ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare & Pharmascope Foundation Journal Home Page: www.ijrps.com

Relationship between uric acid and creatinine in pre-diabetic and diabetic patients: Vidarbha region of Maharashtra

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Article History:

Received on: 13 Apr 2020
Revised on: 16 May 2020
Accepted on: 19 May 2020

Keywords:

Prediabetes,
Type II Diabetes Mellitus,
Uric Acid,
Serum Creatinine,
IGT,
IFG

ABSTRACT

Prediabetes is a glucose homeostasis condition characterized by decreased absorption to glucose or reduced fasting glucose. Both of these are reversible stages of intermediate hyperglycaemia providing an increased type II DM risk. Pre-diabetes can therefore be viewed as a significant reversible stage which could lead to type II DM, and early detection of prediabetes may contribute to type II DM prevention. Prediabetes patients are at high risk for potential type II diabetes, and 70 percent of them appear to develop Type II diabetes within 10 years. The present study includes total 200 subjects that include 100 Pre-diabetic patients, 50 T2DM patients and 50 healthy individual. Blood samples were collected from the subjects were obtained for FBS, PPBS, Uric acid and Creatinine estimation, from OPD and General Medicine Wards. Present study showed low levels of Serum Uric Acid in prediabetic and T2DM patients were decreased as compared to control group, while the level of creatinine in pre-diabetic and diabetic were elevated as compared to control group, were not statically significant. Serum Uric Acid was high in control group and low in prediabetic and diabetic patients. Serum creatinine was declined in control group and increased in prediabetic and diabetic patients with increasing Fasting blood glucose level.

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ISSN: 0975-7538

DOI: https://doi.org/10.26452/ijrps.v11i3.2479

Production and Hosted by

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INTRODUCTION

Pre-diabetes is a glucose homeostasis condition characterised by decreased absorption to glucose or reduced fasting glucose. Both of these are reversible stages of intermediate hyperglycaemia providing an increased Type II DM risk (Kahn, 1997). Among people with diabetes, the incidence of hemoptysis and sputum positivity was higher than in non-diabetics (Cladius *et al.*, 2017). Pre-diabetes is a disorder described as having blood glucose levels above average but lower than the established diabetes threshold. It is considered an at-risk state,

with high chances of DiabetesDiabetes. While pre-diabetes is usually an asymptomatic disease, pre-diabetes is often present before DiabetesDiabetes begins.

Pre-diabetes can, therefore, be viewed as a significant reversible stage which could lead to Type II DM, and early detection of pre-diabetes may contribute to Type II DM prevention. Pre-diabetes patients are at high risk for potential Type II diabetes, and 70% of them appear to develop Type II diabetes within ten years (Pour and Dagogo-Jack, 2011). Higher in the pre-diabetic community were systolic blood pressure, diastolic blood pressure, BMI, dyslipidemia and CIMT (Bhinder and Kamble, 2018). We conclude that pre-diabetes is a risk factor for neuropathy development, with hyperglycemia working by the same mechanism as in diabetes cases. Patients with pre-diabetes run the risk of developing full-blown neuropathy (Rathi *et al.*, 2019).

Blood sugar elevation is a continuum, and therefore pre-diabetes cannot be considered a benign disease. Pre-DM is classified as

1. Impaired fastening glucose (IFG) with fastening plasma glucose levels of 100 to 125 mg/dL (5.6 to 6.9 mmol/L),
2. Impaired glucose tolerance (IGT) with plasma glucose levels of 140 to 199 mg / dL (7.8 to 11.0 mmol/L)2-hour postprandial.
3. 5.7 to 6.4% HbA1c (American Diabetes Association, 2010).

Uric acid (UA) is the final product of purine catabolism in humans. Since the time hyperuricemia with hyperglycemia levels (99-101, 38 and 40) were described, there has been a growing interest in the association. The association was described in 1923 (Kylin, 1923). High blood uric acid concentration can lead to gout and is associated with several medical conditions, including metabolic syndrome, cardiovascular disorders, DiabetesDiabetes, and renal dysfunctions (Remedios *et al.*, 2012; Chen *et al.*, 2007; Ali *et al.*, 2018). Serum uric acid (SUA) has been shown in epidemiological research to be a risk factor for hypertension, dyslipidemia, cardiovascular and kidney disease (Ali *et al.*, 2019; Feig *et al.*, 2008). The biological process that underlying the relationship between Serum uric acid and development of DiabetesDiabetes remains a matter of debate. Hyperuricemia can lead to endothelial dysfunction of and inhibition of nitric oxide, which in turn contributes to insulin resistance and thus DiabetesDiabetes (Nakagawa *et al.*, 2005).

Serum creatinine is mainly a metabolite of creatine, almost all of which is in the skeletal muscle. Standard creatinine levels are 0.8 to 1.4 mg/dL. Females typically have a lower creatinine (0.6 to 1.2 mg/dL) than males, because they generally have less muscle mass (Goldman *et al.*, 2007).

