

**RELATION OF CALCULATED HbA<sub>1c</sub> WITH FASTING PLASMA GLUCOSE  
AND DURATION OF DIABETES**

Manjunatha Goud B.K<sup>1</sup>, Bhavna Nayal<sup>2</sup>, Sarsina Devi O<sup>3</sup>, Sathisha .T.G<sup>4</sup>, Sweta Shivashanker<sup>4</sup>, Devaki R.N<sup>5</sup>.

<sup>1</sup>Department of Biochemistry, MMMC, Manipal University, Manipal, Karnataka, India.

<sup>2</sup>Department of Pathology, KMC, Manipal University, Manipal, Karnataka, India

<sup>3</sup>Department of Nursing, New City Nursing College, Udupi, Karnataka, India.

<sup>4</sup>Department of Biochemistry, KMC, Manipal University, Manipal, Karnataka, India

<sup>5</sup>Department of Biochemistry, JSS Medical College, Mysore, India.

**ABSTRACT****Background and objectives**

Glycosylated hemoglobin (HbA<sub>1c</sub>) is a marker of evaluation of long-term glycemic control in diabetic patients and predict risks for the development and/or progression of diabetic complications. Glycosylation process depends on the exposure to glucose. Studies on chronic complications of diabetes established the role of glycosylated hemoglobin (HbA<sub>1c</sub>) as a marker of evaluation of long term glycemic control and risk for chronic complications. The aim of this study is to evaluate the significance of calculated HbA<sub>1c</sub> by using fasting plasma glucose levels and comparison with duration of diabetes mellitus.

**Materials and methods**

The present study has 2 groups of subjects, 27 normal and 32 diabetic subjects. The diabetic subjects were divided into 2 groups based on complication i.e cataract and nephropathy with duration of diabetes. Plasma glucose was estimated by GOD – POD method. Estimation of glycated hemoglobin was done by calculation.

**Results and conclusion**

We found the significance in the duration of diabetes and the levels of glycated hemoglobin and fasting glucose levels were significantly increased in diabetic group as compared to normal subjects (p<0.001). Thus, calculated HbA<sub>1c</sub> levels can be used with regular checkups of FPG and HbA<sub>1c</sub> levels in diabetic patients at lesser cost.

**Key words:** Glycated hemoglobin (HbA<sub>1c</sub>), Diabetes mellitus, Fasting plasma glucose (FPG).

**INTRODUCTION**

Studies on chronic complications of diabetes established the role of glycosylated hemoglobin (HbA<sub>1c</sub>) as a marker of evaluation of long term glycemic control and risk for chronic complications (1). The diabetes Control and Complication Trial (DCCT) study, has demonstrated that the 10% stable reduction in HbA<sub>1c</sub> determines a 35% risk reduction for retinopathy, a 25-44% risk reduction for nephropathy (2-4).

In normoglycemic subjects a small proportion of hemoglobin A is attached to a carbohydrate moiety thus creating what is called glycated hemoglobin (3). In conditions of sustained hyperglycemia, such as in diabetes mellitus, the proportion of hemoglobin that is glycated is increased substantially (5,6). Studies conducted by Arnetz *et al* (7) and Kilpatrick *et al* (8) in diabetic patients have shown a significant positive correlation between HbA<sub>1c</sub> and age as well as duration of diabetes. In contradiction to this Kabadi (9) found no significant relationship between age, duration of diabetes and fasting blood glucose (FBG), glycated hemoglobin.

The aim of this study is to evaluate the significance of calculated HbA<sub>1c</sub> by using fasting plasma glucose levels and comparing it with duration of diabetes mellitus.

## MATERIALS AND METHODS

The present study has 2 groups of subjects, 27 normal and 32 diabetic subjects. The diabetic subjects were divided into 2 groups based on complication i.e cataract and nephropathy with duration of diabetes. The study was approved by the Institutional Time Bound Research committee. A written informed consent was taken from the subjects.

### Sample collection

2ml of fasting venous blood samples were collected in sodium fluoride vacutainers under aseptic precautions from all subjects. Age, sex and duration of diabetes were noted. The blood was analyzed for glucose.

### Biochemical estimations

Plasma glucose was estimated by GOD – POD method (10). Estimation of glycated hemoglobin was done by calculation (11).  $HbA_{1c} = 2.6 + 0.03 \times \text{Plasma glucose (mg/dl)}$ , mean blood glucose level of 130 mg/dl (=7.2 mmol/L) would be equivalent to 6.5%  $HbA_{1c}$ . Any additional 10 mg/dl (=0.56 mmol/L) translate to an additional 0.3%  $HbA_{1c}$ .

