Vidyodaya J. of Sci. (2001) Vol. 10, pp 119-126

A preliminary study of serum fructosamine values of Sri Lankan adults.

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Received on: 02.14.02
Accepted on: 04.24.02

Abstract

The determination of glycosylated serum proteins (Fructosamine) has become an accepted method for assessing the metabolic situation in diabetic patients. As there are no studies reported on serum fructosamine levels for Sri Lankan adults, a cross-sectional descriptive study was conducted with 326 non diabetic, 160 impaired glucose tolerance (IGT) and 160 diabetic subjects to monitor their serum fructosamine levels. Results revealed that the serum fructosamine values of normal and IGT subjects were in the range of 192 to 260 μmol/L and 264 to 290 μmol/L respectively. The diabetic subjects had value more than 297 μmol/L. No significant difference was observed between males and females and between age groups. Overall the fructosamine values obtained by the present study could be used as an index for assessing the glycaemic status of an individual and to monitor the metabolic control of diabetic patients over a moderately shorter period of 2-3 weeks.

Key Words: Fructosamine value, Non-diabetic, Impaired Glucose Tolerance, Diabetic

1. Introduction

Elevated levels of blood glucose are held responsible for many complications of diabetes such as microvascular disease, retinopathy, nephropathy and neuropathy (1). However, strict glycaemic control could delay the onset and slow the progress of complications.

The blood glucose concentration represents the actual conditions at the time the blood sample is collected. Until long-term glucograms are available, the course of blood glucose concentration with time can only be

determined incompletely. The quantitative determination of glycation products has proved a useful auxiliary parameter for long term glycaemia diagnosis. The clinical importance of glycosylated haemoglobin (HbA_{1c}) is established in this context. Similary, the clinical relevance of fructosamine as a measure of the degree of glycation of serum proteins had been recognized in the recent past.

Glucose reacts non-enzymatically with proteins to form Schiffs bases which, through an Amadori conversion, are rearranged into stable ketoamines (2). Fructosamine indicates the ketoamine group formed by glucose with serum proteins. The largest fraction, about 60-70% of the glycated serum proteins consist of albumin with a half-life of about 2-3 weeks, thus the level of fructosamine is related to the average glucose concentration in blood over moderately shorter period (3).

In practice, however the data available on the fructosamine reference values for Sri Lankans are very rare and therefore the present study was conducted to establish some reference values for non-diabetic and diabetic subjects in Sri Lanka.

2. Methods and meterials

A cross-sectional descriptive study was performed with 326 non-diabetics, 160 impaired glucose tolerance and 160 diabetic subjects attending hospital clinics with equal number of males and females of age group ranging from 18-70 years. The study population represented five provinces viz. Western, Southern, South-west, Central and North Central of Sri Lanka. Subjects with proteinuria have been excluded from the study.

Screening of non-diabetics was based on the WHO (4) criteria, i. e. those with less than 110 mg/dL of fasting blood glucose or with the postprandial blood glucose level less than 140 mg/dL. Those who had above the normal values were screened by oral glucose tolerance test and identified the impaired glucose tolerance (IGT) subjects i. e. 2 hour blood glucose level of 140-190 mg/dL after ingestion of 75g of glucose (5). The screening of diabetics was based on their clinical history and/or the 2 hour blood glucose value of greater than 200mg/dl after 75g of oral glucose test.

Sample collection and laboratory assay

Venous blood from each subject was collected into two sets of tubes. One set contained sodium fluoride/potassium oxalate and other set did not contain any anticongulants. Blood collected into tubes containing anti-co-

agulant, centrifuged immediately at 2000 rpm for 15 min and plasma was separated and assayed for glucose by the standard glucose oxidase method, whilst the blood collected into plain tubes was allowed to clot and serum was separated and stored at -20^{0}C pending frutosamine assay. Serum fructosamine assay was performed by a colorimetric method (6).

Statistical Analysis

Results were analysed using SPSS package and the significant difference between variables were calculated by two-way ANOVA using Mann-Whitney U test.

3. Results

Analysis of data revealed that the serum fructosamine value among the non-diabetics in Sri Lanka ranges from 192 to 260 µmol/1 (i.e. 2.5 to 97.5%) with a mean value of 226 (fg. 1). No significant difference (P>0.05) was observed between males and females or between age groups (Table 1).

