ESTIMATION OF SERUM URIC ACID LEVELS IN NORMAL PREDIABETIC AND DIABETIC PERSON

Prakash Gurupad Mantur[1], Rajendra Chandrashekar Bidri[2]

[1]Associate Professor, Department of Medicine, BLDEU, Shri B. M. Patil Medical College, Hospital and Research Centre, Vijayapura.
[2]Professor, Department of Medicine, BLDEU, Shri B. M. Patil Medical College, Hospital and Research Centre, Vijayapura.

ABSTRACT

BACKGROUND

Raised serum uric acid has been associated with a lot of diseases like hypertension, cardiovascular diseases, chronic kidney disease, peripheral vascular diseases and metabolic disorders. But, the association of serum uric acid levels to that of diabetes mellitus has not been successfully understood. A sincere effort has been put in this study to find out the serum uric acid levels in normal individuals, prediabetics and diabetics and come to a conclusion on the correlation of serum uric acid in diabetes mellitus.

MATERIALS AND METHODS

One hundred eighty people who visited the Department of Medicine were selected. The study included ninety males and ninety females and in each group there were thirty non-diabetic, thirty prediabetics and thirty diabetics. Prediabetics were considered as 110 to 125 mg/dL (6.1 mM/L to 6.9 mM/L) - that is WHO criteria was followed. All the subjects were aged between 40-60 years. The correlations were made between the serum uric acid levels and serum fasting glucose, serum postprandial and HbA1c.

RESULTS

The results show a rise in the serum uric acid levels in the prediabetic and not so much in the non-diabetics and the confirmed diabetics.

CONCLUSION

The serum uric acid level measurements can be used as a powerful tool in identifying the prediabetic condition and help an individual to make the necessary lifestyle adjustments so that the progression of the diseases can be stopped or maybe infinitely delayed.

KEYWORDS

Serum Uric Acid, Diabetes Mellitus, Prediabetic, Purine Nucleotide Catabolism.

BACKGROUND

The end product of purine nucleotide catabolism is uric acid. The degradation is taking place in the liver. The xanthine oxidase is a metalloflavoprotein containing FAD, molybdenum and iron. As xanthine is oxidised to uric acid, the electrons are transferred first to molybdenum, then to FAD and finally to molecular oxygen, when hydrogen peroxide (one of the reactive oxygen species) is produced. Strecker in 1857 showed the presence of uric acid in urine. In 1892, Sir Frederick Hopkins (Nobel Prize, 1929) estimated uric acid. In 1895, Emil Fischer (Nobel Prize, 1902) showed that uric acid is derived from purine.

Normal blood level of uric acid ranges from 2-5 mg/dL in females and 3-7 mg/dL in males. The daily excretion varies from 500-700 mg. Nucleic acid content is more in non-vegetarian diet. Uric acid is sparingly soluble in water. Uric acid is an antioxidant.[1]

Raised serum uric acid has been associated with a lot of diseases like hypertension,[2,3,4] cardiovascular diseases,[5] chronic kidney disease,[6] peripheral vascular diseases[7] and metabolic disorders.[8]

But, the association of serum uric acid levels to that of diabetes mellitus has not been successfully understood. In some studies, the results showed a positive association between high serum uric acid levels and diabetes,[9-14] whereas other studies reported no association[15] or an inverse relationship.[16,17] With this background, a sincere effort has been put in this study to find out the serum uric acid levels in normal individuals, prediabetics and diabetics and come to a conclusion on the correlation of serum uric acid in diabetes mellitus. The correlation of serum uric acid with that of fasting serum glucose level, postprandial serum glucose level and HbA1c was also done to get a correct answer for the above-discussed problem.

AIMS AND OBJECTIVES
1. To estimate the serum uric acid level in normal, prediabetic and diabetic subjects.
2. To correlation of serum uric acid with that of fasting serum glucose level, postprandial serum glucose level and HbA1c.

MATERIALS AND METHODS
One hundred eighty people who visited the Department of Medicine from September 2016 to February 2017 were included in the study.

The study was done in the Department of Medicine, OPD/IPD.

