

## INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH



**STUDY THE ASSOCIATION BETWEEN HbA1c (GLYCATED HEMOGLOBIN) LEVELS WITH THE COMPLICATIONS PREVALENT IN OUTDOOR AND INDOOR PATIENTS HAVING TYPE 2 DIABETES FOR MORE THAN 10 YEARS IN A TERTIARY CARE HOSPITAL OF A METROPLITIAN CITY**

**Medicine**

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**ABSTRACT**

HbA1c (Glycated haemoglobin) is better than fasting glucose for determining risks of cardiovascular disease and death from any cause and its monitoring in diabetic patients may improve treatment. Therefore, attempt is made to study the complications prevalent in patients with long-standing diabetes and their co-relation with the HbA1c levels.

**Objectives**

1. To measure the HbA1c levels of the patients with type 2 diabetes of chronic duration.
2. To co-relate HbA1c levels with the prevalence of complications in patients with type 2 diabetes.

**Methodology :** Observational study including 102 subjects having diabetes for > 10 years of either sex after taking informed consent were included. For analysis patients were divided into two groups as those with a HbA1c value < 7% and with well controlled sugars; and those with HbA1c value of > 7%.

**Results and Conclusions:** All microvascular or macrovascular complications had a direct co-relation with increasing values of HbA1c. HbA1c value of >7% was significantly associated with presence of complications.

**KEYWORDS**

Diabetes mellitus, HbA1c(Glycated Haemoglobin).

**INTRODUCTION**

According to recent estimates, approximately 285 million people worldwide (6.6%) in the 20–79 year age group will have diabetes in 2010 and by 2030, 438 million people (7.8%) of the adult population, is expected to have diabetes.[1] Diabetes Mellitus Type 2 is one of the most common endocrinopathy present today accounting for the most common cause for ESRD (End Stage Renal Disease) and other complications like blindness and CAD (Coronary Artery Disease).

The 2010 American Diabetes Association Standards of Medical Care in Diabetes added the HbA1c  $\geq 48$  mmol/mol ( $\geq 6.5\%$ ) as another criterion for the diagnosis of diabetes.[2] In diabetes mellitus, higher amounts of glycated haemoglobin, indicating poorer control of blood glucose levels, have been associated with cardiovascular disease, nephropathy, and retinopathy. Monitoring the HbA1c in type-1 diabetic patients may improve treatment.[3] Glycated haemoglobin is better than fasting glucose for determining risks of cardiovascular disease and death from any cause.[4]

Therefore, attempt is made to study the complications prevalent in patients with long-standing diabetes and their co-relation with the HbA1c (Glycated Hemoglobin) levels.

**AIM AND OBJECTIVES**

1. To measure the HbA1c levels of the patients with type 2 diabetes of chronic duration at the time of inclusion in the study.
2. To study the complications prevalent at the time of inclusion in the study, in these patients.
3. To co-relate HbA1c levels with the prevalence of complications in patients with type 2 diabetes.

**MATERIALS AND METHODS**

An observational study was conducted over one year period at a tertiary care hospital from August 2010 to August 2011. Patients attending diabetic OPD as well as indoor patients were included in the study.

**Inclusion Criteria-**

- Patients of age > 40 years of either sex.
- Duration of Type 2 Diabetes Mellitus for more than 10 years.
- Patient with hypertension and hyperlipidemia.

**Exclusion Criteria-**

- Patient presenting in DKA or HHS or any other acute severe metabolic complication of Diabetes.
- Duration of disease less than 10 years.
- Significant comorbid illnesses such as liver disease, cancer,

pregnancy or nursing mothers.

- Bed ridden patients.
- Patients not giving consent.

Complete general and systemic examination done and routine investigations like complete hemogram, fasting and post prandial blood sugars, liver function tests, chest X-Ray, ECG; and USG abdomen wherever indicated were done.

