

# Uric Acid Levels in Good Controlled and Poorly Controlled Diabetic Patients

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## ABSTRACT

**Background:** Diabetes Mellitus is a metabolic disorder which is characterized by hyperglycemia. Prevalence of diabetes is high ranging from 7.6 to 11% in Pakistan. Diabetes can affect many different organs in the body and can lead to various complications. Glycosylated hemoglobin (HbA1c) is the most vital tool to monitor glycemetic control. Desirable value for HbA1c is below 7.00. The association between the blood glucose and the serum uric acid levels has been known for quite some time. Some studies have demonstrated the role of UA in the progression of pre diabetes to diabetes.

**Methods:** This cross sectional study was conducted in the Laboratory of Ghurki Trust Teaching Hospital, Lahore. A total of 158 diabetic patients were included. Uric Acid levels were performed by colorimetric method (Uricase) on fully automated chemistry analyzer. HbA1c was performed by High Performance Liquid Chromatography (HPLC). Data was analysis by using SPSS.

**Results:** 63.9% population was female and 36.1% population was male. Mean age of the study population was 48.14±11.29 years (range 24-79 years). Two groups of the study subjects were formulated on the basis of HbA1c results. The participants of the study having HbA1c of less than or equal to 7% were included in Good control group while the study participants having HbA1c value of equal or greater than 7% were assigned in Poor control group. The difference of means between good control and poor control group was statistically non significant with a *p*-value of 0.694.

**Conclusion:** The present study concluded that there is no significant association of HbA1c levels with serum uric acid levels in our population. Uric acid should only be requested in case of patient presenting with symptoms of hyperuricemia.

**Keywords:** Diabetes Mellitus, Uric Acid, Hyperuricemia, HbA1c.

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## INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disorder which is characterized by hyperglycemia with disturbances of carbohydrate, fat and protein metabolism. It results from defects in insulin secretion, insulin action, or both. Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces<sup>1</sup>.

It is estimated that 366 million people had DM in 2011; by 2030 this would have risen to 552 million. The number of people with type 2 DM is increasing in every country with 80% of people with DM living in low and middle-income countries. DM caused 4.6 million deaths in 2010<sup>2</sup>. The world prevalence of diabetes in 2010 among adults aged 20-79 years is estimated to 6.4%, affecting 285 million adults<sup>3</sup>. Prevalence of diabetes is high ranging from 7.6 to 11% in Pakistan<sup>2,4,5</sup>. Diabetes and its complications prove to be major cause of morbidity and mortality around the world and contribute largely to health care costs.

Diabetes can affect many different organs in the body system and, after a while, can lead to very difficult complications<sup>6</sup>.

Glycosylated hemoglobin (HbA1c) is the most vital tool to monitor glycemetic control. In this view, desirable value for HbA1c is values below 7.0<sup>7,8,9</sup>. HbA1c is a gold standard to evaluate the status of diabetic patients that indicates the average blood glucose during the past three months which is essential to ensure the optimal care of diabetic patients<sup>10</sup>. One percent alteration in HbA1c is equivalent to approximately 35 mg/dl change in mean plasma glucose. Lower values of HbA1c indicate improved glycemetic control. The research has shown that the risk of microvascular complications is reduced by 40% with each one percent reduction in the value of HbA1c<sup>11</sup>.

The association between the blood glucose and the serum uric acid levels has been known for quite some time. Some studies have demonstrated the role of UA in the progression of prediabetes to diabetes<sup>12</sup>. Elevated level of uric acid is a risk factor for peripheral arterial disease, insulin resistance, and components of the metabolic syndrome. Some studies reported that there is a positive association between high serum

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uric acid levels and diabetes, whereas other studies reported no association, or an inverse relationship<sup>13</sup>. Hyperuricemia has been also added to the set of metabolic abnormalities associated with insulin resistance and/or hyperinsulinemia in metabolic syndrome. Uric acid has been implicated in the development of metabolic syndrome and hypertension. However, hyperuricemia is not always found in diabetic individuals. Although several studies have implicated the role of UA in progression of prediabetes to diabetes, studies related to UA levels in diabetes development are controversial and deserve further analysis<sup>14</sup>.

