



Study of HbA1C to Fructosamine in Type2 DM in Early Detection of Diabetic Complications

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ABSTRACT

In few studies earlier showed upon determining fructosamine reflecting the concentration of blood glucose over the period of 2-3 weeks whereas HbA1c showed concentrations of blood glucose level for last 6-8 weeks. Whereas the amount of fructosamine increased in diabetes thought to constitute to the long term complications of the disease. The fructosamine assay is affected by decreased serum albumin concentrations in conditions like nephrotic syndrome and hepatic disease. A combination of fructosamine and HbA1c determination is useful in type2-DM. 25 cases of controls and 25 patients were analysed for lipid profile, FBS and PLBS, HbA1c, fructosamine and MAU with diasys kits for assays. Mean value of HbA1c in controls and patients with type-2DM was 4.72 and 9.32 and mean value of fructosamine was 200.7 and 378.9 respectively. The p value for HbA1c and fructosamine in controls and patients of diabetes showed highly significant (p value < 0.0001) when taken as controls of HbA1c to the controls of serum fructosamine and patients of type-2 DM with HbA1c to patients of DM with fructosamine. The highly significant of levels of HbA1c to fructosamine shows that in patients of type2-DM fructosamine is an important test in combination to HbA1c estimation.

KEY WORDS : HbA1c, Fructosamine, Type-2DM.

Introduction

Recent statistics from WHO project showed an increase in prevalence of DM worldwide in developing countries. Type-2 Diabetes has a more gradual onset, with slowly rising glucose levels over time, and its diagnosis has required specified glucose values to distinguish

pathologic glucose concentrations in non-diabetic populations. Diagnosis of Diabetes in modern times has relied on measurement of plasma (blood or serum) glucose concentrations in fasting and post prandial samples. The NDDG (National diabetic data group) relied on distribution of glucose levels, rather than on the relationship of glucose levels with complications, to diagnose diabetes despite emerging evidence that the micro vascular complications of diabetes were associated with higher range of fasting and OGTT glucose values [1-4]. It is noted that a reliable measure of chronic glycemic levels such as HbA1c which captures the degree of glucose exposure over time and which is related more intimately to the risk of complications than single measure of glucose levels, serve as a better biochemical marker of diabetes.

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There are studies related to HbA1c which is stronger correlation to retinopathy than between FBG and retinopathy [5]. The correlations between HbA1c levels and complications has also been shown in type2DM [6]. MAU is potent risk factor for cardio vascular events, early detection of diabetic nephropathy and death in type 2 DM. Currently, India leads the world with largest number of diabetic subjects. This is expected to rise further in coming years [7]. There are studies that fructosamine (glycated serum albumin) showed increase in type2-DM. An attempt in this work to establish the correlation of increase of fructosamine in type2-DM with concentrations of blood glucose and HbA1c leading to complications. In one study determination of fructosamine reflects concentration of blood glucose over the period of 2-3 weeks, whereas HbA1c reflects the last 6-8 weeks [8]. The amount of fructosamine is increased in diabetes thought to contribute to the long term complications of the disease [9]. But to some extent Fructosamine assay is affected by decreased serum albumin concentration in conditions like nephrotic syndrome and hepatic disease [9]. Therefore combination of fructosamine and HbA1c determination is useful, because the determination of fructosamine has advantage over assay of glycated Hb because of half-life of albumin is shorter than that of Hb. The concentration of fructosamine will change more rapidly than those of glycated Hb. The fructosamine serves as an index of intermediate term diabetic control (1-3 weeks).

Aim of The Study

The aim of the present study is to evaluate the significance of fructosamine in serum to the combination and comparison of HbA1c estimation in type2-DM, which can prove the best test to reflect early complications. The objective is to decrease mortality and

morbidity by simple measures like life style modification and pharmacotherapy. The study was carried out at Chalmeda Anand Rao Institute of Medical Sciences (CAIMS), Karimnagar, Telangana, India.

Materials and Methods

Study Population

The study population consisted of 50 subjects (Males aged 40-60 years) divided into two groups. Type-2 Diabetic patients < 5 years (n=25) and non diabetic subjects (n=25). The study was carried out at Chalmeda Ananda Rao Institute of Medical Sciences, (CAIMS) Karimnagar, Telangana.

All the samples were analysed in "BS 300 Fully automated Mindray, Germany" during the period from 1st January, 2015 to 31st March, 2016.

Inclusion Criteria

Type-2 DM patients were diagnosed based on the WHO study group report criteria.

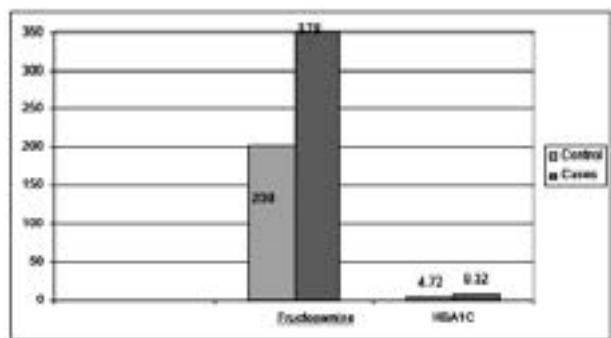
Exclusion Criteria

Patients with incomplete records, presence of urinary tract infection and heart failure were excluded.

