COMPARISON OF FRUCTOSAMINE AND GLYCOSYLATED HEMOGLOBIN IN A NON-INSULIN DEPENDENT DIABETIC POPULATION

M. Amini[1]*., B. Moaydi*[2]*., M. Ani*[3]*., S. Yonesi*[1] *and M. Hosseinpour*[1]

(1) Endocrine and Metabolism Center, Amin Hospital, Faculty of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

(2) Department of Immunology, Faculty of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

(3) Department of Biochemistry, Faculty of Pharmacy, Isfahan University of Medical Sciences, Isfahan, Iran

Abstract - In an attempt to determine the clinical value of fructosamine assay for monitoring type II diabetic patients, correlation of fructosamine with glycosylated hemoglobin was studied. 100 patients with type II diabetes mellitus were compared with 100 normal subjects. Fasting blood glucose, glycosylated hemoglobin, albumin and fructosamine were measured in all subjects. In the diabetic patients, a significant correlation was observed between fasting blood glucose and glycosylated hemoglobin ($r = 0.64$, $P < 0.01$) and serum fructosamine ($r = 0.7$, $P < 0.01$). There was also a significant correlation between glycosylated hemoglobin and serum fructosmine ($r = 0.94$, $P<0.01$). Fructosamine, assay can be used as an index of diabetes control.

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Key Words: Fructosamine, glycosylated hemoglobin, diabetes mellitus

INTRODUCTION

Diabetes mellitus is the most common metabolic disease in the world(1). Although many authors have established serious complications due to diabetes (2-5), the latter can be controlled by maintaining blood glucose at accepted levels (6-10). Protein glycosylation plays a role in the metabolic control and in the pathogenesis of diabetic complications; indeed it has an important role in the process leading to micro-and macroangiopathy in diabetes (11). Evaluation of diabetic control can be performed by using fasting plasma glucose, glycosylated hemoglobin (GHB) and fructosamine (12). In an attempt to determine the clinical value of fructosamine assay for monitoring type II diabetic patients, the correlation of fructosamine and GHB was studied.

MATERIALS AND METHODS

Patients

In this study, 100 patients with type II diabetes mellitus (50 males and 50 females; average age 55.48±10.86 years) were selected. The control population consisted of 100 subjects, (60 males and 40 females; average age 50.2±10.3 years), with normal glucidic tolerance as assessed by oral glucose tolerance test (OGTT). Subjects with previous history or clinical findings of chronic liver disease, malignancy, thyroid disease, pregnancy, chronic renal disease, venous disease, medications (oral contraceptive, captopril, penicillamine, propylthiouracil, hexosamines) and hypoproteinemia were excluded. World Health Organization (WHO) criteria (13) were used for the diagnosis of non-insulin dependent diabetes mellitus (NIDDM).

Specimens

Blood from each fasted subject was collected by venipuncture in EDTA- evacuated tubes and kept at 4° C before and during study. Samples were analyzed for fasting blood glucose by the glucose oxidase method (Pars Azmun, Tehran, Iran), GHB by calorimetric method (Mahsa Yaran, Isfahan, Iran). Albumin was measured by calorimetric method (Zist Chemi, Tehran, Iran). The nitro blue tetrazolim method (NBT) was used for the measurement of fructosamine.

Statistical analysis

SPSS (V. 6) was used for tabulating the data and calculating unpaired Student's t-test. The unpaired Student's test and ANOVA were used for comparisons involving continuous variables. Multivariate analysis for examining the association of variables was performed by multiple regression and linear correlation. In this study P less than 0.05 was considered significant.

RESULTS

Table 1 compares the demographic features of cases and controls. In table 2, the metabolic variables of groups were compared. In the diabetic patients, there

was a satisfactory correlation between fasting blood glucose and GHB (r = 0.64, P<0.01) and serum fructosamine (r = 0.7, P<0.01). There was also a significant correlation between GHB and serum fructosamine (r = 0.94, P<0.01).