Morbidity and Mortality

As of 2013, the world had 382 million people living with DiabetesDiabetes, more than 592 million by 2035 (Guariguata *et al.*, 2014). According to predictions in the 6th edition of the Diabetes Atlas of the International Diabetes Federation, Turkey is expected to become one of ten countries with the most significant number of patients suffering from diabetes mellitus (Satman *et al.*, 2013; Decode study group and European Diabetes Epidemiology Group, 2001). Such an increase in DiabetesDiabetes incidence indicates the need to take measures to avoid DiabetesDiabetes. The first step to be considered is to identify important risk factors for candidates for DiabetesDiabetes and the progression of Diabetes. In individuals with Diabetes, the platelet indices were significantly higher relative to non-diabetic controls (Kumar *et al.*, 2019). The existence of impaired fasting glucose, impaired glucose tolerance, or both, increases the risk that DiabetesDiabetes can contract. Any of these disorders is called pre-diabetes (Stefan *et al.*, 2016). Plasma Sugar, HbA1c and MDA will help to diagnose DiabetesDiabetes, its severity, complications and metabolism (Ranjit *et al.*, 2020).

Serum uric acid (SUA) has been identified in epidemiological research as a risk factor for hypertension, dyslipidemia, cardiovascular disease and kidney disease (Feig *et al.*, 2008; Dehghan *et al.*, 2008). Decreased serum creatinine is associated with an increased risk of Type II diabetes Mellitus that may indicate a smaller skeletal muscle volume. Skeletal muscle is a significant insulin target tissue, and a lower skeletal muscle volume would mean less insulin target sites that cause insulin resistance to increase. This may lead to the development of Type II diabetes mellitus. This may explain in part the pathogenesis of Type II diabetes associated with lower serum creatinine (Dabla, 2010).

MATERIALS AND METHODS

Study Area

The study was conducted in the Department of Biochemistry and Department of Medicine at Datta Meghe Medical College, Shalinitai Meghe Hospital and Research Centre, Hingana Nagpur in collaboration with Jawaharlal Nehru Medical College,

(Datta Meghe Institute of Medical sciences) Sawangi (Meghe) Wardha, Maharashtra.

Study Population

Group I:100 Pre diabetic Patients from group 1 were enrolled in the medical ward.

Group II: 50 T2DM patients from group 2 and

Group III: 50 Normal control was selected from the general population

Patients Selection

Total of 200 subjects was enrolled and was grouped as mentioned ahead.

Study Type

A cross-sectional study

Sample Collection

5 ml blood sample was collected in the plain dry test tube and fluoride tube. A serum sample was obtained by centrifugation. The sample was immediately separated into another plain sterile test tube and stored at -170 C. Serum sample was used to estimate serum creatinine, serum uric acid by using semi autoanalyser and fluoride sample was used to determine FBS. Serum creatinine was analysed using Jaffe's method, serum uric acid by caraways method. FBS was estimated by GOD-POD method.

Biochemical Analysis

Serum Uric Acid and serum creatinine were analysed in the central clinical laboratory by following methods at DMMC, SMHRC Hospital, Wanadongri, Nagpur in collaboration with JNMC & AVBRH Sawangi, Wardha, Maharashtra.

Fasting Blood Glucose level estimated by GOD-POD method (Davis *et al.*, 1978).

Serum Uric Acid was analysed by caraways Method (Archibald, 1957).

Serum Creatinine was analysed by Jeff's Method (Syal *et al.*, 2013).

Inclusion Criteria

Subject with FBS >110mg/dl in 35 to 65-year-old male and female

Exclusion Criteria

Subjects with age < 35 yrs and >65 yrs

Chronic liver disease

Chronic renal disease

HIV patient

Tuberculosis

Asthma

Malignancy

Pregnant women

Any chronic inflammatory disease

Statistical Analysis

The collected data was entered the Microsoft Excel Worksheet and statistically analysed by using SPSS (Statistical Package for Social Sciences) version 20. For quantitative data mean, standard means, standard deviation, t-test and Karl Pearson's Coefficient of Correlation were calculated. P-value < 0.05 (0.01) will be considered as statically significant (highly significant) at 95% confidence interval.

OBSERVATION AND RESULTS

Table 1 shows that the FBS level in pre-diabetic patients were 115±6.23 as compared to control group 88.9±11.1, which is statistically significant. The level of Serum uric acid in pre-diabetic was 5.68±1.70, and in control group 6.20±1.86, serum creatinine level in the pre-diabetic patient were 1.38±0.39 and in control group level of creatinine were 1.34±0.54.

Table 2 shows that the FBS level in T2DM patients were 189.6±70.2 as compared to control group 88.9±11.1, which is statistically significant. The level of Serum uric acid in T2DM were 4.88±1.60, and in control group 6.20±1.86, serum creatinine level in T2DM patient were 1.38±0.44 and in control group level of creatinine were 1.34±0.54.

