ASSESSING THE CORRELATION BETWEEN LEVELS OF GLYCOSYLATED HB AND SERUM ALBUMIN IN SUBJECTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

Introduction: Diabetes mellitus has a high prevalence globally with rising incidence in the world. Despite the identification of diabetes mellitus and associated complications for a long time, the measures to reduce mortality and morbidity in subjects with diabetes mellitus are focused only for a few decades.

Objective: The present study was conducted to assess the correlation between levels of glycosylated Hb and serum albumin in subjects with type 2 diabetes mellitus.

Method: The present institution-based observational study included subjects with a confirmed diagnosis of diabetes mellitus type 2 where levels of glycosylated hemoglobin (HbA1c) and serum albumin were assessed and correlated.

Result: It was seen that in subjects with glycosylated hemoglobin of <7%, mean serum albumin level was 3.87±0.88 mg/dl, in subjects with glycosylated hemoglobin of 7-9%, mean serum albumin level was 2.95±0.53 mg/dl, and in subjects with hemoglobin of >9%, it was seen that mean serum albumin was 2.46±0.69 mg/dl. A negative correlation was noted where lesser HbA1C% was related to higher mean values of serum albumin.

Conclusion: The present study concludes that subjects having higher values of glycosylated hemoglobin have lower serum albumin levels compared to subjects where lower glycosylated

hemoglobin levels in subjects were associated with near-normal or normal serum albumin levels.

Keywords: Glycosylated Hemoglobin, Hypertension, Obesity, Serum Albumin, Type 2 Diabetes Mellitus

INTRODUCTION

Diabetes mellitus has a high prevalence globally with rising incidence in the world. Despite the identification of diabetes mellitus and associated complications for a long time, the measures to reduce mortality and morbidity in subjects with diabetes mellitus are focused only for a few decades. One of the major complications of diabetes leading to death is diabetic ketoacidosis, which is largely controlled after insulin discovery. Diabetes is still associated with various microvascular and macrovascular complications along with metabolic abnormalities. The increasing incidence of diabetes mellitus leads to an increased risk of cerebrovascular accidents and coronary artery diseases along with non-traumatic limb amputations and end-stage renal diseases.[1]

These chronic complications are usually seen when diabetes is diagnosed. Chronic diabetes complications and occurrence of diabetes when correlated, the data is scarce in the literature. These complications should be considered even at the time of diagnosis of diabetes. Medical help can be sought earlier in the diabetics by educating and motivating the high-risk individuals concerning the complications associated with diabetes. To a point, these diabetes-related complications can be prevented. After the complications are detected in the diabetics, these complications continue to progress even after aggressive management of hyperglycemia. This points to dedicated screening of diabetics for chronic metabolic, microvascular, and macrovascular complications in diabetics at the time of diagnosis itself.[2]

In subjects with type 2 diabetes mellitus, glycemic control for long-term is assessed by evaluating HBA1C (glycosylated hemoglobin) levels where HbA1c level >9% shows poor diabetic control, 7 to 9% shows moderate diabetic control, and HbA1c level - <7% are desired levels and shows good control. Although HbA1c is a reliable indicator for assessing diabetes control, it is affected by various factors including albumin levels, uremia, anemia, drugs, Hbc, Hbs like hemoglobin variants. Levels of serum albumin are regularly monitored only in subjects with diabetic nephropathy and not in regular diabetics. Hence, follow-up, crucial evaluation, and identification of serum albumin levels are vital in the diabetics along with monitoring of HbA1c levels.[3]

The present study was conducted to assess the correlation between levels of glycosylated Hb and serum albumin in subjects with type 2 diabetes mellitus so that primary measures can be taken to prevent mortality and morbidity associated. This will also aid healthcare professionals to manage hyperglycemia and reduce the occurrence of complications. The data assessing this correlation is scarce in the literature. Literature data also suggest that HbA1c is also raised in subjects with iron deficiency anemia. Hence, the present study was conducted to assess the correlation between levels of glycosylated Hb and serum albumin in subjects with type 2 diabetes mellitus.

MATERIALS AND METHODS

The present institution-based observational study was conducted to assess the correlation between levels of glycosylated Hb and serum albumin in subjects with type 2 diabetes mellitus. The study was conducted Department of General Medicine, Gulbarga Institute of Medical Science, Kalaburagi, Karnataka
after obtaining clearance from the concerned ethical committee. The study population was comprised of the subjects visiting the institute with a confirmed diagnosis of type 2 diabetes mellitus. After explaining the detailed study design, informed consent was taken from all the subjects in both written and verbal form.