Table 1. Demographic features of cases and controls

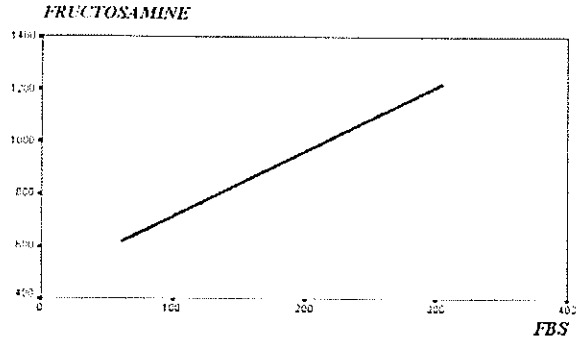
	patients	controls	P
Total number	100	100	
men to women ratio	1 : 1	1.5 : 1	NS
age (years)	55.48±10.86*	50.2±10.3*	NS

* Mean ± SD

In the control group, the correlation between fructosamine and fasting blood glucose (r=0.5) and GHB (r=0.3) were smaller. Regression analyses showed that in patients, results had a slope different from the control group. (fig. 1). The correlation between fructosamine and albumin was significant in both groups (r=0.06 in patients and r = 0.2 in controls).

Table 2. Metabolic features of groups

	patients	controls	P
Fasting plasma glucose(mg/dl)	165.2±48.3	86.2±9.97	0
Glycosylated hemoglobin(%)	10.14±2.05	6.16±0.7	0
Fructosamine (μmol/lit)	876.07±169.35	463.4±69.2	0



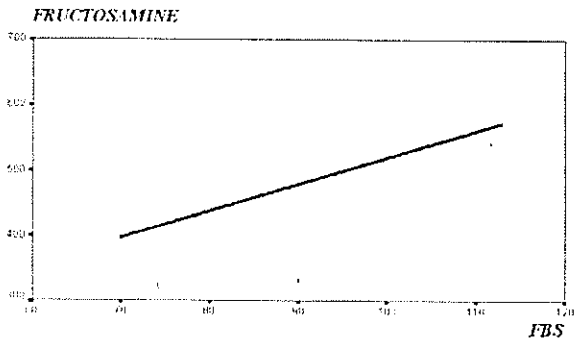


Fig. 1- Comparison of regression line in patients (above) and controls (below)

DISCUSSION

This cross-sectional study found a significant correlation between fructosamine and both GHB and fasting plasma glucose. Fructosamine is a general name for several serum proteins which have a non-enzymatic reaction with the glucose molecule and produce a stable ketoamine (1-amino-1- deoxy-2- fructose)(14). The production rate of this metabolite is dependent on glucose concentration and half-life of these proteins. Today, many investigators and medical centers determine serum fructosamine as a parameter for monitoring metabolic control in diabetes (15-18). Ajabnoor and coworkers (19) compared serum fructosamine in 105 Saudi diabetic subjects with 54 healthy nondiabetic subjects. Their study showed that fructosamine concentration in the diabetics was significantly higher than in healthy controls, and it correlated significantly with fasting blood glucose and HbA1 in diabetics (r=0.67and r=0.59 respectively). Cockram and coworkers (20) showed that fructosamine measurement had the advantages of being cheaper and faster to perform on large numbers of patients than HbA1 measurements. Kuenburg and coworkers (21) showed that fructosamine may be considered as an alternative diabetic long-term parameter to HbA1c.

A possible advantage of fructosamine its the short half-life (16 days). Therefore changes in the metabolic control of diabetes can be evaluated faster. However, variations of protein concentrations limit the clinical usefulness of fructosamine (22), but in selected patients it can be used safely. The results of several studies have shown that decreased albumin may decrease fructosamine. In our study although serum albumin was significantly lower in diabetic patients, after adjusting the fructosamine level for albumin, serum fructosamine was greater in diabetics than controls.

In conclusion, our results suggest that in selected NIDDM patients, fructosamine assay can be used as a parameter for diabetes control.

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