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

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ABSTRACT

Introduction: The prevalence of diabetes mellitus is high worldwide and is on the rise. Even though diabetes mellitus and its complications have been known about for a while, efforts to lower mortality and morbidity in people with the disease have only been concentrated on the last few decades.

Aim: The goal of the current investigation was to determine whether glycosylated hemoglobin levels and serum albumin levels in individuals with type 2 diabetes are correlated.

Methods: The current institution-based observational study measured and linked the levels of glycosylated hemoglobin (HbA1c) and serum albumin in participants with a confirmed diagnosis of type 2 diabetes mellitus. **Results:** the mean serum albumin level in subjects with glycosylated hemoglobin of <7% was 3.87±0.88 mg/dl, in subjects with glycosylated hemoglobin of 7-9% it was 2.95±0.53 mg/dl, and in subjects with hemoglobin of >9% it was 2.46±0.69 mg/dl. Less HbA1C% was found to be negatively correlated with higher mean serum albumin levels.

Conclusion: The current study comes to the conclusion that people with greater glycosylated hemoglobin values have lower serum albumin levels than subjects whose lower levels were linked to near-normal or normal serum albumin levels.

Keywords: Type 2 Diabetes Mellitus, Glycosylated Hemoglobin, Obesity, and Hypertension

INTRODUCTION

Globally, diabetes mellitus is very common and is becoming more commonplace. Even though diabetes mellitus and its complications have been known about for a while, efforts to lower mortality and morbidity in people with the disease have only been concentrated on the last few decades. Diabetic ketoacidosis is one of the main consequences of diabetes that can be fatal, however it can be mostly controlled thanks to the discovery of insulin. In addition to metabolic problems, diabetes is still linked to a number of macrovascular and microvascular consequences. Together with non-traumatic limb amputations and end-stage renal diseases, the rising prevalence of diabetes mellitus increases the risk of cerebrovascular accidents and coronary artery diseases.1

Diabetes diagnoses typically result in these long-term consequences. Data on the correlation between the occurrence of diabetes and chronic diabetes complications are hard to come by in the literature. These

consequences need to be taken into account even when diabetes is first diagnosed. By informing and encouraging high-risk persons about the difficulties linked to diabetes, medical assistance can be sought early in the disease.

These consequences linked to diabetes can be avoided to some extent. Even with rigorous hyperglycemia treatment, problems in diabetics persist after they have been identified. This suggests that diabetics should be specifically screened for long-term metabolic, microvascular, and macrovascular problems at the time of diagnosis.2

Glycemic control in individuals with type 2 diabetes mellitus is measured over the long term using HBA1C (glycosylated hemoglobin) levels; a level >9% indicates poor diabetic control, a level 7 to 9% indicates intermediate diabetic control, and a level <7% indicates good control. HbA1c is a good measure of how well diabetes is controlled, but there are a lot of variables that can alter it, such as albumin levels, uremia, anemia, medications, and hemoglobin variations such as Hbc and Hbs. Serum albumin levels are only routinely checked in patients with diabetic nephropathy; normal diabetics do not have their levels checked. Thus, in addition to keeping an eye on HbA1c levels, follow-up, critical assessment, and identification of serum albumin levels are essential in diabetics.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 purpose of the current institution-based observational study was to evaluate the relationship between glycosylated hemoglobin levels and serum albumin levels in individuals with type 2 diabetes. The research was carried out at the Gulbarga Institute of Medical Science, Kalaburagi, Karnataka, in the Department of General Medicine, following approval from the relevant ethical committee. The individuals who came to the institute with a verified diagnosis of type 2 diabetes mellitus made up the study population. All subjects gave their written and verbal informed consent after being fully told about the study's concept. A total of 102 participants, of both sexes, having a verified diagnosis of type 2 diabetes mellitus were included in the study.

Subjects who were willing to participate in the study and who had a verified diagnosis of diabetes mellitus and were at least 18 years old were the study's inclusion criteria. Subjects with type 1 diabetes mellitus, iron or vitamin B12 deficiency, hypertriglyceridemia, chronic liver illness, renal disease, pregnancy, and subjects unwilling to engage in the study were excluded from the research. Following the study subjects' final inclusion, each subject underwent a thorough medical history, a general examination, and any necessary laboratory testing. Subsequently, the demographic data was recorded using a standardized standard formula, encompassing BMI, height, weight, personal history, medical history, gender, age, and general examination.

All of the subjects underwent the following laboratory tests: 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. The HbA1c test was performed using the immune turbidimetry method. An automated analyzer was employed to evaluate every aspect of the total blood count.

Using SPSS software version 21 (Chicago, IL, USA) for statistical assessment and one-way ANOVA and t-test for result formulation, the gathered data were examined. The data were presented as a mean, standard deviation, percentage, and number. At $p<0.05$, the significance threshold was maintained.

RESULTS

The current observational and institution-based studies were carried out to evaluate the relationship between glycosylated hemoglobin levels and serum albumin levels in individuals diagnosed with type 2 diabetes. A total of 102 participants, of both sexes, having a verified diagnosis of type 2 diabetes mellitus were included in the study. Table 1 contains a list of the study individuals' demographic details. The average age of the research participants was found to be 48.6±6.24 years. 12.74% (n=13) of the subjects were between the ages of 30 and 40, 23.52% (n=24) were between the ages of 41 and 50, 32.35% (n=33) were between the ages of 61 and 70, and 10.78% (n=11) were over the age of 70. The majority of the subjects were between the ages of 51 and 60.