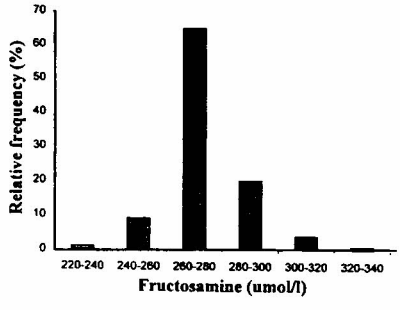

Figure 1 : Distribution of Serum Fructosamine values of non-diabetic (normal) subjects in Sri Lanka

Table 1 Serum fructosamine values (µmol/1) of normal (non-diabetic) adults of Sri Lanka.

Age (Years)	Males (n=163) Mean±SD	Females (n=163) Mean±SD
18 - 30 (n=54)	232±24	235±25
31 - 50 (n=55)	220±24	229±29
51 - 70 (n=54)	228±26	232±23

The serum fructosamine values of IGT subjects fall within the range of 264 to 290 µmol/1 (i.e. 2.5 to 97.5%) with a mean value of 275 µmol/1 (fig. 2). No significant difference (P>0.05) was observed between males and females and age groups (Table 2).

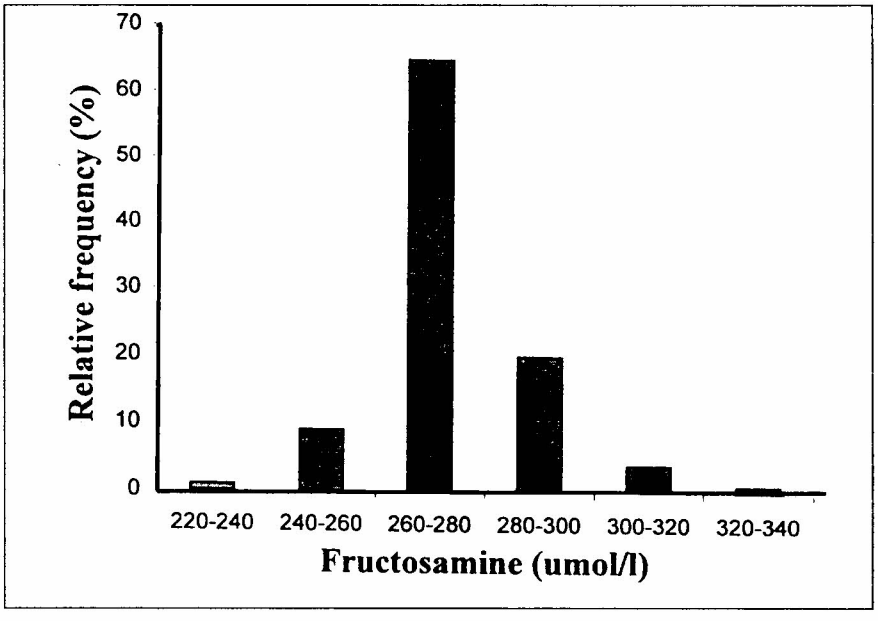

Figure 2 Distribution of serum fructosamine values of Impaired Glucose Tolerance subjects in Sri Lanka.

Table 2 Serum fructosamine values (µmol/1) of Impaired Glucose Tolerance (IGT) and diabetic subjects of Sri Lanka.

	Age 31-50 Years		Age 51-70 Years	
	Males	Females	Males	Females
Subject Group	(n=40) Mean±SD	(n=40) Mean±SD	(n=40) Mean±SD	(n=40) Mean±SD
IGT	276±11	278±12	268±9	272±12
Diabetic	374±76	354±58	359±60	368±71

The diabetic subjects had high serum fructosamine values of more than 297 μmole/1 (table 2 and fig. 3) and these values were significantly higher (P>0.001) when compared with the non-diabetic subjects (Table 3). The significant differences between males & females and the age groups of diabetics were not tested due to their poor metabolic control of blood glucose.