The study included ninety males and ninety females and in each group there were thirty non-diabetic, thirty prediabetics and thirty diabetics.

Prediabetics were considered as 110 to 125 mg/dL (6.1 mM/L to 6.9 mM/L) - that is WHO criteria was followed.

All the subjects were aged between 40-60 years.

Informed consent was taken.

All the subjects underwent serum uric acid estimation. Then, the mean serum fasting glucose, mean serum postprandial and mean HbA1c was estimated in prediabetics and diabetics.

The correlations were made between the serum uric acid levels and serum fasting glucose, serum postprandial and HbA1c.

Inclusion Criteria
1. The subjects were between 40-60 years old.
2. WHO criteria was taken into consideration. So, 100-125 mg/dL serum fasting glucose levels were considered as prediabetics and were considered for study.

Exclusion Criteria
1. Other muscle wasting, starving, liver disease patients were omitted.
2. Patients with serum creatinine >1.0 mg/dL (sign of renal failure) were excluded.

RESULTS

Sex	Number of Patients	Mean Uric Acid Level
Male	30	3.84 ± 0.62
Female	30	4.77 ± 0.71

Table 1. Mean Serum Uric Acid Levels in Non-Diabetic Subjects

Sex	Number of Patients	Mean Uric acid Level
Male	30	5.96 ± 0.17
Female	30	7.43 ± 0.54

Table 2. Mean Serum Uric Acid Levels in Prediabetic Subjects

Sex	Number of Patients	Mean Uric Acid Level
Male	30	4.32 ± 0.73
Female	30	4.79 ± 0.12

Table 3. Mean Serum Uric Acid Levels in Diabetic Subjects

The results show a rise in the serum uric acid levels in the prediabetic and not so much in the non-diabetics and the confirmed diabetics.

Sex	Prediabetics (Fasting Glucose Level)	Prediabetics (Uric Acid Level)	Diabetics (Fasting Glucose Level)	Diabetics (Uric Acid Level)
Male	114 ± 0.73	5.96 ± 0.17	179 ± 0.54	4.32 ± 0.73
Female	109 ± 0.21	7.43 ± 0.54	194 ± 0.71	4.79 ± 0.12

Table 4. Mean Fasting Blood Glucose Levels and Mean Uric Acid Levels

Sex	Prediabetics (Postprandial Glucose Level)	Prediabetics (Uric Acid Level)	Diabetics (Fasting Glucose Level)	Diabetics (Uric Acid Level)
Male	182 ± 0.73	5.96 ± 0.17	206 ± 0.62	4.32 ± 0.73
Female	167 ±0.21	7.43 ± 0.54	243 ± 08	4.79 ± 0.12

Table 5. Mean Postprandial Blood Glucose Level and Mean Uric Acid Level

Sex	Prediabetics (HbA1c)	Prediabetics (Uric Acid Level)	Diabetics (HbA1c)	Diabetics (Uric Acid Level)
Male	5.9 ± 0.2	5.96 ± 0.17	7.4 ± 0.5	4.32 ± 0.73
Female	6.2 ± 0.6	7.43 ± 0.54	7.6 ± 0.3	4.79 ± 0.12

Table 6. Mean HbA1c and Mean Uric Acid Level

There is a significant relation between the prediabetes condition and the serum uric acid levels.

DISCUSSION
Impaired fasting glucose or prediabetes refers to a condition in which the fasting blood glucose is elevated above what is considered normal levels, but is not high enough to be classified as diabetes mellitus. It is associated with insulin resistance and increased risk of cardiovascular pathology. It is thought to be lesser risk than Impaired Glucose Tolerance (IGT). In 50% cases, it progresses to type 2 diabetes mellitus. There is a 50% risk over 10 years of progressing to overt diabetes.

Studies have shown that uric acid is significantly elevated in prediabetic stages and low in diabetes and rises again

after the development of renal insufficiency.[18] Measurement of uric acid is easy in terms of screening can be performed with simple methods in routine laboratories and is inexpensive. Thus, a preventive, cost-effective approach is available with potential implications for public health. It can be used as a powerful tool in identifying the prediabetic condition and help an individual to make the necessary lifestyle adjustments, so that the progression of the diseases can be stopped or maybe infinitely delayed.

