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Original Research Article

ESTIMATION OF ALBUMIN IN CORRELATION WITH GLYCATED HEMOGLOBIN IN TERTIARY CARE CENTER

Jhansi Rani C[1], C Sarojini[2], Rachabathuni Hema Malini[3]

[1]*Associate Professor, Department of Biochemistry, Government Medical College, Gadwal, Telangana, India.*
[2]*Assistant Professor, Department of General Medicine, Government Medical College, Nandyal, Andhra Pradesh, India.*
[3]*Associate Professor, Department of Biochemistry, Government Medical College, Quthbullapur, Medchal, Malkajgiri, Telangana, India.*

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Corresponding Author:
Dr. Jhansi Rani C,
Associate Professor, Department of Biochemistry, Government Medical College, Gadwal, Telangana, India.
Email: jhansirani131@gmail.com

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ABSTRACT

Background: Diabetes is a prevalent endocrine system disorders which manifests with hyperglycemia leading to nonenzymatic glycation of the free amino groups of protein (of lysine residues) and cause the structural and functional changes that result in complication of diabetes. Albumin, which is extensively Glycated in diabetes, could control plasma hemoglobin glycation.
Aim: The present study aimed to evaluate the estimation of albumin in correlation with Glycated Hemoglobin.
Materials and Methods: A total of fifty subjects aged >35 years were included in the study. All the study groups including control groups were attending Government General Hospital, Gadwal, Telangana State, India.
Results: HBA1C and serum albumin concentration were significantly correlated negatively. Group I patients' fasting blood sugar mean and S.D. were 83±17.6, where mean and SD of Sr. albumin and HBA1C of Group I subjects 4.29± 0.41 and 5.7± 1.45 respectively. In Group II subject fasting plasma glucose 125.68± 23.97 where concentrations of Sr albumin and HBA1C are 3.29±0.41 and 7.73±0.8 respectively. Where the p value < 0.001.
Conclusion: HbA1**c** and serum albumin have a negative correlation. Therefore, more research is required to determine the average glucose levels from the HBA1C concentration, which may effectively tell patients about their glycemic control.
Keywords: Diabetes, Glycated Hemoglobin Albumin (HBA1C), glycemic control.

INTRODUCTION

About 830 million people worldwide have diabetes, the majority living in low- and middle-income countries. More than half of people living with diabetes are not receiving treatment. Both the number of people with diabetes and the number of people with untreated diabetes have been steadily increasing over the past decades.[1] It is the fifth most common cause of death in the majority of developed nations and one of the greatest risk to human health in the twenty- first century.[2]

In diabetes, the increased glucose levels begin to create covalent adducts with plasma proteins via a non-enzymatic process referred to as glycation. The non- enzymatic interaction between the free amino groups of proteins and the carbonyl groups of reducing sugars is termed the Maillard reaction.[3] Approximately 50% of plasma proteins consist of albumin, which is a single polypeptide chain made up of 585 amino acid residues and has a molecular weight of 66,460 Daltons.[4] At first glance, proteins appear to be the primary targets of glucose molecules that circulate at elevated levels in diabetes. The glycation of proteins disrupts their normal functions by altering molecular conformation, modifying enzyme activity, and hindering receptor recognition.[5] The processes through which glycation affects cellular function include denaturation and a decline in the functionality of the target protein,[6] which consequently leads to reduced albumin levels in diabetes. HBA1C is commonly utilized as a glycemic marker for diabetic patients.

Nevertheless, HBA1C is affected by factors beyond just blood glucose levels.[7,8] It has been proposed that low plasma albumin levels may predict glycated hemoglobin HBA1C in individuals with type 2 diabetes,[9] thereby strongly implicating albumin in the regulation of plasma protein glycation and HBA1C. The objective was to ascertain whether lower albumin levels could be linked to elevated HBA1C levels and conversely.

MATERIALS AND METHODS

This research was conducted as a retrospective study, involving a total of fifty participants aged over 35 years. All groups, including the control groups, were patients at the Government General Hospital in Gadwal, Telangana State, India.

Inclusion Criteria: A family history of obesity, a family history of diabetes, age over 35 years, a BMI greater than 26 kg/m2, and a waist circumference exceeding 102 cm.

Exclusion Criteria: Anemia, renal impairment, pregnancy, chronic liver disease, hypertriglyceridemia, and deficiencies in iron or vitamin B12.