### Statistical analysis

Results were subjected to statistical analysis by Analysis of variance (ANOVA)(Kruskal Wallis test) and the values expressed as mean ± SD. Since the data showed a skewed distribution median & inter quartile range were given. Wherever the Kruskal Wallis test was significant pair wise comparison was done using Mann Whitney test adjusting for type 1 error.

## RESULTS

The results of the study are shown in table 1. We found significance in the duration of diabetes. The levels of glycated hemoglobin and fasting glucose levels were significantly increased in diabetic group as compared to normal subjects. The correlation study has no significance with respect to duration with glycated hemoglobin as shown in graph 1. We also found no significance in  $HbA_{1c}$  levels between diabetic groups.

**Table 1: Duration, Glucose and  $HbA_{1c}$  levels in study subjects**

	Normal subjects (27)	Diabetic with cataract (20)	Diabetic with nephropathy (12)
Duration of diabetes(Yrs)	-	5.00 (2.25-7.5)	9.00 <sup>c*</sup> (5.75-11.5)
Glucose (mg/dl)	91.50 <sup>a***</sup> (79.59-99.48)	142.17 <sup>b***</sup> (103.2-168.6)	174.53 <sup>c*</sup> (168.55-197.51)
$HbA_{1c}$	5.3 <sup>a***</sup> (4.98-5.5)	6.86 <sup>b***</sup> (5.7-7.66)	7.81 (7.29-8.32)

\* = Significant ( $p < 0.05$ )

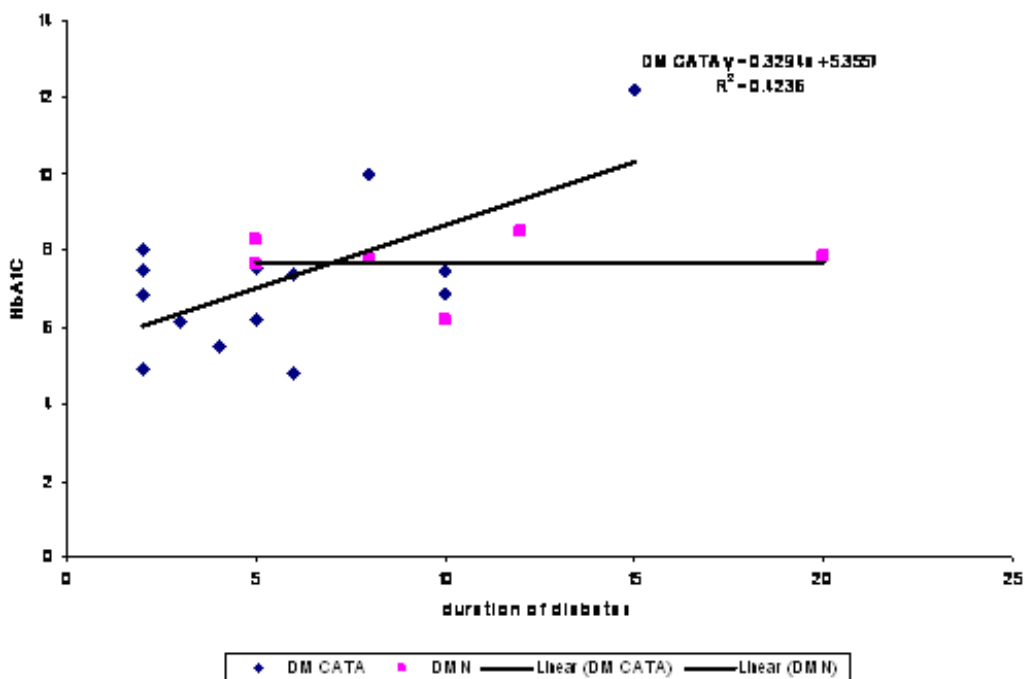
\*\* = Highly Significant ( $p < 0.01$ )

\*\*\* = Very Highly Significant ( $p < 0.001$ )

a= Comparison between group 1 & 3

b= Comparison between group 1 & 2

c= Comparison between group 2 & 3

Graph 1: Correlation of HbA<sub>1c</sub> with duration of diabetes

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