The study included a total of 102 subjects from both genders with a confirmed diagnosis of type 2 diabetes mellitus. The inclusion criteria for the study were subjects having confirmed diagnosis of diabetes mellitus, of age 18 years or more, and the subjects who were willing to participate in the study. The exclusion criteria for the study were subjects having type 1 diabetes mellitus, vitamin B12 deficiency, iron deficiency, hypertriglyceridemia, chronic liver disease, renal disease, pregnant females, and the subjects who were not willing to participate in the study.

After the final inclusion of the study subjects, detailed history and general examination of done for all the subjects along with necessary laboratory investigations. This was followed by the recording of the demographics including BMI, height, weight, personal history, medical history, gender, age, and general examination on the structured standard formula. Laboratory investigations done for all the subjects were HbA1c using immune turbidimetry method, serum albumin using bromocresol green assay, liver function tests, fasting, random, and postprandial blood sugar, serum creatinine, blood urea, routine and microscopic urine examination, platelet count, total leukocyte counts, and hemoglobin levels. An automated analyzer was used for assessing all parameters of complete blood count.

The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$.

RESULTS

The present institution-based and observational studies were conducted to assess the correlation between levels of glycosylated Hb and serum albumin in subjects with type 2 diabetes mellitus. The study included a total of 102 subjects from both genders with a confirmed diagnosis of type 2 diabetes mellitus. The demographic characteristics of the study subjects are listed in table 1. It was seen that the mean age of the study subjects was 48.6±6.24 years. There were 12.74% (n=13) subjects in the age of 30-40 years, 23.52% (n=24) subjects from 41-50 years, majority of the subjects was within the age of 51-60 years with 32.35% (n=33) subjects, 20.58% (n=21) subjects from 61-70 years, and 10.78% (n=11) subjects from >70 years. There were 71.56% (n=73) males and 26.47% (n=27) females in the present study. The diabetes duration was ≤5 years in 9.80% (n=10) study subjects, 5-10 years in 32.35% (n=33) study subjects, 11-15 years in 34.31% (n=35) subjects, and >15 years in

23.52% (n=24) study subjects. Most common comorbidity was hypertension in 36.27% (n=37) subjects followed by obesity in 26.47% (n=27) subjects, whereas, other comorbidities were seen in 37.25% (n=38) subjects (Table 1).

On assessing various parameters in the study subjects, it was seen that mean fasting blood sugar was 140.2±6.24mg/dl and was in the range of 90-265mg/dl. Postprandial blood sugar has a mean value of 202.4±4.28mg/dl, whereas, the range was 101-298 mg/dl in the study subjects. The mean value of glycosylated hemoglobin in the study subjects was 8.2%. The value of <7% was seen in 31.37% (n=32) study subjects, 7-9% in 47.05% (n=48) subjects, and >9% in 21.56% 9n=22) study subjects. The mean serum albumin level in the study subjects was 3.12±1.62mg/dl. The levels of <3mg/dl was seen in 53.92% (n=550 subjects, 3-3.3 mg/dl in 23.52% (n=55) study subjects, and >3.5 mg/dl in 22.54% (n=23) study subjects as shown in Table 2.

The present study also assessed the correlation between levels of glycosylated hemoglobin and serum albumin. It was seen that in subjects with glycosylated hemoglobin of <7%, mean serum albumin level was 3.87±0.88 mg/dl, in subjects with glycosylated hemoglobin of 7-9%, mean serum albumin level was 2.95±0.53 mg/dl, and in subjects with hemoglobin of >9%, it was seen that mean serum albumin was 2.46±0.69 mg/dl as summarized in Table 3. A negative correlation was noted where lesser HbA1C% was related to higher mean values of serum albumin.

DISCUSSION

The present institution-based and observational studies were conducted to assess the correlation between levels of glycosylated Hb and serum albumin in subjects with type 2 diabetes mellitus. The study included a total of 102 subjects from both genders with a confirmed diagnosis of type 2 diabetes mellitus. It was seen that the mean age of the study subjects was 48.6±6.24 years. There were 12.74% (n=13) subjects in the age of 30-40 years, 23.52% (n=24) subjects from 41-50 years, majority of the subjects was within the age of 51-60 years with 32.35% (n=33) subjects, 20.58% (n=21) subjects from 61-70 years, and 10.78% (n=11) subjects from >70 years. There were 71.56% (n=73) males and 26.47% (n=27) females in the present study. The diabetes duration was ≤5 years in 9.80% (n=10) study subjects, 5-10 years in 32.35% (n=33) study subjects, 11-15 years in 34.31% (n=35) subjects, and >15 years in 23.52% (n=24) study subjects. Most common comorbidity was hypertension in 36.27% (n=37) subjects followed by obesity in 26.47% (n=27) subjects, whereas, other comorbidities were seen in 37.25% (n=38) subjects. These demographics were comparable to the studies of Rosemary AA[4] in 2019 and Po-Chung Cheng et al[5] in 2016 where authors assessed diabetics with comparable demographics as in the present study.