Serum creatinine, fundus for retinopathy, urine routine and microscopy especially for proteinuria, bio-thesiometry for peripheral neuropathy, serum triglycerides and cholesterol and 2D ECHO were recorded. HbA1c was measured using the boronate affinity chromatography. A detailed weekly dietary chart was obtained also care was taken to avoid taking dietary history during festival period wherein there are temporary but gross changes in diet.

For analysis patients were divided into two groups as those with a HbA1c value less than 7% and with well controlled sugars; and those with HbA1c value of more than 7%. Since both the control group and the study group had duration of diabetes for more than 10 years, both groups have equal risks of developing complications of diabetes as far as the duration of the disease is concerned.

**DATA ANALYSIS-** SPSS software. Chi square test applied.

Ethical clearance was obtained.

**RESULTS**

Of the 102 patients, average age being 57.95 years, where 49.0% cases were male and 51.0% cases were females. 49.0% cases belonged to lower economic status group followed by 48.1% cases that belonged to lower middle economic status and 2.9% cases belonged to upper middle economic status. 31.37% of patients had serum cholesterol above 250mg% and 55.88% of the patients had serum tri-glycerides above 150mg%.

This profile states that 97.5% cases with serum creatinine < 1.7 mg% had HbA1c value < 7% where proportion of cases were more than 19.4% cases with serum creatinine < 1.7 mg% having HbA1c > 7% and the difference between them was statistically significant. The maximum and minimum creatinine levels seen were 5.8 mg% and 0.6 mg% respectively. 95.0% cases that had HbA1c < 7%, showed absence of urine-proteinuria where proportion of cases were more as compared to 11.3% cases with HbA1c > 7% that showed absence of urine-proteinuria and the difference between them was statistically significant. 2D Echo profile states that IHD was present among 41.9% cases among whom HbA1c was > 7% where proportion of cases were

significantly more than none among the cases with HbA1c < 7%. 97.5% cases with HbA1c < 7% showed absence of retinopathy on fundus examination and 11.3% cases with HbA1c > 7% showed absence of retinopathy. On comparison proportion of cases that showed absence of retinopathy were significantly more among the cases with HbA1c < 7%. 95.0% cases with HbA1c < 7% showed absence of neuropathy on biothesiometry and 9.7% cases with HbA1c > 7% showed absence of neuropathy where proportion of cases that showed absence of neuropathy was significantly more among cases with HbA1c < 7%.

56.5% cases with HbA1c > 7% were on insulin where proportion of cases were significantly more than none among the cases with HbA1c < 7%. Mean carbohydrate intake of the cases with HbA1c < 7% was 355.80 g/day that was significantly less than 419.52 g/day among the cases with HbA1c > 7%. Among the cases with HbA1c < 7%, mean calorie intake of the cases was 1930.30 Cal that was significantly less than 2494.39 Cal among the cases with HbA1c > 7%.

PARAMETER	PATIENTS WITH HbA1c <7%	PATIENTS WITH HbA1c > 7%	Chi square test
CREATININE >1.7 mg%	1/40 (2.57%)	50/62 (80.6%)	p < 0.05
URINE PROTEINURIA-			p < 0.05
NO PROTEINURIA	38/40 (95%)	7/62 (11.3%)	
1+	2/40 (5%)	25/62 (40.3%)	
2+		30/62 (48.4%)	
PRESENCE OF ISCHEMIC HEART DISEASE	0/40 (0%)	36/62 (58.1%)	
RETINOPATHY-			
NO RETINOPATHY	39/40 (97.5%)	7/62 (11.3%)	p < 0.05
GRADE 1	1/40 (2.5%)	25/62 (40.3%)	
GRADE 2		21/62 (33.9%)	
GRADE 3		9/62 (14.5%)	
NEUROPATHY-			p < 0.05
NO NEUROPATHY	38/40 (95%)	6/62 (9.7%)	
MILD	2/40 (5%)	27/62 (43.6%)	
MODERATE		19/62 (30.6%)	
SEVERE		10/62 (16.1%)	
PATIENTS REQUIRING INSULIN	0/40 (0%)	35/62 (56.5%)	p < 0.05
DAILY INTAKE OF CARBOHYDRATE	40 (39.21%)	62 (60.78%)	p < 0.05
WITH DAILY CALORIE INTAKE	40 (39.21%)	62 (60.78%)	p < 0.05

