Comparitive Study of Serum Albumin and Glycosylated Haemoglobin Levels in North Indian Patients with Type 2 Diabetes Mellitus

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Abstract-Type 2 diabetes mellitus in Asian Indian people is characterized by a young age of onset and occurrence at low levels of BMI. Available data also suggest that the susceptibility of Asian Indian people to the complications of diabetes mellitus differs from that of white populations. To investigate whether a correlation exists between HbA1c and serum albumin levels in South Indian patients with type 2 diabetes mellitus, a prospective study of electronic case records of type 2 diabetes patients presenting to the institution as part of the routine care was undertaken. Those who attended the diabetes clinic for screening but were not found to be diabetic (HbA1c <6.5%) served as the reference group. Fasting and Post-Prandial blood Glucose, HbA1c levels and serum albumin levels were measured. Spearman correlation and multiple linear regression analysis were done to test the dependence of albumin on HbA1c, Fasting blood sugar as well as Post-Prandial blood sugar levels. The values of HbA1c values were higher when the levels of albumin were low and lower when the level of albumin level was high. Serum albumin level was significantly lower in the reference group of patientswhen compared with control group and correlated negatively with HbA1C levels. Although a negative correlation was found between the levels of HbA1c and albumin in control and reference groups, the relationship between the variables was weak. Since HbA1c has become the standard tool for monitoring Glycaemic control in patients with diabetes, the values should be interpreted with caution in our population.

KEYWORDS: Type 2 Diabetes Mellitus, Serum Albumin, HbA1c, Fasting blood glucose& Post-Prandial Blood sugar.

I. INTRODUCTION

India has emerged as one of the epicentres of the global diabetes mellitus pandemic. Rapid socioeconomic development and demographic changes, along with increased susceptibility for Indian individuals, have led to a dangerous increase in the prevalence of diabetes mellitus in India over the past Three and four decades. Type 2 diabetes mellitus in Asian Indian people is characterized by a young age of onset and occurrence at low levels of BMI. Available data also suggest that the susceptibility of Asian Indian people to the complications of diabetes mellitus differs from that of white populations. Glycated haemoglobin (HbA1c) is a commonly employed and extensively validated marker for the assessment of Glycaemic control in the routine management of diabetes since it provides an accurate, precise measure of chronic Glycaemic levels and correlates with the risk 3 of diabetes complications. Although HbA1c has established itself as a valuable tool, it is expensive and time consuming to perform. Further, there are a number of clinical conditions which may affect the accuracy of the test, resulting in falsely high or low readings.Despite a significant negative correlation existing between plasma Albumin levels and HbA1c in type 2 diabetes, levels of serum Albumin are not routinely 5 monitored in patients with diabetes . Hence, the present study was designed to investigate whether a correlation exists between HbA1c and serum Albumin levels in Indian patients with Type 2 Diabetes Mellitus.

II. MATERIALS & METHODS

Study design

This study was a prospective study of case records undertaken at a rural tertiary care hospital in Northern India, between June 2017 and March 2018. Studies were performed at no extra cost to the participants and patients were not compensated.

Patients

The electronic records of type 2 diabetes patients presenting to the institution as part of the routine care of our centre were reviewed. Patients with type 2 diabetes formed the study group, whereas those who attended the diabetes clinic for screening but were not found to be diabetic (HbA1c <6.5%) served as the reference group. The inclusion was as broad as possible in order to maximize generalization and to reflect the 'real-world' conditions. The data were extracted using a standardized data extraction form. The study was approved by the Institutional Ethics Committee and written informed consent was obtained from all participants.

Assessments

A fasting blood sample was taken after ensuring a minimum of 8 h of overnight fasting for the estimation of glucose (FBS) by GOD-POD Method. Blood sample was also collected for measurement of Post-Prandial Glucose (PPBS) concentration by GOD-POD Method. HbA1c was estimated by Methodology :Boronate Affinity (HemoCue HbA1C501) Albumin was estimated by colorimetric assay

by Dye-Binding method, with Bromocresol green.

