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Effect of hyperglycemia on serum uric acid levels - A real world comparative study

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Objective: - To determine the relationship between hyperglycaemia and uric acid levels.

Material and methods:- Patients, with known diabetes or impaired glucose tolerance/newly detected patients of diabetes treated on OPD basis or in patients admitted in B.T.G.H over a period of 1yr from April 2017 to March 2018.
Study design: - randomized, comparative, cross-sectional.

Result: - 19 cases of type 2 DM had hypouricemia while 6 in controls .7 cases of IGT had hyperuricemia, 6 controls had hyperuricemia and none in patients with type 2 DM.
Conclusion:- Serum uric acid concentration is slightly reduced in patients with type 2 DM. Serum uric acid concentration is increased in patients with IGT

INTRODUCTION

It is estimated globally 463 million adults are suffering from , the latest data (2019) from the International Diabetes Federation[1]. Diabetes prevalence is rapidly increasing. As per 2017 estimates 425 million people living with diabetes[2]. The number is projected to almost double by 2030. Several studies have shown there are evidences to suggest that low serum uric acid levels may precede the onset of diabetic retinopathy.

Plasma uric acid, an end product of purine metabolism[3].Its levels are genetically determined but are influenced by multiple environmental factors. Recently, it has been shown that there is a definite relationship between hyperglycemia and uric acid levels[4]

Studies done so far have shown that, in the early stages of diabetes, the levels were high and as the diabetic status progresses there is gradual decline of uric acid levels in many patients[5]. It has been reported that hypouricemia may also predict the future progression and hence be an indicator of incipient nephropathy in Type2 DM.

Study design: Comparative study

Study location: B.T.G.H

Ethics approval: BTGH ethical committee.

Study period: April 2017 to March 2018.

Sample size: Approximately 100 patients 50 with impaired glucose tolerance test and/or patients with diabetes mellitus newly detected or already on treatment and 50 normal subjects

Inclusion criteria: Patients, with known diabetes or impaired glucose tolerance/newly detected patients of diabetes or impaired glucose tolerance treated on OPD basis or in patients. Patients already on treatment or freshly detected diabetes

Exclusion criteria

- Patients with BMI >30
- Patients with history of hypertension, alcoholic, myeloproliferative disorders, lymphoproliferative disorders, psoriasis
- Patients not capable of giving consent (psychiatric patients).
- Patients not willing to participate in the study (who refused to give consent)
- Pregnant and lactating women

Methodology:

Parameter used: - Serum uric acid levels, Random blood sugar levels, Impaired glucose tolerance test[1].

STATISCAL ANALYSIS

- Statistical analysis was done using SPSS 16 software.
- Results were interpretedusing paired and unpaired t tests and chi square tests.

RESULTS

Sex	Type 2 DM		IGT		Controls	
		NO.	%	NO.	%	NO.
MALE	22	51.16	3	42.85	25	50
FEMALE	21	48.84	4	57.15	25	50
TOTAL	43	100	7	100	50	100

Table 1. *Cases and Controls number and percentage with respect to gender*

In relation to	Parameters	Cases	Control
type 2 DM	Serum uric acid (mg/dl)	3.54 ±0.82	4.398 ±0.76
IGT	Serum uric acid (mg/dl)	6.5±0.2	4.398±0.76

Table 2. ***Distribution of patients with type 2 DM , IGTin case and controls in relation to serum uric acid level***

			Type 2 DM	IGT	Controls
Hypouricemia	Positive		19	0	6
		Negative		24	7
Hyperuricemia		Positive	0	7	6
		Negative	43	0	44

