Original Research Article

Relationship between serum uric acid levels and diabetes mellitus: A cross-sectional study

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Abstract

Background: Some studies reported that there is a positive association between high serum uric acid levels and diabetes, whereas other studies reported no association, or an inverse relationship. Present study is done to know the association of blood uric acid with the duration (2-10 years) of diabetes in people with type 2 diabetes only with no other morbidities and any complication. **Material and Methods:** Present cross-sectional study was conducted at tertiary care institute of Gujarat for the duration of 1 year. Hundred type 2 diabetic patients randomly selected from the medicine outpatient department for current study. A biochemical investigation, like the Uricase method employed for fasting serum uric acid levels estimation. Statistical analysis by the Pearson correlation test used. **Results:** A positive correlation present between SUA and duration of type 2 diabetes is statistically significant. As the duration of diabetes increases than there is an increase in the serum uric acid concentration in type 2 diabetes patients. Average uric acid level elevated from 6.80 ± 0.89 in people with the duration of diabetes 2 to 6 years to 7.72 ± 2.90 in people with the duration of diabetes 7 to 10 years. **Conclusion:** The present study has shown a positive correlation existing between SUA and duration of diabetes in the type 2 diabetics. Further large sample study with other investigations like insulin, leptin levels should be assessed to know the strength of this positive association.
Key Words: Cross-sectional, Diabetes, Pearson correlation, Serum uric acid

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INTRODUCTION

The Morbidity and mortality due to noncommunicable diseases specially attributed to diabetes mellitus and coronary heart disease is raising rapidly in India, causing nearly 5.8 million deaths per year annually.[1,2] Insulin resistance state is associated with diabetes mellitus and metabolic syndrome (MS). The four major players in the MS are hyperinsulinemia, hypertension, hyperlipidemia, and hyperglycaemia. According to world health organization diabetes is going to be the 7th leading cause of mortality in 2030. International Diabetes Federation report estimated that 642 million people would be affected by diabetes at the end of the year 2040. Diabetes mellitus is having multiple risk factors and is one of the silent killers of the middle to old aged people in the entire world. It is a metabolic disorder having hyperglycemia associated with dysregulation of lipid and protein metabolism. There are several types of diabetes, out of which type 2 diabetes is because of progressive insulin secretion defect on the background of insulin resistance. In today's scenario, India considered as the diabetes capital of the world. India scores the second-highest number of cases of diabetes in the world after China during the year 2015.[3] Several independent risk factors are associated with the causation of type 2 diabetes. Among them, prominent risk factors are ageing, increased body mass index, lack of exercise etc. Studies show that elevated uric acid levels in the blood might play as an independent biochemical risk factor for the causation of type 2 diabetes. Serum uric acid, an end product of purine metabolism, has been shown to be

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associated with an increased risk of hypertension, cardiovascular disease, and chronic kidney disease in previous epidemiological studies. Also, elevated levels of uric acid is a risk factor for peripheral arterial disease, insulin resistance, and components of the metabolic syndrome.[4-10] However, the putative association between serum uric acid levels and diabetes mellitus is not clear. Some studies reported that there is a positive association between high serum uric acid levels and diabetes, whereas other studies reported no association, or an inverse relationship.[11-16] Few studies show that reduced clearance of uric acid is associated with hyperinsulinemia that causes insulin resistance in type 2 diabetes. A positive correlation between uric acid and fasting blood glucose levels leads to the causation of type 2 diabetes. Furthermore, certain studies indicate that uric acid functions as pro-oxidant and antioxidant according to their concentration levels. Blood uric acid has a role of pro-oxidant properties that causes oxidative stress in the cells and results in the resistance of the cells to the insulin. Studies showed hyperuricemia is associated with excess risk for development of type 2 diabetes.[17-19] whether the hyperuricemia causes type 2 diabetes, or is it one of the complications of diabetes? Therefore the study is done to know the association of blood uric acid with the duration of diabetes in people with type 2 diabetes only with no other morbidities and any complication.

MATERIAL AND METHODS

Present cross-sectional study was conducted at tertiary care institute of Gujarat for the duration of 1 year. Hundred type 2 diabetic patients randomly selected from the medicine outpatient department for current study.

Inclusion criteria: Patients with type 2 diabetes mellitus, Patient's age> 40 years and both sexes were included.

Exclusion criteria: History of CVS, Respiratory, GIT, Renal and CNS disorders. History of endocrine and metabolic disorders like type 1DM, GOUT. Overweight and obese. Smokers. Alcoholics.

Personal, family and diet history from the patients recorded. General physical examination, height (cms), weight (kgs), BMI (Kg/m2), vitals and systemic examinations performed to rule out the exclusion criteria. Overweight, obese and hypertensive excluded from the study, which could affect uric acid and insulin resistance in type 2 diabetics. Specific instructions were given to the patients about 8 hour overnight fasting. Collection of the venous blood samples under aseptic precaution at Central Laboratory of the Hospital done. A biochemical investigation like Uricase method (Peroxidase) employed for the estimation of serum uric acid (SUA) levels in the patients. Uricase method: Uric acid in the blood serum utilizes peroxidase system added with several oxygen acceptors to form a chromogen that develops a colour. By using colourimeter absorbance of the intensity measured at 440 nanometer.