Elevated uric acid is one of the metabolic abnormalities associated with hyperinsulinemia as seen in NIDDM and impaired glucose tolerance. The role of elevated S. uric acid in the progression of prediabetic to overt diabetic stage is well established<sup>15</sup>. Hence the present study was conducted on controlled & uncontrolled diabetic patients in order to observe the effect of abnormal glycemic control on uric acid metabolism.

## MATERIAL AND METHODS

This cross sectional study was conducted in the Laboratory of Ghurki Trust Teaching Hospital and Shalamar Hospital Lahore. A total of 158 diabetic patients were included in this study from the Out-Patient Department. The study subjects were classified as good controlled diabetic group which include 76 patients and poor controlled diabetic group which contain 82 patients based on their HbA1C level (individuals with HbA1C level < 7.00 was considered as good controlled diabetic group and with HbA1C level 7.00 was considered as poor controlled diabetic group). Patients with serious co morbid diseases (infection, stroke, myocardial infarction, major surgery, malabsorption), history of using drugs significantly affecting glucose metabolism (glucocorticoids, oral contraceptives containing levonorgestrel or high-dose estrogen, phenytoin, high-dose thiazide diuretics) were excluded.

3mL of venous blood was collected from each subject in EDTA vacutainer and 2mL in serum separator tubes (BD vacutainer). The serum sample was allowed to clot for 15 to 30 minutes in a vertical position till a dense clot formed. Serum was separated by centrifugation at 3000g for 05-10 minutes. Separated serum was stored at -20°C before analysis. Uric Acid levels were performed by colorimetric method (Uricase) on fully automated chemistry analyzer. HbA1c was performed by High Performance Liquid Chromatography (HPLC). Data analysis was performed by using Statistical Package for Social Science (SPSS) for Windows version 20.

Student's *t* test was done to compare mean between groups. *p* value less than 0.05 was considered as significant.

## RESULTS

A total number of 158 subjects were included in the study. 63.9% population was female and 36.1% population was male. Mean age of the study population was 48.14±11.29 years (range 24-79 years). Mean HbA1c level recorded was 8.154±2.274% (range 4.6-15.6%). Mean serum uric acid level of the study participants was 5.289±1.602 mg/dL (range 2.2-11.0 mg/dL).

Two groups of the study subjects were formulated on the basis of HbA1c results. The participants of the study having HbA1c of less than or equal to 7.0% were included in Good control group while the study participants having HbA1c value of equal or greater than 7.0% were assigned in Poor control group. These groups were named according to the control of diabetes mellitus by the study subjects. According to this criteria 76 out of 158(48.1%) study subjects were categorized as good control and 82 out of 158(51.9%) were placed in poor control. The mean serum uric acid level in good control group was 5.24±1.48mg/dL. The mean serum uric acid level in poor control group was 5.34±1.718mg/dL. Student t-test was applied to compare the means of serum uric acid between these two groups. The difference of means between good control and poor control group was statistically non significant with a *p*-value of 0.694.

The mean serum uric acid level was 5.77mg/dL in good controlled diabetic males. The mean serum uric acid level was 5.43mg/dL in males having poor controlled diabetes. The mean serum uric acid level was 4.86mg/dL in females having good control of diabetes. The mean serum uric acid level was 5.29mg/dL in females having poor control of diabetes. There was a positive correlation between HbA1c and serum uric acid levels(*r* 0.013) but this correlation was not statistically significant (*p* 0.870).