Table 3 shows that the FBS level in pre-diabetic patients were 115±6.23 as compared to T2DM patients 189.6±70.2, which is statistically significant. The level of Serum uric acid in pre-diabetic was 5.68±1.70, and in T2DM patients 4.88±1.6, serum creatinine level in the pre-diabetic patient were 1.38±0.39 and in T2DM patients' level of creatinine were 1.38±0.44.

DISCUSSION

Our study shows the serum uric acid is lower in pre-diabetic and T2DM patients (5.68±1.70 and 4.88±1.65, respectively) as compared to control group (6.20±1.86). (Anothaisintawee *et al.*, 2017) The relationship between Serum uric acid and glucose metabolism markers in pre-diabetes patients was discussed and the role of WC in this relationship. Mediation analysis findings indicated that uric acid was substantially correlated with FBS; that is increasing uric acid would increase Fasting plasma glucose.

(Haque *et al.*, 2019) A significant negative correlation was found between Serum Uric Acid and Fast-

Table 1: Comparison of Mean SUA and S. creatinine in control groupand prediabetic, patients T2DM and Control Group

Parameters	Control (n=50)	Prediabetic(n=100)	'P' Value
FBS (mg/dl)	88.9±11.1	115±6.23	<0.0001
Serum Uric Acid(mg/dl)	6.20±1.86	5.68±1.70	0.0892
Serum Creatinine(mg/dl)	1.34±0.54	1.38±0.39#	0.6048

Table 2: Comparisonof Mean SUA and S. creatinine in control group and T2DM patients

Parameters	Control (n=50)	T2DM (n=50)	'P' Value
FBS (mg/dl)	88.9±11.1	189.6±70.2**	<0.0001
Serum Uric Acid(mg/dl)	6.20±1.86	4.88±1.6	0.0002
Serum Creatinine(mg/dl)	1.34±0.54	1.38±0.44#	0.6856

Table 3: Comparisonof Mean SUA and S. creatinine in prediabetic and T2DM patients

Parameters	Prediabetic(n=100)	T2DM (n=50)	'P' Value
FBS (mg/dl)	115±6.23**	189.6±70.2**	<0.0001
Serum Uric Acid(mg/dl)	5.68±1.70	4.88±1.6	0.0063
Serum Creatinine(mg/dl)	1.38±0.39#	1.38±0.44#	1.0000

ing Blood Glucose concentrations Pearson's coefficient test ($p < 0.01$) combines participants from all classes. A significant negative association between serum uric acid and fasting blood glucose was also observed when individuals are combined in the non-diabetes and pre-diabetes classes ($p < 0.01$). Serum uric acid levels in the pre-diabetes and diabetes groups were steadily decreased compared with the non-diabetic stable community in both genders.

Table 2 shows that the FBS level in T2DM patients were 189.6±70.2 as compared to control group 88.9±11.1, which is statistically significant. The level of Serum uric acid in T2DM were 4.88±1.60 and in control group 6.20±1.86.

Various studies were undertaken to determine the role of uric acid in T2DM. Nan *et al.* (2010) investigated the association of serum UA with either FPG or 2hPG levels among Chinese adults in Qingdao, China. This study revealed that fasting serum UA levels were higher in the pre-diabetic population but lower in people with DiabetesDiabetes, suggesting that UA changes may serve as a marker of deterioration in glucose metabolism.

Robles-Cervantes *et al.* (2011) studied Serum uric acid concentration in DM 2 and showed a positive relationship with the total phase of insulin secretion r = 0.295 (P =0.049). This study concluded that even in states before hyperuricemia, uric acid could play an essential role in the function of the beta-cell in patients with DM2.

In our study, we found the level of creatinine in the pre-diabetic patient was 1.38±0.39, and in T2DM patient 1.38±0.44 as compare to control group 1.34±0.54, which is statically non-significant.

Nwose *et al.* (2011) Mean serum creatinine levels were not statically significantly different in the controls (80 +/- 32 micromol/L), diabetes (82 +/- 26 micromol/L) and pre-diabetes (82 +/- 23 micromol/L). Low serum creatinine levels less prevent pre-diabetes (11%) than in control (23%).

Sitholay *et al.* (2017) shows that the activity of blood urea, serum creatinine and uric acid was highly significantly increased found in type-2 DM patients compared to the regular healthy group.

CONCLUSION

Serum Uric Acid was high in the control group and low in pre-diabetic and diabetic patients. Serum creatinine was declined in the control group and increased in pre-diabetic and diabetic patients with increasing Fasting blood glucose level. Further studies are required to conclude the reliability of examining serum uric acid and serum creatinine to predict DiabetesDiabetes.

Source of Funding and sponsorship

Nil

Conflicts of interest

There are no conflicts of interest.

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