Research Article

Assessment of serum uric acid levels in Type 2 diabetes mellitus patients

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Received: October 02, 2017; **Accepted:** October 18, 2017

ABSTRACT

Background: Diabetes mellitus is a metabolic disorder of carbohydrate metabolism, producing hyperglycemia and is affected by factors like insulin resistance. Hyperglycemia can produce reactive oxygen species or free radicals due to its effects on various pathways. These free radicals may lead to oxidative stress in diabetes and as a preventive measure; the body may increase its preventive antioxidants. **Objectives:** Uric acid is considered to be an antioxidant and this study was undertaken to understand the relation of serum uric acid levels in Type 2 diabetes patients. **Materials and Methods:** A cross-sectional study was done and included 100 individuals (50 Type 2 diabetes cases and 50 normal controls). Fasting blood glucose level and 2-h postprandial blood glucose level were estimated by glucose oxidase-peroxidase endpoint method, and serum uric acid levels were measured by uricase-trinder endpoint method on fully automated chemistry analyzer. **Results:** Serum uric acid levels were significantly elevated in Type 2 diabetes patients group as compared to nondiabetic controls. The mean uric acid level in cases was found to be 8.02 ± 1.86 mg/dl, whereas in controls, it was found to be 3.73 ± 1.06 mg/dl. The difference was statistically significant ($P < 0.05$). **Conclusion:** Monitoring of serum uric acid levels in persons having Type 2 diabetes can help in knowing the effects of oxidative stress in these cases and can be used as an aid to other tests.

KEY WORDS: Diabetes Mellitus Type; Serum Uric Acid; Antioxidant

INTRODUCTION

Diabetes mellitus is a group of metabolic disorders of carbohydrate metabolism in which glucose is underused, producing hyperglycemia. The key risk factors are metabolic syndrome and insulin resistance. Oxidative stress can produce reactive oxygen species (ROS) and is proposed to be the link between the various molecular disorders leading to insulin resistance, β-cell dysfunction and impaired glucose tolerance which can result in the development of Type 2 diabetes mellitus.[1,2]

Access this article online	
Website: http://www.ijmsph.com	**Quick** Response code
DOI: 10.5455/ijmsph.2017.1027618102017	

Hyperglycemia can lead to the production of ROS such as superoxide, hydrogen peroxide, and hydroxyl radicals during a number of enzymatic and nonenzymatic pathways such as glucose oxidative phosphorylation, the polyol pathway, advanced-glycation end-products, outflow during mitochondrial respiratory chain, and nicotinamide adenine dinucleotide phosphate oxidase activation.[3] These free radicals may lead to oxidative stress in diabetes, and as a preventive measure, the body may increase its preventive antioxidants as a defence mechanism.

Uric acid is the most abundant of antioxidant in plasma.[4] Urate, the soluble form of uric acid in the blood, can scavenge superoxide radicals, hydroxyl radicals, and singlet oxygen and can chelate transition metals.[5] Uric acid is considered to be a potent scavenger of free radicals. Recent researchers have shown that uric acid has extreme scavenging capability and may have therapeutic influences.[6]

However, the role of uric acid in diabetes mellitus has not been clearly defined. Uric acid is one of the major endogenous water-soluble antioxidants of the body. Increase in serum uric acid concentration along with blood glucose reflects the role of hyperglycemia in the genesis of oxidative stress in the diabetic patients.[7]

Hence, uric acid as a biochemical parameter may be estimated to know its relation as an antioxidant in Type 2 diabetes. This study was conducted to understand the relation of serum uric acid levels in Type 2 diabetes cases.

MATERIALS AND METHODS

The cross-sectional study was carried out at civil hospital, Ahmedabad, from May 2017 to September 2017. This study included total 100 subjects, out of whom 50 were Type 2 diabetic patients as cases and 50 healthy individual controls. Case group had a mean age of 54.6 ± 10.05 years; of which, 50% were men and 50% were women. The control group had mean age of 44.9 ± 10.2 years with 50% men and women each. Patients with Type 1 diabetes mellitus were excluded.