III.   STATISTICAL ANALYSIS

Continuous variables were expressed as mean ± SD, and categorical variables as the number and percentage. Student's t-test and chi square-test were used for comparisons between sex and groups. Analysis of variance (ANOVA) was applied for comparisons. The correlations among A1C, Fasting plasma glucose (FPS), and 2-h post-prandial plasma glucose were determined using Spearman correlations. Multiple linear regression analysis was done to test the dependence of albumin on HbA1c, fasting blood sugar as well as post-prandial blood sugar levels. $P < 0.05$ was considered as statistically significant.

IV.   RESULTS

The demographic and clinical characteristics of the Reference and Study groups are shown in Table 1. Both groups were comparable at baseline, and there were no significant differences with respect to age, sex, weight, and BMI or waist circumference except for duration of diabetes.

Table-1

Demographic and Clinical Characteristics

Characteristic	Reference Group	Study Group
Age (years)	55.3 ± 8.9	57.5 ± 9.7(NS)
Women (%)	15 (58)	55 (60)(NS)
Body weight (kg)	66.8 ± 9.1	70.1 ± 12.3(NS)
Body mass index kg/m2)	24.7 ± 3.0	26.4 ± 4.4(NS)
Waist Circumference (cm)	90.7 ±8.8	93.0 ± 11.9(NS)
Duration of diabetes (years)	----	10.9 ± (4.1)
More than 5 years (%)		47 (52)
Less than 5 years (%)		44 (48)

NS = Not significant

Correlation among A1c albumin FPG and PPG

The values of HbA1c values were higher when the levels of albumin were low and lower when the albumin levels were high (Table 2). Serum albumin level was significantly lower in the reference group of patients when compared with control group and correlated negatively with HbA1C levels. Although a negative correlation was found, the relationship between the variables was weak (r= -0.1051 and -0.1274). The value of R 2 the co-efficient determination was 0.011 and the results were not significant. Stepwise multiple regression analysis showed no significant correlation between HbA1c and albumin or

post prandial blood sugar or duration of diabetes.

Table 2 Biochemical Characteristics of Study and Reference Groups

Characteristic	Reference Group	Study Group
	(n= 26)	(n=91)
Fasting Blood sugar (mmol/L)	05.21 ± 0.7	10.35 ± 3.91***
Postprandial Blood Sugar (mmol/L)	10.35 ± 1.25	15.48 ± 5.30***
HbA1c (%)	4.4 ± 1.1	9.4 ± 1.9***
Albumin (g/dL)	5.3 ± 0.6	4.1 ± 0.9***

ANOVA F = 10.99 $p < 0.001$

*** $P < 0.001$

V.   DISCUSSION

The present study designed to investigate whether a correlation exists between HbA1c and serum albumin levels in North Indian patients with Type 2 diabetes mellitus found serum Albumin levels to be low. The finding of low albumin levels could be attributed to predominantly vegetarian food which is low in proteins. Fall in HbA1c levels associated with increase in albumin levels implies that that the Glucose control of patients with Albumin levels significantly above or below average may not be properly reflected by the standard classification in terms of HbA1c measurements alone. Since HbA1c has become the standard tool for 6 monitoring Glycaemic control in patients with diabetes, the values should be interpreted with caution in our population. There was no significant correlation between HbA1c and serum Albumin or Post- Prandial blood sugar levels. However a positive correlation was observed between HbA1c and serum albumin levels and age as well as duration of diabetes in studies conducted by 7,8Arnetz and KilpatrickwhileKabadi found no significant relationship between age, duration of diabetes and fasting blood glucose, glycated 9 haemoglobin, glycated protein or glycated albumin. In contradiction to this there was a significant negative 5,10correlation between HbA1c and serum albumin.

VI.   CONCLUSION

In conclusion our study shows that HbA1c values should be interpreted with caution in our population. To our knowledge, the current study is the first study to report the relationship between HbA1c and Albumin levels in North Indian predominantly patients with type 2 diabetes mellitus. Since the number studied is small, it may not be possible to draw generalised conclusions; hence studies carried out at multiple centres across India, are warranted

and may throw light on diverse Indian population.

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