Specimen Collection

All venous blood samples were obtained after overnight fasting of 12 hours for FBS, lipid profile, serum fructosamine (plane tube) and HbA1c (EDTA tube) in aseptic conditions. Samples were analysed on BS300 fully auto analyser, consent were taken from control subjects and patients of type-2 DM. The parameters analysed were calibrated with Diacal auto lypholised control serum [10,11]. Fructosamine done by calculation based on HbA1c values which are multiplied by factor 58.82

Fig. No.1 : Comparison of HbA1C and Fructosamine



The 25 individuals of Non Diabetic and 25 patients of Type 2 Diabetes Mellitus were analysed in the Lab for FBS, PLBS, HbA1c, Microalbuminuria, Lipid profile with fasting & post meal samples appropriately in CAIMS, Hospital, Karimnagar. The serum values of HbA1c and Fructosamine are taken for this study from the other parameters analysed.

The diagrammatic picture of comparison of HbA1c and fructosamine shows that fructosamine control and patients of type-2DM as 200 and 378 and HbA1c as 4.72 and 9.32 respectively in the graph.

Table.No. 1: Comparison of HbA1c In Control & Cases of Type 2D

HbA1C	CONTROL	CASES OF TYPE 2DM
MEAN	4.72	9.32
SD	0.24	1.87
P VALUE	< 0.0001	< 0.0001

Table. No. 2: Comparison of Fructosamine In Control & Cases of Type 2DM

FRUCTO SAMINE	CONTROL	CASES OF TYPE 2DM
MEAN	200.16	378.84
SD	10.2	69.7
P VALUE	< 0.001	< 0.0001

Discussion

In present study, increase of fructosamine in type 2 diabetes correlates with concentrations of Blood glucose and HBA1c leading to complication of disease. The half life of RBC is about 120 days, that of albumin about 14-20 days. In one study determination of fructosamine reflects concentration of blood glucose over the period of 2-3 weeks, whereas HbA1c reflects the last 6-8 weeks[8]. The amount of fructosamine is increased in diabetes thought to contribute to the long term complications of the disease[9-11]. Fructosamine assay is affected by decreased serum albumin concentration in conditions like nephrotic syndrome and hepatic disease. A combination of fructosamine and HbA1c determinations is useful. The determination of fructosamine has advantage over assay of glycated Hb because of half-life of albumin is shorter than that of Hb. The concentration of fructosamine will change more rapidly than those of glycated Hb. The fructosamine serves as an index of intermediate term diabetic control (1-3 weeks) which can alert physician to deteriorating control even before changes in HbA1c can be detected. In practice, fructosamine is rarely measured clinically (even in individuals with hemoglobinopathies or other red cell disorders) due to a number of pragmatic concerns.

First, diabetes care is rarely changed in short (1-4 weeks) intervals, since diabetes medications can take months to reach a steady state. An exception to this is pregnancy, where medication needs can change more rapidly and fructosamine may help provide closer short-term monitoring.

second, fructosamine has higher variability than HbA1c tests.

Third, The overwhelming majority of studies in diabetes care are based on HbA1c measurements, which can make fructosamine results difficult to interpret.

Fourth, The HbA1c test is very well standardized [13] and trusted due to its nearly universal use. Each change of 3.3 mmol (60 mg/dl) in average blood sugar levels will give rise to changes of 2% HbA1c and 75 micromol fructosamine values [14]. However, this overemphasizes the upper-limit of many laboratories reference ranges of 285 micromole/L as equivalent to HbA1c 7.5% rather than 6.5%. A comparative study [15] which has been used in official advice for quality and outcomes framework guidance in the UK [16] and summarised by the United States National Quality Measures Clearinghouse [17-18] gives the following formula and resulting values.

$$\text{HbA1c} = 0.017 \times \text{fructosamine} + 1.61$$

Table No.3 Reference details for fructosamine

Hence: Fructosamine = $(\text{HbA1c} - 1.61) \times 58.82$.

Fructosamine (μmol)	HbA1c %	HbA1c IFCC (mmol/mol)
200	5	31
258	6	42
288	6.5	48
317	7	53
346	7.5	58
375	8	64
435	9	75
494	10	86
552	11	97
611	12	108

Thus in present study fructosamine is better parameter than HbA1c in type-2 DM.

Conclusion

The highly significant of levels of HbA1c to fructosamine shows that in patients of type-2-DM fructosamine is an important test in

combination to HbA1c estimation. The scope of the study is for early detection and good control of diabetic complications i.e kidney diseases.

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