Blood samples (3ml) were collected after a fasting period of 12 hours and placed into a clean, dry test tube. Fasting blood sugar (FBS) and serum albumin levels were analyzed using a fully automated analyzer (DS-302). Glucose levels were determined using the "GOD-PAP" enzymatic photometric test methodology, while serum albumin was measured through a photometric test utilizing bromo cresol green methodology. The HBA1C level was assessed using the Fine CareTM HBA1C Rapid Quantitative Test, which employs fluorescence immunoassay technology and a sandwich immunodetection method to quantify the percentage of HBA1C in human blood. The sample for HBA1C was collected in a capillary tube from the package with the clip. The local ethical committee of the Government General Hospital, Gadwal, has granted approval for the study protocols.

Statistical Analyses: The differences in mean values between groups were assessed using Student's t-test. Two-tailed p-values were calculated, and statistical significance was defined as a p-value of less than 0.001. The relationships between variables were examined using linear regression. Data were presented as mean ± standard error of the mean.

RESULTS

We conducted a study involving 50 participants (32 males and 18 females) to simultaneously measure serum albumin, fasting plasma glucose (FPG), and HbA1c levels. The participants were categorized into two distinct groups. In Group I, the fasting plasma glucose was recorded at 83.56±17, with serum albumin and HbA1c concentrations at 4.29±0.35 and 5.78±1.45, respectively. Conversely, Group II exhibited a fasting plasma glucose level of 125.68±23.97, with serum albumin and HbA1c concentrations of 3.29±0.41 and 7.73±0.8, respectively. Table 1 presents the statistical comparison of HbA1c and fasting plasma glucose, along with serum albumin levels across the two groups. For Group I (mean, SD), the fasting blood glucose was 83.56±17, while for Group II (mean, SD), the T values were 125.68±23.97, 4.29±0.35, 5.78±1.45,
3.29±0.41, and 7.73±0.8, yielding T values of 7.35, 9.32, and 4.96. We analyzed the results of the two groups using paired sample statistics, revealing that serum albumin concentrations were lower in Group II, where HbA1c was elevated at
7.73±0.8 and fasting plasma glucose was 125.68±23.97. In contrast, Group I demonstrated higher serum albumin levels, with a lower HbA1c of 5.78±1.45 and fasting plasma glucose of 83.5±17.6. This study indicates that elevated serum albumin levels may correlate with reduced HbA1c levels, while decreased serum albumin levels may lead to increased HbA1c levels.

Our research indicates a statistically significant negative correlation between HBA1C and serum albumin levels. Traditionally, glycosylated hemoglobin (HBA1C) has been utilized to assess glycemic control in patients with diabetes mellitus (DM). HBA1C reflects glycemic control over the previous 1-3 months.[10-11] However, HBA1C levels may be underestimated in individuals with poor glycemic control due to the reduced lifespan of erythrocytes in hyperglycemic conditions.[12] Additionally, HBA1C is affected by factors such as anemia,[13] and uremia.[14-15] Conditions that disrupt HBA1C measurements, such as anemias and renal failure, have been excluded from consideration. According to the findings of Shalbha Tiwari et al. and Santiago Rodriguez-Segade et al., elevated serum albumin levels may lead to a decrease in HBA1C levels, while lower serum albumin levels may result in an increase in HBA1C levels, a phenomenon previously reported in Western studies.[15] The correlation between HBA1C and serum albumin suggests that this may be attributed to serum albumin competing with hemoglobin for glycation, which subsequently lowers HBA1C levels. It is conceivable that other proteins could be engineered to become progressively glycated, thereby preventing tissue glycation and modifying the incidence of complications. Indeed, this has been examined both in vitro and in vivo, with some indications of potential benefits.[16,17] Albumin, due to its extended half-life and elevated concentration relative to other proteins, is particularly sensitive to glycation.[18] Moderate hyperglycemia in individuals with type 2 diabetes is linked to increased nitrogen flux, body protein synthesis, and degradation,[19] which consequently reduces albumin levels in diabetic patients.

CONCLUSION

In conclusion, the glucose regulation of patients with albumin levels that are significantly above or below the average may not be accurately represented by the standard classification based solely on HBA1C measurements. The statistically significant increase in HBA1C associated with low albumin levels suggests that albumin could be an additional factor influencing HBA1C in pre- diabetic individuals. Therefore, HBA1C may not be a dependable indicator for diagnosing pre-diabetes. Furthermore, there may be a discrepancy between the level of glycemic control indicated by HBA1C measurements and the assessment of diabetic complications.

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