might be attributed to the cytolysis and leakage out of necrotic or damaged cells in the liver. This study is consistent with the results of Falchuk & Conlin (1983) [8], Sando et al (1980)[10] and Sherlock (1985)[12], who also observed elevated levels of ALP in diabetic patients.

In this study, serum GGT level in subjects with diabetes mellitus (Group B) was elevated when comparing with control group (A) and difference was highly significant (p<0.01) statistically. This increased GGT in diabetic patients may be attributed to the cytolysis and leakage out of damaged cells in the liver. This study is consistent with the results of Sherlock (1985) [12], Sando et al (1980)[10], Monami et al (2008) [14] and Falchuk & Conlin (1983)[8], who also observed increased GGT levels in patients of diabetes mellitus.

Serum alkaline phosphatase isoenzymes were analysed by agarose gel electrophoresis technique. Twenty five patients revealed a sharp, compact and intense blue band of hepatic isoenzyme as identified in comparison to the control serum. The liver isoenzyme was the fastest moving isoenzyme towards the anode. Five patients revealed a second band with a mobility faster than placental but much slower than liver isoenzyme bands. These bands were too faint to be photographed and were in the region of intestinal isoenzyme. Spooner et al (1982)[13] analysed alkaline phosphatase isoenzymes in seven patients (all with raised serum alkaline phosphatase and gamma glutamyl transferase) and reported three patients with liver and three with bone isoenzymes only whereas the remaining one patient had both the liver and bone isoenzymes and was suffering from diabetes mellitus.

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