CORRELATION OF GLYCOSYLATED HEMOGLOBIN AND BMI IN TYPE 2 DIABETES MELLITUS PATIENTS

Narasimha Rai K¹

¹Professor and HOD, Department of Physiology, Chamarajanagar Institute of Medical Sciences, Chamarajanagar, Karnataka.

ABSTRACT: BACKGROUND: The risk of diabetes increases progressively with increasing body mass index and waist-hip ratio. Obesity is a positive risk factor in the development of type 2 Diabetes mellitus, dyslipidemia, insulin resistance and hypertension.

AIM : The present study was undertaken to correlate glycosylated hemoglobin and BMI in type 2 Diabetes mellitus patients.

MATERIALS AND METHOD: The study includes 101 type 2 diabetic patients and were divided into Group 1 with 47 Diabetic patients with BMI<25 and Group 2 with 54 Diabetic patients with BMI>25. Glycosylated hemoglobin was measured by auto analyzer method. Any value >7% were considered as increased HbA1c. HbA1c was measured after one month of recording FBS & PPBS levels. BMI was calculated by dividing weight in kilograms by the square of the height in meters (Kg/m²).

STATISTICAL ANALYSIS was done using one-way ANOVA and p<0.05 was considered as significant.

RESULTS: From our study, we found that the glycosylated hemoglobin levels were higher in diabetes mellitus patients with BMI > 25, and it was statistically significant.

CONCLUSION: The mean HbA1c levels were higher in individuals in the diabetic group with BMI > 25.

KEYWORDS: Type 2 Diabetes Mellitus, Glycosylated Hemoglobin.

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INTRODUCTION: Obesity is an abnormal growth of the adipose tissue due to an enlargement of fat cell (Hypertrophic obesity) or an increase in fat cell number (Hyperplastic obesity), or a combination of both. Obesity is a major risk factor for type 2 diabetes mellitus. Obesity is often expressed in terms of body mass index (BMI).^[1]

The estimation of urine and blood sugar levels are done commonly for diagnosis and monitoring of glycemic control, and they are subjected to various physiological and pathological fluctuations.

They represent the current glycemic status of the patient and they are poor indicators of long-term control of diabetes. For the last few years, estimation of glycosylated hemoglobin and fructosamine has been increasingly used to achieve better monitoring of long-term glycemic control in diabetics.

When plasma glucose is consistently elevated, there is an increase in non-enzymatic glycation of hemoglobin. This alteration reflects the glycemic history over the previous 2 to 3 months, since erythrocytes have an average life span of 120 days.^[2]

Formation of glycated hemoglobin is irreversible, and the blood level depends on both the life span of the red blood cell (Average 120 days) and the blood glucose concentration.

The amount of HbA1c therefore represents the integrated values for glucose over the preceding 6 to 8 weeks and provides an additional criterion for assessing glucose control. Values are free of day-to-day glucose fluctuations and unaffected by exercise or recent food ingestion. The interpretation of glycated hemoglobin depends on the red blood cells having a normal life span. Patients with hemolytic disease or other conditions with shortened red blood cell survival exhibit a significant reduction in HbA1c. High HbA1c levels have been reported in iron deficiency anemia, probably because of the high proportion of old erythrocytes.^[3]

AIM AND OBJECTIVE: The present study was undertaken to correlate glycosylated hemoglobin and BMI in Type 2 Diabetes Mellitus patients.

MATERIALS AND METHODS: The present work was carried out at KMC hospital, Attavar, Mangalore, after a written consent from all the participants and the institutional ethical clearance. The study includes 101 diabetic patients and were divided into Group 1 with 47 Diabetic patients with BMI<25 and Group 2 with 54 Diabetic patients with BMI>25.

A detailed history was taken. General physical examination including height, body weight, blood pressure, pulse rate, respiratory rate and complete systemic examination was done. Fasting blood sugar (FBS), postprandial blood sugar (PPBS) and glycosylated hemoglobin (HbA1c) were studied. Drug history was taken. The patients diagnosed for Type 2 diabetes were included in the study whereas; patients with Type 1 diabetes were excluded in the present study.

Major selection criteria for diabetes included: a random plasma glucose level of 200mg/dL or greater when the

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Corresponding Author:

Dr. Narasimha Rai K,

Department of Physiology,

Chamarajanagar Institute of Medical Sciences.

Chamarajanagar, Karnataka, India.

E-mail: raisimha24@rediffmail.com

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symptoms of diabetes were present and a fasting plasma glucose level of 126mg/dL or greater.

STATISTICAL ANALYSIS: Data are expressed as Mean $\pm$ SEM. Statistical analysis was done by using "ANOVA"; students 't' test. Tukey's test was used in intercomparison of the three groups. P value was taken as significant at 5 percent confidence level ($P < 0.05$).

RESULTS: There were 47 individuals in the diabetic group with BMI < 25, and their mean HbA_{1c} level was 7.71%, and 54 individuals with BMI > 25, and their mean HbA_{1c} level was 8.65%. The mean HbA_{1c} levels were higher in individuals in the diabetic group with BMI > 25. (Table-1, Fig-1).

	BMI < 25 (N=47)	BMI > 25 (N=54)	P value
HbA _{1c} (%)	7.71 $\pm$ 0.14	8.65 $\pm$ 0.07	0.001 ***

Table 1: Mean HbA_{1c} levels and BMI in Type 2 Diabetes Mellitus. Data were expressed as Mean $\pm$ SEM.

*** Highly Significant

Fig.1: Mean HbA_{1c} (%), & BMI in Diabetic group

DISCUSSION: Risk of type 2 diabetes increased progressively and significantly with increasing levels of initial BMI, and also with the duration of overweight and obesity. Studies have shown the critical importance of overweight and obesity, particularly of long duration, in the development of type 2 diabetes and support the current public health

recommendations to reduce the risk of type 2 diabetes by preventing weight gain in middle-aged men who are not overweight, and by encouraging weight loss in overweight and obese men.^[4,5]

In normoglycemic subjects, a small proportion of HbA is attached to carbohydrate moiety, and forms glycosylated hemoglobin. In conditions of sustained hyperglycemia, such as diabetes mellitus, the proportion of hemoglobin that is glycosylated is increased substantially. This glycosylation is the result of post-translational modification of HbA molecules. The binding of glucose is a non-enzymatic process that occurs continuously during the life of the red blood cell. Thus the amount of glycosylated hemoglobin reflects the glycemic control of a patient during the 6-8 week period before the blood sample was obtained.^[6]

CONCLUSION: In our study the mean HbA_{1c} levels were higher in individuals in the diabetic group with BMI > 25.

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