Table 3. ***Analysis of Hypo & Hyperuricemia in cases and controls***

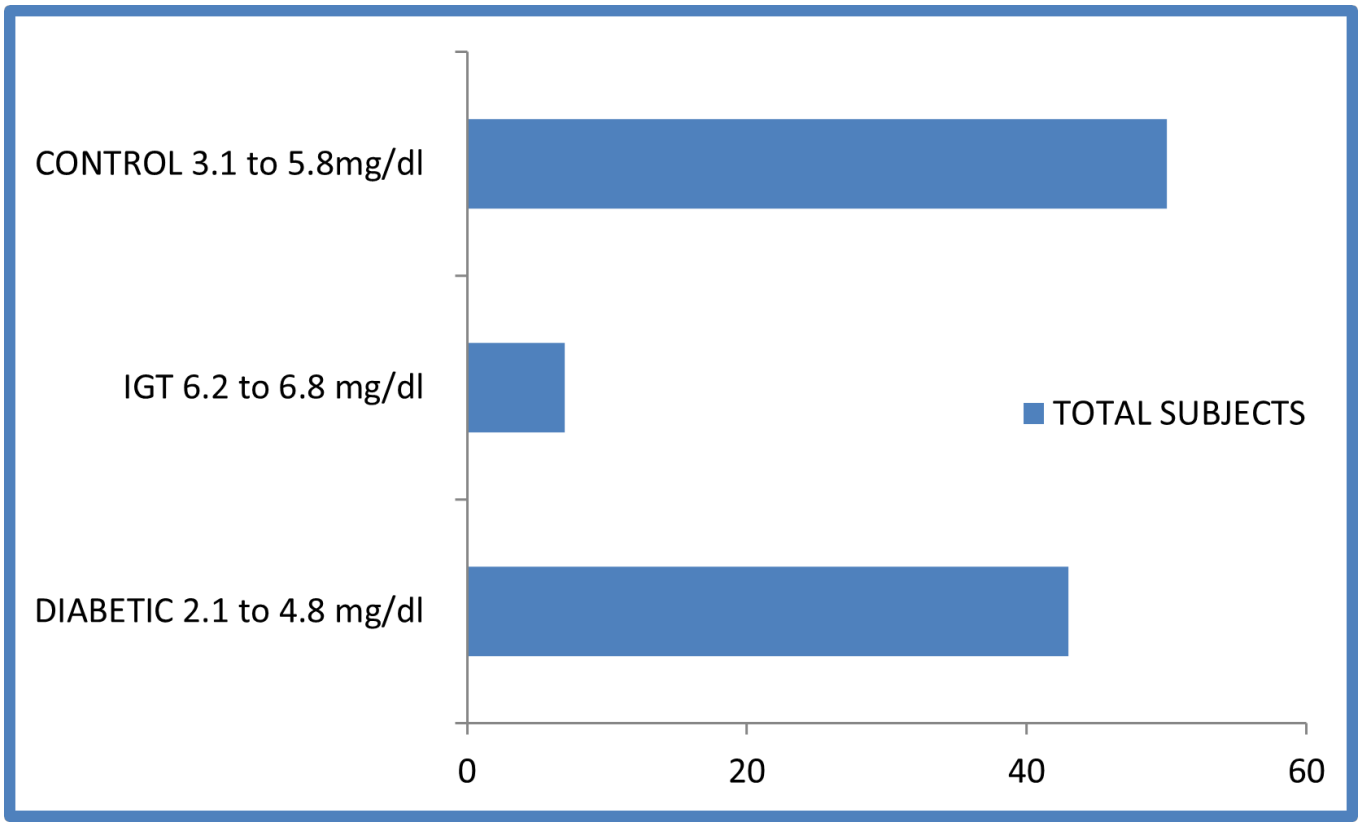

Figure 1. *Baseline serum uric acid levels*

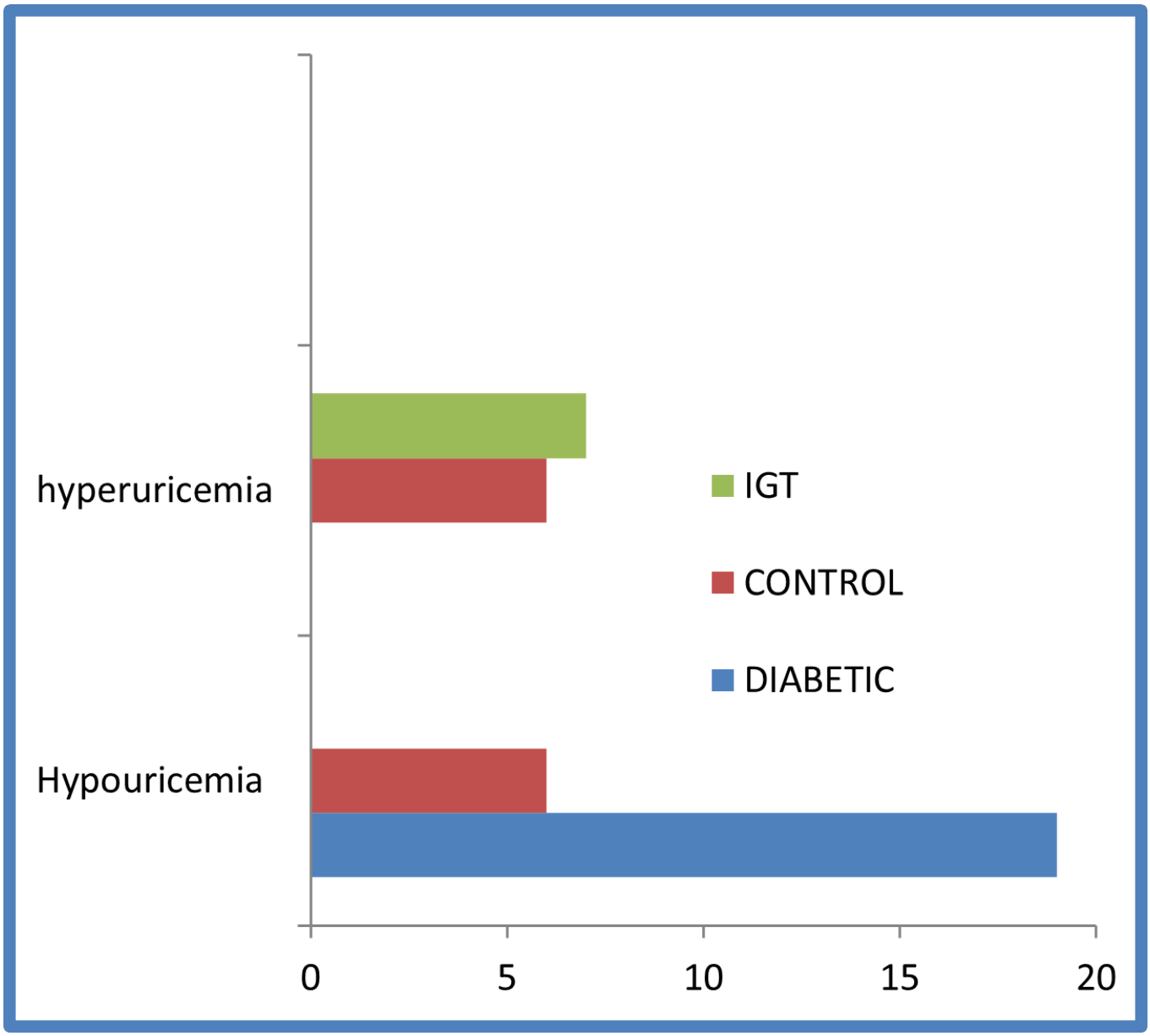

Figure 2. *Subjects with Hypouricemia And Hyperuricemia*

- The total number of subjects included in this study was 100. Among these 100 subjects. 43 were patients of type 2 DM, 7 were diagnosed to have IGT and 50 were controls. Among the 100 cases studied, there were 22 males and 21 females with type 2 DM. 3 males and 4 females were diagnosed to have IGT and among 50 controls there were 25 males and 25 females
- Serum uric acid in diabetic population and control varied from 2.1 to 4.8 and 3.1 to 5.8mg/dl respectively. The mean and standard deviation of uric acid among diabetics was 3.54±0.819 while in control it was 4.398±0.767 respectively
- Serum uric acid in patients with IGT and control varied from 6.2 to 6.8 and 3.1 to 5.8. The mean and standard deviation of uric acid among cases was 6.5±0.2 while in control it was 4.398±0.767.
- Hypouricemia defined as serum uric acid levels <3.5mg/dl in males and <3.0mg/dl in females. 19 cases of type 2 DM had hypouricemia while 6 in controls
- Hyperuricemia defined as uric acid level>5.5mg/dl in males and 5mg/dl in females 7 cases

of IGT had hyperuricemia, 6 controls had hyperuricemia and none in patients with type 2 DM

DISCUSSION

The present study of serum uric acid levels in patients with type 2 DM and in patients found to have impaired glucose tolerance was carried out in department of general medicine. Basaveshwar Teaching and general hospital from April 2017 to March 2018

The patients were grouped into study group (patients with type 2 dm and patients with impaired glucose tolerance) and control group (normal patients). The purpose of the study was to determine the serum uric acid levels in patients with type 2 DM and patients with IGT in comparison with normal subjects

The main findings of our study were that the plasma uric acid levels were elevated in men and women with impaired glucose tolerance the lowest plasma uric acid levels was found in Diabetic patients. plasma uric acid levels will clearly decrease, especially in diabetics men. A negative Association of Plasma uric acid with overt diabetes was found in several other studies [6,7,8,9].