**DISCUSSION**

Diabetes mellitus occurs throughout the world, but is more common (especially type 2) in the more developed countries. The greatest increase in prevalence is, however, expected to occur in Asia and Africa, where most patients will probably be found by 2030. [5]. It was also previously observed in a study that the prevalence of diabetes in Indian population is equal among both genders,[17].In western countries, where older populations are most affected, the burden of diabetes in Asian countries is disproportionately high in young to middle-aged adults. [6][7] Diabetes is no longer disease of only the affluent society but is also now more commonly seen in the lower socio-economic groups. In a study conducted by Mishra *et al* it was found that there was a high prevalence of diabetes, obesity and dyslipidemia among the urban slum population of northern India. [16]. M.Estari, J Satyanarayana and group which found that in the age group of 40-59 years the predominant dyslipidemia seen is hypertriglyceridemia, though there is also hypercholesterolemia co-existing in most of these patients. [14]. Hypertension is an independent risk factor for coronary heart disease and strokes.

On analysis of prevalence of complications seen in diabetes mellitus of chronic duration and their co-relation with HbA1c levels it was found that all kinds of complications whether microvascular or macrovascular had a direct co-relation with increasing values of

HbA1c. These findings are in parallel with the findings of the studies mentioned earlier. [12,13] A number of studies have pointed to the beneficial effects of intensive management of blood glucose. A recent population based study reported that the prevalence of overt nephropathy was 2.2 per cent in Indians while microalbuminuria was present in 26.9 per cent. Glycated haemoglobin, duration of diabetes and systolic blood pressure were independently associated with diabetic nephropathy.[18] The CURES Eye study is the largest population based data on the prevalence of diabetic retinopathy done in India. This study showed that the overall prevalence was 17.6 per cent, which was lower when compared to the reports from the West. [19] The relation of HbA1c and prevalence of retinopathy has been studied previously in various populations. [8][9][10][11]. The adverse effects of high HbA1c on prevalence of cardiovascular disease was studied by D E Singer and group in the original cohort of the Framingham Heart Study. [15]

**CONCLUSION**

- 41 patients out of 102 (41.19%) were aged less than or equal to 55 years and had been suffering from the disease for more than 10 years.
- 57/102 (55.88%) patients had hypertriglyceridemia and 32/102 (31.37%) had hypercholesterolemia. Also 23/102 (22.54%) patients had hypertension.
- Prevalence of complications whether microvascular or macrovascular had a direct co-relation with increasing values of HbA1c. HbA1c value of >7% was significantly associated with presence of complications.
- 97.5% cases with serum creatinine <1.7mg% (the upper level of normal range in adult population) had HbA1c value < 7% and also 95.0% cases that had HbA1c < 7% showed absence of urine-proteinuria on routine examination.
- 97.5% cases with HbA1c < 7% showed absence of retinopathy on fundus examination.
- 95.0% cases with HbA1c < 7% showed absence of neuropathy on biothesiometry testing and only 9.7% cases with HbA1c > 7% showed absence of neuropathy.
- Ischemic Heart Disease was present among (26/32) 41.9% cases of whom HbA1c was > 7% as compared to no patients with IHD with a HbA1c < 7%.
- Among the cases with HbA1c < 7%, mean calorie intake was 1930.30 Cal that was significantly less than 2494.39 Cal among the cases with HbA1c > 7%. These findings re-emphasize the fact that dietary modifications are an indispensable part of the treatment planned for a diabetic patient.

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