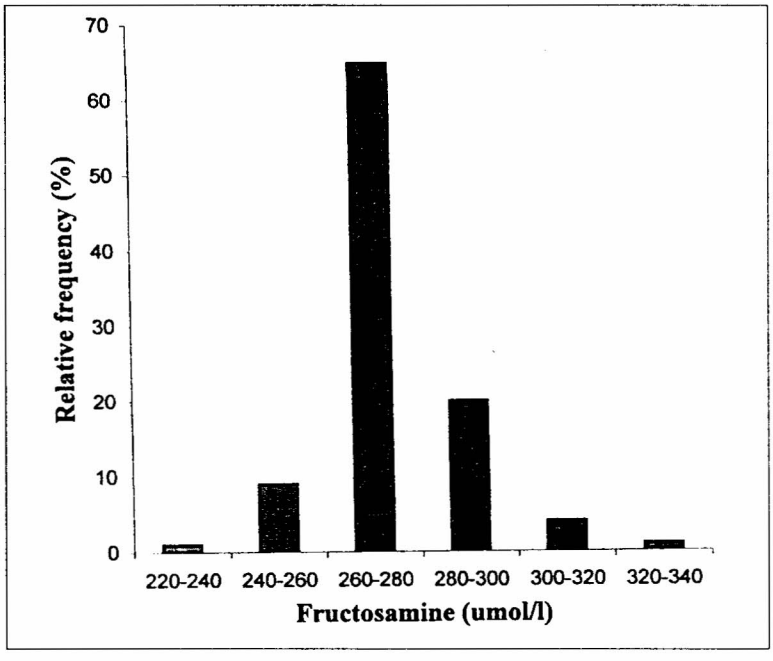

Figure 3 Distribution of serum Fructosamine values of Diabetic subjects in Sri Lanka

Table 3 Serum fructosamine values (μmol/L) of non-diabetic and diabetic subjects of Sri Lanka.

Subject Group	Age 31-50 Years		Age 51-70 Years	
	Male (n=40) Mean±SD	Female (n=40) Mean±SD	Male (n=40) Mean±SD	Female (n=40) Mean±SD
Non-Diabetic	221±23	230±28	227±27	233±24
Diabetic	274±76	354±58	359±60	368±71

4. Discussion

A blood sugar determination tells us the glycaemic status about a period of only a few minutes. Self-testing for urinary sugar at regular intervals of 4 to 6 hours yields and average over this period. A 24 hrs. urine sample again provides information on the behaviors of the mean blood sugar during this period, particularly whether it has exceeded the renal threshold, and if so to what extent. Glycosylated haemoglobin provides information of the individual glycaemic status spanning a period of 6-8 weeks. Between these two parameters lies the fructosamine which gives a picture covering of 2-3 weeks. Therefore serum fructosamine values may be an effective parameter for evaluating the long term control of diabetes and a method of screening patients who are at risk of developing diabetes in later life.

Results of this study revealed that the serum fructosamine values of non-diabetic adults range from 192 to 260 μmol/1 (i. e. 2.5 to 97.5%) whilst the IGT adults show a value range of 264 to 290 μmol/1 suggest that the serum fructosamine value of 260 μmol/1 could safely be taken as upper normal limit. As there are no frucosamine reference values available for impaired glucose tolerance, the values reported by the present study may be of value in screening the IGT subjects.

The fructosamine range reported for non-diabetics in the present study, corresponded closely to the published value i. e. less than 285/ μmol/1 (7). Furthermore, the lower reference value of 297 μmol/1 reported for diabetics by the present study confirm the results of other publi-

cations (7,8). Hence the 290 value could safely be considered as the upper limit for IGT subjects.

However, the serum fructosamine values may vary with the serum protein concentrations, especially with the albumin level. Therefore, usefulness of fructosamine is limited in patients who are receiving frequent haemodialysis therapy, as dialysis leads to marked fluctuations in the protein concentration between pre and post-dialysis procedure (8). In patients with chronic renal insufficiency, fructosamine parameter for monitoring diabetic control could therefore only be used if a correction of the fructosasmine value is made to the total protein or albumin concentration (8).

Nevertheless, fructosamine assay provides an useful index of glycaemia capable of distinguishing normal (non-diabetic) and diabetic populations. Therefore the reference values reported by the present study could be used locally to monitor diabetic control in the diabetic clinics in Sri Lanka.

5. Acknowledgements

The study was supported by NSF research grant (RG/95/M/15). Author gratefully acknowledge the assistance given by Mr. K. P. R. Niroshana (Technical Assistant) during the study period.

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