RESULTS

Table 1 show the Pearson correlation of SUA with the duration of diabetes in years of type 2 diabetes. The result showed that a positive correlation present between SUA and duration of type 2 diabetes is statistically significant. As the duration of diabetes increases than there is an increase in the serum uric acid concentration in type 2 diabetes patients. SUA in the type 2 diabetes patients was 7.8 ± 1.7 (mean ± SD) stating that they were suffering from hyperuricemia. Hyperuricemia is termed as >7.0 mg/dL in males and > 6.0 mg/dL in females. 22 Out of 30 were suffering from hyperuricemia (73%). Average uric acid level elevated from 6.80 ± 0.89 in people with the duration of diabetes 2 to 6 years to 7.72 ± 2.90 in people with the duration of diabetes 7 to 10 years shown in the Table 2.

Table 1: Pearson correlation of SUA with the duration of diabetes in Type 2 DM patients

Pair	r value	P value
SUA versus duration of type 2 diabetes	+0.7	0.001*

* indicates statistically significance at p≤0.05; Test applied Pearson correlation test.

Table 2: SUA and duration of type 2 diabetes (T2DM)

Duration of T2DM (years)	No. of patients (30)	SUA (mg/dL)	
		Mean	SD
2-6	14	6.80	0.89
7-10	16	7.72	2.90

DISCUSSION

Considering the strong association between the levels of serum uric acid and the occurrence of coronary atherosclerosis in subjects with type 2 diabetes mellitus, the current study has been undertaken to assess the factors influencing the serum uric acid levels in patients with type 2 diabetes mellitus. Previous studies examining the association between serum uric acid levels and diabetes mellitus were restricted to specific racial/ethnic groups and gender and were not consistent in their findings. Some studies reported that there is a positive association between elevated serum uric acid levels and diabetes, whereas some other study reported no positive association between serum uric acid and diabetes mellitus.[11-16] Also, some studies reported that serum uric acid is inversely associated with diabetes mellitus.[17,18,19] The exact reason for why previous studies found a positive relation between uric acid and diabetes is not clear. Most of these studies were limited by small sample sizes, including either men or women and not both, not having data on confounding factors, or were from

selected populations such as industrial workers as opposed to general population samples. A positive correlation between SUA and the duration of diabetes in type 2 diabetic patients shown in Table 1. Similar results obtained from the study done by Rao TMV and Vanukuri NK[20]on type 2 diabetes patients in India. But in their study exclusion of overweight, obesity and hypertension not done, which acts as a confounding factor to cause hyperuricemia. Hyperuricemia can cause dysfunction of endothelial cells and reduced secretion of nitric oxide that causes insulin resistance and type 2 diabetes. Thirteen Studies done on fructose induced hyperuricemia rats leading to insulin resistance and development of the metabolic syndrome. Hyperuricemia treated by taking hypouricemic drugs.[21] In their review, Katsiki N *et al.* have concluded a strong association between the serum uric acid levels and diabetes and it complications.[22] Keenan T., *et al.* have reported increased by Serum urate levels were not associated with T2DM, CHD, ischemic stroke, or HF. In contradiction to majority of the published studies on the subject, this particular study has suggested, there is no causal role of uric acid and cardiovascular complications in diabetic population.[23] Choi H. K., *et al.* have evaluated the correlation between gout and the future risk of type 2 diabetes among men with a high cardiovascular risk profile and confirmed that, among men with a high cardiovascular risk profile with gout, there is a higher risk of future risk of type 2 diabetes independent of other known risk factors.[24] The uric acid level can also guide as a marker of cardiovascular disease, which is the most frequent cause of mortality in diabetes mellitus. The limitations of the present study include small sample size, other biochemical parameters which support the type 2 diabetes-like serum triglycerides, cholesterol, blood urea, serum creatinine, insulin levels, leptin and other inflammatory mediators like C reactive protein levels not assessed.

CONCLUSION

The present study has shown a positive correlation existing between SUA and duration of diabetes in the type 2 diabetics. Further large sample study with other investigations like insulin, leptin levels should be assessed to know the strength of this positive association. From this study, we conclude that by reducing the uric acid levels with medications can help in preventing the occurrence of insulin resistance. Serum uric acid levels were significantly elevated in diabetic population.