Table 1: Demographic data of study participants

	N	Min.	Max.	Mean	Std. Deviation
Age (Years)	158	24	79	48.14	11.294
HbA1c(%)	158	4.6	15.6	8.154	2.2747
S.UA(mg/dl)	158	2.2	11.0	5.289	1.6026

Table 2: Uric acid levels in Good and Poor control subjects

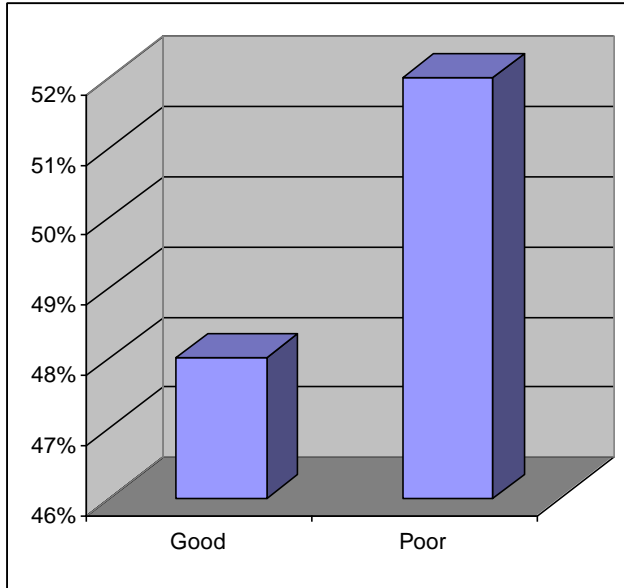
HbA1c Group	N	Mean	Std. Deviation
SUA(mg/dl)			
Good	76	5.237	1.4811
Poor	82	5.338	1.7153

P value: 0.694

Table 3: correlation of HbA1c with serum uric acid.

HbA1c(%)	S.UA(mg/dL)
Pearson Correlation	.013
Significance(2-tailed)	.870

Fig. 1: Groups of patients on the basis of HbA1c levels.



**DISCUSSION**

A total number of 158 subjects were included in the study. The study was planned to find out the consequences of Diabetes Mellitus on uric acid metabolism. DM is one of the major diseases that affect a large number of the population of the world. Life style changes are one of the main contributors to the causes of DM. These life style changes and pathology of DM may also contribute to uric acid metabolism.

Serum uric acid has been shown to be associated with cardiovascular disease, hypertension, and chronic kidney disease in previous studies. However, few studies have examined the association between serum uric acid and diabetes mellitus and their findings are not consistent. It is concluded in the current study that there is no significant difference in mean serum uric acid levels between patient having good diabetic control and patients with poor diabetic control. Positive but non significant association was observed between HbA1c and serum uric acid levels.

Adam et al., (2012) conducted a study on Uric acid profile in apparently healthy people and diabetics. Prevalence of hyperuricemia in relation to age, gender and disease condition was monitored. A total of 96 subjects were evaluated in the study. They reported that levels of uric acid were much higher in subjects that have type 2 diabetes mellitus.

Bonakdaran et al., (2011) reported after a cross-sectional study of 1275 patients (555 men and 720 women) with type 2 diabetes mellitus. Serum uric acid and urinary albumin-creatinine ratio were determined in the study. Other parameters included were lipid profile, HbA1c, glomerular filtration rate, body mass index, blood pressure and blood glucose were assessed. According to results, the mean age of the patients was 52.45±10.11 years. There was a significant relationship between hyperuricemia and serum triglyceride, fasting blood glucose, HbA1c, glomerular filtration rate, and serum creatinine levels (P<.001). The results of present study are not in continuation with these results this may be due to change in genetic makeup and different life style between the populations.

Bandaru, P. et al., (2011) reported that higher serum uric acid levels were inversely associated with diabetes mellitus. Taniguchi, Y. et al., (2001) included a total of 6356 Japanese men, aged 35-60 years in study and concluded that serum uric acid level was associated with an increased risk for hypertension but not for Type 2 diabetes. The results of this study are in agreement of the present study.

**CONCLUSION**

The present study concluded that there is no significant association of HbA1c levels with serum uric acid levels in our population. The serum uric acid investigation is not required in routine for diabetic patients. Uric acid should only be requested in case of patient presenting with symptoms of hyperuricemia.

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