Concerning various parameters in the study subjects, it was seen that mean fasting blood sugar was 140.2±6.24mg/dl and was in the range of 90-265mg/dl. Postprandial blood sugar has a mean value of 202.4±4.28mg/dl, whereas, the range was 101-298 mg/dl in the study subjects. The mean value of glycosylated hemoglobin in the study subjects was 8.2%. The value of <7% was seen in 31.37% (n=32) study subjects, 7-9% in 47.05% (n=48) subjects, and >9% in 21.56% 9n=22) study subjects. The mean serum albumin level in the study subjects was 3.12±1.62mg/dl. The levels of <3mg/dl was seen in 53.92% (n=550 subjects, 3-3.3 mg/dl in 23.52% (n=55) study subjects, and >3.5 mg/dl in 22.54% (n=23) study subjects.

These results were consistent with the studies of Nazki FA et al[6] in 2017 and Sarojini C[7] in 2017 where authors reported similar parameters as in the present study.

The present study also assessed the correlation between levels of glycosylated hemoglobin and serum albumin. It was seen that in subjects with glycosylated hemoglobin of <7%, mean serum albumin level was 3.87±0.88 mg/dl, in subjects with glycosylated hemoglobin of 7-9%, mean serum albumin level was 2.95±0.53 mg/dl, and in subjects with hemoglobin of >9%, it was seen that mean serum albumin was 2.46±0.69 mg/dl as summarized in Table 3. A negative correlation was noted where lesser HbA1C% was related to higher mean values of serum albumin. These results were in agreement with the studies of Kumar M et al[8] in 2016 and Tiwari S et al[9] in 2015 where authors reported a similar correlation of serum albumin and glycosylated hemoglobin comparable to this study.

CONCLUSION

Within its limitations, the present study concludes that subjects having higher values of glycosylated hemoglobin have lower serum albumin levels compared to subjects where lower glycosylated hemoglobin levels in subjects were associated with near-normal or normal serum albumin levels. However, the present study had a few limitations including a small sample size, short monitoring period, and geographical area biases. Hence, more longitudinal studies with a larger sample size and longer monitoring period will help reach a definitive conclusion.

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TABLES

S. No	Characteristics	Percentage (%)	Number (n)
1.	**Mean age(years)**	48.6±6.24	
2.	**Age range (years)**		
a)	30-40	12.74	13
b)	41-50	23.52	24
c)	51-60	32.35	33
d)	61-70	20.58	21
e)	>70	10.78	11
3.	**Gender**		
a)	Males	71.56	73
b)	Females	26.47	27
4.	**Diabetes duration**		
a)	≤5	9.80	10
b)	5-10	32.35	33
c)	11-15	34.31	35
d)	>15	23.52	24
5.	**Comorbidity**		
a)	Hypertension	36.27	37
b)	Obesity	26.47	27
c)	Others	37.25	38

Table 1: Demographic characteristics of the study subjects

S. No	Parameter	Percentage (%)	Number (n)
1.	**Fasting blood sugar (mg/dl)**		
2.	Mean values	140.2±6.24	
3.	Range	90-265	
4.	**Postprandial blood sugar (mg/dl)**		
5.	Mean values	202.4±4.28	
6.	Range	101-298	
7.	**Glycosylated Hemoglobin (%)**		
8.	Mean values	8.2%	
9.	<7	31.37	32
10.	7-9	47.05	48
11.	>9	21.56	22
12.	**Serum Albumin (mg/dl)**		
13.	Mean values	3.12±1.62	

14.	<3	53.92	55
15.	3-3.5	23.52	24
16.	>3.5	22.54	23

Table 2: Parameters associated with diabetes and serum albumin in the study subjects

S. No		**Serum albumin mg/dl (mean)**
	HbA1c levels	
1.	<7	3.87±0.88
2.	7-9	2.95±0.53
3.	>9	2.46±0.69

Table 3: Correlation of glycosylated hemoglobin and serum albumin levels in the study subjects