CONCLUSION

The serum uric acid level measurements can be used as a powerful tool in identifying the prediabetic condition and help an individual to make the necessary lifestyle adjustments, so that the progression of the diseases can be stopped or maybe infinitely delayed.

REFERENCES

[1] Vasudevan DM, Sreekumari S, Vaidyanathan K. Textbook of biochemistry for medical students. London: JP Medical Ltd 2013:566-567.

[2] Shankar A, Klein R, Klein BE, et al. The association between serum uric acid level and long-term incidence of hypertension: population-based cohort study. Journal of Human Hypertension 2006;20(12):937-945.

[3] Klein R, Klein BE, Cornoni JC, et al. Serum uric acid. Its relationship to coronary heart disease risk factors and cardiovascular disease, Evans County, Georgia. Archives of Internal Medicine 1973;132(3):401-410.

[4] Sundstrom J, Sullivan L, D'Agostino RB, et al. Relations of serum uric acid to longitudinal blood pressure tracking and hypertension incidence. Hypertension 2005;45(1):28-33.

[5] Fang J, Alderman MH. Serum uric acid and cardiovascular mortality the NHANES I epidemiologic follow-up study, 1971-1992. National Health and Nutrition Examination Survey. Journal of the American Medical Association 2000;283(18):2404-2410.

[6] Chonchol M, Shlipak MG, Katz R, et al. Relationship of uric acid with progression of kidney disease. American Journal of Kidney Diseases 2007;50(2):239-247.

[7] Shankar A, Klein ABE, Nieto FJ, et al. Association between serum uric acid level and peripheral arterial disease. Atherosclerosis 2008;196(2):749-755.

[8] Yoo TW, Sung KC, Shin HS, et al. Relationship between serum uric acid concentration and insulin resistance and metabolic syndrome. Circulation Journal 2005;69(8):928-933.

[9] Dehghan A, Hoek VM, Sijbrands E J, et al. High serum uric acid as a novel risk factor for type 2 diabetes. Diabetes Care 2008;31(2):361-362.

[10] Chien KL, Chen MF, Hsu HC, et al. Plasma uric acid and the risk of type 2 diabetes in a Chinese community. Clinical Chemistry 2008;54(2):310-316.

[11] Kramer CK, Von Mühlen D, Jassal SK, et al. Serum uric acid levels improve prediction of incident type 2 diabetes in individuals with impaired fasting glucose. The Rancho Bernardo Study Diabetes Care 2009;32(7):1272-1273.

[12] Nakanishi N, Okamoto M, Yoshida H, et al. Serum uric acid and risk for development of hypertension and impaired fasting glucose or Type II diabetes in Japanese male office workers. European Journal of Epidemiology 2003;18(16):523-530.

[13] Kodama S, Saito K, Yachi Y, et al. Associa

[14] Modan M, Halkin H, Karasik A, et al. Elevated serum uric acid-a facet of hyperinsulinaemia. Diabetologia 1987;30(9):713-718.

[15] Taniguchi Y, Hayashi T, Tsumura K, et al. Serum uric acid and the risk for hypertension and type 2 diabetes in Japanese men: the Osaka health survey. Journal of Hypertension 2001;19(7):1209-1215.

[16] Oda E, Kawai R, Sukumaran V, et al. Uric acid is positively associated with metabolic syndrome but negatively associated with diabetes in Japanese men. Internal Medicine 2009;48(20):1785-1791.

[17] Nan H, Dong Y, Gao W, et al. Diabetes associated with a low serum uric acid level in a general Chinese population. Diabetes Research and Clinical Practice 2007;76(1):68-74.

[18] Choi HK, Ford ES. Haemoglobin A1c, fasting glucose, serum C-peptide and insulin resistance in relation to serum uric acid levels-the Third National Health and Nutrition Examination Survey. Rheumatology 2008;47(5):713-717.