Under aseptic precautions, venous blood sample was collected in plain and fluoride vacutainers (fasting and postprandial samples). Diagnostic criteria for Type 2 diabetes mellitus were based on fasting blood sugar (FBS) ≥126 mg/dl, 2-h blood glucose levels ≥200 mg/dl. The test methodology for glucose levels was by colorimetric method of glucose oxidase-peroxidase. Serum sample was used to estimate serum uric acid by uricase-trinder endpoint method. (Reference range: Males - 3.6-8.4 mg/dl and females - 2.9-7.5 mg/dl). Fully auto chemistry analyzer was used for the testing of samples.

Statistical Analysis

Data were entered into Microsoft Excel 2007 and Epi Info 7. Demographic data analysis was performed and unpaired *t*-test was used to show the significance of serum FBS, postprandial blood sugar, and serum uric acid levels between cases and controls. The entire data were analyzed using the software graph pad. $P < 0.05$ was considered to be statistically significant and $P < 0.001$ was considered to be statistically highly significant.

RESULTS

In this study, 100 subjects were studied in which 50 were Type 2 Diabetic cases and 50 were apparently healthy controls. Both the groups were sex-matched with 25 males and 25 females in each groups. The mean age of the cases involved in this study was 54.6 ± 10.05 years and the mean age of controls was 44.9 ± 10.2 years. The mean fasting plasma glucose level was higher in cases (181.36 ± 67.22 mg/dl) than in controls (95.56 ± 8.51 mg/dl). The mean postprandial plasma glucose level was also higher in cases (268.77 ± 88.06 mg/dl) than controls (116.01 ± 17.57 mg/dl). The mean uric acid level in cases was found to be 8.02 ± 1.86 mg/dl, whereas in controls, it was found to be 3.73 ± 1.06 mg/dl as shown in Table 1.

Table 1: Mean fasting blood glucose, PPBS, and uric acid level in cases and controls

Parameter	Case	Control	*P*
(Mean±SD)	(*n*=50)	(*n*=50)	
FBS (mg/dl)	181.36±67.22	95.56±8.51	<0.05
PPBS (mg/dl)	268.77±88.06	116.01±17.57	<0.05
S.UA (mg/dl)	8.02±1.86	3.73±1.06	<0.05

PPBS: Postprandial blood sugar, FBS: Fasting blood sugar, SD: Standard deviation

The mean value of serum uric acid level was higher in cases than in controls and the difference is statistically significant ($P < 0.05$).

DISCUSSION

This study shows that the serum uric acid levels in Type 2 diabetic cases were significantly higher as compared to healthy control persons.

Similar results were observed in various other studies such as done by Srivastava and Dixit,[8] Kumari and Sankaranarayana[9] which also reported higher serum uric acid levels in Type 2 diabetics than in normal controls. Furthermore, in the study done by Rao and Vanukuri,[10] it was reported that serum uric acid levels are significantly elevated in diabetics and the levels correlated with high triglycerides and with duration of diabetes. However, in the study reported by Rao and Sahayo,[11] the uric acid levels were higher only for prediabetics and not for diabetics. The studies done by Shabana et al.[12] reported a decreased uric acid level. As per our study, it was concluded that hyperuricemia was positively associated with hyperglycemia.

Hyperuricemia is caused by muscle wasting and weight loss in diabetes mellitus. Chronic high glucose concentration causes tissue injury, in turn, leads to increasing nonprotein nitrogen substances. This well-known phenomenon may account for increased uric acid levels. Hyperuricemia has been found to be associated with obesity and insulin resistance, and consequently with Type 2 diabetes.[13,14]

The small sample size is a limitation for this study.

CONCLUSION

It can be concluded as per this study that serum uric acid levels are elevated in persons having Type 2 diabetes as

compared to normal control persons. Since uric acid has an antioxidant effect, and its levels rise due to oxidative stress in the body, this basic test can be utilized to monitor the effects on Type 2 diabetes mellitus patients and can be an aid to other tests done in diabetic cases.

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How to cite this article: Sidhu GK, Oza R, Khubchandani AS, Prajapati B. Assessment of serum uric acid levels in Type 2 diabetes mellitus patients. Int J Med Sci Public Health 2017;6 (Online First). Doi: 10.5455/ijmsph.2017.1027618102017

Source of Support: Nil, **Conflict of Interest:** None declared.