In the current study, there were 26.47% (n=27) females and 71.56% (n=73) males. 9.80% (n = 10) research participants had diabetes for less than five years, 5–10 years for 32.35% (n = 33), 11–15 years for 34.31% (n = 35), and more than fifteen years for 23.52% (n = 24) of the study participants. Table 1 shows that the most prevalent comorbidity observed in 36.27% (n=37) of the subjects was hypertension, followed by obesity in 26.47% (n=27) of the subjects. Other comorbidities were observed in 37.25% (n=38) of the subjects. Upon evaluating multiple parameters in the research participants, the average fasting blood sugar was found to be 140.2±6.24 mg/dl, falling between the 90-265 mg/dl range. The study individuals' postprandial blood sugar ranged from 101-298 mg/dl, with a mean value of 202.4±4.28 mg/dl.

Among the study participants, the average level of glycosylated hemoglobin was 8.2%. 31.37% (n=32) research participants had a value of less than 7%, 47.05% (n=48) had a value of 7–9%, and 21.56% (n=22) had a value of more than 9%. The study patients had a mean blood albumin level of 3.12±1.62 mg/dl. According to Table 2, 53.92% (n=550) of the study subjects had levels of less than 3 mg/dl, 23.52% (n=55) had levels between 3 and 3.3 mg/dl, and 22.54% (n=23) had levels greater than 3.5 mg/dl. The relationship between serum albumin and glycosylated hemoglobin levels was also evaluated in this investigation.

As summarized in Table 3, it was observed that the mean serum albumin level in subjects with glycosylated hemoglobin of <7% was 3.87±0.88 mg/dl, in subjects with glycosylated hemoglobin of 7-9% it was 2.95±0.53 mg/dl, and in subjects with hemoglobin of >9% it was 2.46±0.69 mg/dl. Less HbA1C% was found to be negatively correlated with higher mean serum albumin levels.

DISCUSSION

The current observational and institution-based studies were carried out to evaluate the relationship between glycosylated hemoglobin levels and serum albumin levels in individuals diagnosed with type 2 diabetes.

A total of 102 participants, of both sexes, having a verified diagnosis of type 2 diabetes mellitus were included in the study. The average age of the research participants was found to be 48.6±6.24 years. 12.74% (n=13) of the subjects were between the ages of 30 and 40, 23.52% (n=24) were between the ages of 41 and 50, 32.35% (n=33) were between the ages of 61 and 70, and 10.78% (n=11) were over the age of 70. The majority of the subjects were between the ages of 51 and 60. In the current study, there were 26.47% (n=27) females and 71.56% (n=73) males. 9.80% (n = 10) research participants had diabetes for less than five years, 5–10 years for 32.35% (n = 33), 11–15 years for 34.31% (n = 35), and more than fifteen years for 23.52% (n = 24) of the study participants.

The most prevalent comorbidity observed in 36.27% (n=37) of the subjects was hypertension, which was followed by obesity in 26.47% (n=27) of the respondents. 37.25% (n=38) of the subjects had other comorbidities. These characteristics were similar to those of studies conducted in 2019 by Rosemary AA4 and in 2016 by Po-Chung Cheng et al., who evaluated diabetics with similar characteristics to those of the current study. The mean fasting blood sugar of the study participants was found to be 140.2±6.24 mg/dl, falling within the range of 90-265 mg/dl based on several factors. The study individuals' postprandial blood sugar ranged from 101-298 mg/dl, with a mean value of 202.4±4.28 mg/dl. Among the study participants, the average level of glycosylated hemoglobin was 8.2%.

31.37% (n=32) research participants had a value of less than 7%, 47.05% (n=48) had a value of 7–9%, and 21.56% (n=22) had a value of more than 9%. The study patients had a mean blood albumin level of 3.12±1.62 mg/dl. 53.92% (n=550) of the study subjects had levels of less than 3 mg/dl, 23.52% (n=55) had levels between 3 and 3.3 mg/dl, and 22.54% (n=23) had levels greater than 3.5 mg/dl. These findings aligned with research conducted in 2017 by Nazki FA et al. and Sarojini C7, whose authors reported comparable parameters to those used in this investigation. The relationship between serum albumin and glycosylated hemoglobin levels was also evaluated in this investigation.

As summarized in Table 3, it was observed that the mean serum albumin level in subjects with glycosylated hemoglobin of <7% was 3.87±0.88 mg/dl, in subjects with glycosylated hemoglobin of 7-9% it was 2.95±0.53 mg/dl, and in subjects with hemoglobin of >9% it was 2.46±0.69 mg/dl. Less HbA1C% was found to be negatively correlated with higher mean serum albumin levels. These findings corroborated those of research by Tiwari S et al. (2015) and Kumar M et al. (2016), whose authors found a comparable relationship between serum albumin and glycosylated hemoglobin to that of this investigation.

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	HbA1c levels	Serum albumin mg/dl (mean)
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