REFERENCES

1. Shrivastava U, Misra A, Mohan V, Unnikrishnan R, Bachani D. Obesity, Diabetes and Cardiovascular Diseases in India: Public Health Challenges. Current diabetes reviews, 2016.
2. Kakkar R. Rising burden of DiabetesPublic Health Challenges and way out. Nepal journal of epidemiology, 2016; 6(2): 557-9.
3. International Diabetes Federation. IDF Diabetic Atlas 7th Edition; 2016. Available from: http://www.idf.org/idf-diabetes-atlas-seventh edition.Accessed.
4. A. Shankar, R. Klein, B. E. K. Klein, and F. J. Nieto, "The association between serum uric acid level and long-term incidence of hypertension: population-based cohort study," Journal of Human Hypertension, vol. 20, no. 12, pp. 937–945, 2006.
5. R. Klein, B. E. Klein, J. C. Cornoni, J. Maready, J. C. Cassel, and H. A. Tyroler, "Serum uric acid. Its relationship to coronary heart disease risk factors and cardiovascular disease, Evans County, Georgia," Archives of Internal Medicine, vol. 132, no. 3, pp. 401–410, 1973.
6. J. Sundstrom, L. Sullivan, R. B. D'Agostino, D. Levy, W. B. Kannel, and R. S. Vasan, "Relations of serum uric acid to longitudinal blood pressure tracking and hypertension incidence," Hypertension, vol. 45, no. 1, pp. 28–33, 2005.
7. J. Fang and M. H. Alderman, "Serum uric acid and cardiovascular mortality: the NHANES I epidemiologic follow-up study, 1971–1992," Journal of the American Medical Association, vol. 283, no. 18, pp. 2404–2410, 2000.
8. M. Chonchol, M. G. Shlipak, R. Katz et al., "Relationship of uric acid with progression of kidney disease," American Journal of Kidney Diseases, vol. 50, no. 2, pp. 239–247, 2007.
9. A. Shankar, B. E. K. Klein, F. J. Nieto, and R. Klein, "Association between serum uric acid level and peripheral arterial disease," Atherosclerosis, vol. 196, no. 2, pp. 749–755, 2008.
10. T. W. Yoo, K. C. Sung, H. S. Shin et al., "Relationship between serum uric acid concentration and insulin resistance and metabolic syndrome," Circulation Journal, vol. 69, no. 8, pp. 928–933, 2005.
11. A. Dehghan, M. Van Hoek, E. J. G. Sijbrands, A. Hofman, and J. C. M. Witteman, "High serum uric acid as a novel risk factor for type 2 diabetes," Diabetes Care, vol. 31, no. 2, pp. 361–362, 2008.
12. K. L. Chien, M. F. Chen, H. C. Hsu et al., "Plasma uric acid and the risk of type 2 diabetes in a Chinese community," Clinical Chemistry, vol. 54, no. 2, pp. 310–316, 2008.
13. C. K. Kramer, D. Von Muhlen, S. K. Jassal, and E. Barrett-¨ Connor, "Serum uric acid levels improve prediction of incident type 2 diabetes in individuals with impaired fasting glucose. The Rancho Bernardo Study," Diabetes Care, vol. 32, no. 7, pp. 1272–1273, 2009.
14. N. Nakanishi, M. Okamoto, H. Yoshida, Y. Matsuo, K. Suzuki, and K. Tatara, "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, vol. 18, no. 6, pp. 523–530, 2003.
15. S. Kodama, K. Saito, Y. Yachi et al., "Association between serum uric acid and development of type 2 diabetes," Diabetes Care, vol. 32, no. 9, pp. 1737–1742, 2009.
16. M. Modan, H. Halkin, A. Karasik, and A. Lusky, "Elevated serum uric acid—a facet of hyperinsulinaemia," Diabetologia, vol. 30, no. 9, pp. 713–718, 1987.

17. Xu Y, Zhu J, Gao L, Liu Y, Shen J, Shen C. Hyperuricemia as an independent predictor of vascular complications and mortality in type 2 diabetes patients: a meta-analysis. PLoS One. 2013;8(10):78206.
18. Krishnan E, Akhras KS, Sharma H, Marynchenko M, Wu EQ, Tawk R, et al. Relative and attributable diabetes risk associated with hyperuricemia in US veterans with gout. QJM. 2013;106(8):721–9. doi:10.1093/qjmed/hct093.
19. Krishnan E, Pandya BJ, Chung L, Hariri A, Dabbous O. Hyperuricimeia in young adults and risk of insulin resistance, prediabetics and diabetes: A 15 year follow up study. Am J Epidemiol. 2012;176:108–124.
20. Rao T, Vanukuri NK. A study on serum uric acid levels in type 2 diabetes mellitus and its association with cardiovascular risk factors. Int Arch Integr Med. 2016;3(12):148–55.
21. Hallfrisch J. Metabolic effects of dietary fructose. FASEB J. 1990;4(9):2652–60. doi:10.1096/fasebj.4.9.2189777
22. Katsiki N, Papanas N, Fonseca VA, Maltezos E, Mikhailidis DP. Uric acid and diabetes: Is there a link? Current pharmaceutical design, 2013; 19(27): 4930-7.
23. Keenan T, Zhao W, Rasheed A, Ho WK, Malik R, Felix JF, et al. Causal Assessment of Serum Urate Levels in Cardiometabolic Diseases Through a Mendelian Randomization Study. Journal of the American College of Cardiology, 2016; 67(4): 407-16.
24. Choi HK, De Vera MA, Krishnan E. Gout and the risk of type 2 diabetes among men with a high cardiovascular risk profile. Rheumatology (Oxford, England)., 2008; 47(10): 1567-70.

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