Our results confirm this finding despite the methodological differences and various Diagnostic criteria for diabetes mellitus used in these studies. In a prospective study of 10,000 Israeli men, it was found that a diabetic man had lower plasma uric acid levels than pre-diabetic man, who had higher levels than nondiabetic man[10, 11]

None of the previously published epidemiologic studies of Plasma uric acid uric acid and diabetes have used the WHO classification for impaired glucose tolerance and diabetes mellitus.our study used the WHO criteria and showed that patients with impaired glucose tolerance have the highest plasma uric acid level .an interesting finding in our study was that plasma uric acid levels Were clearly reduced in Diabetic patients when compared with nondiabetic patients.

In this study mean serum uric acid levels were less in patients with poorly controlled diabetes when compared to patients with well controlled Diabetes. The mean serum uric acid level was 3.09 ± 0.123 and 3.94 ± 0.619 poorly controlled and well-controlled diabetic patients, respectively.

Derek G Cook et.al. show that there was a positive relationship between serum glucose and uric acid concentrations at Higher levels of glucose serum uric acid levels decreased. he concluded that serum uric acid probably reflects the biochemical interaction between serum glucose and purine metabolism with increased excretion of uric acid during hyperglycemia and glycosuria [12.]

In our study the mean serum uric acid was high in all patients with IGT when compared to controls and diabetic subjects and the difference was statistically significant.

Kodama S et.al. in their study assessed systematical evaluation of association between serum uric acid levels and subsequent development of type 2 DM and concluded that serum uric acid level is positively associated with the development of type 2 DM regardless of various study characteristics and concluded that further research should we attempted to determine whether it is effective to utilize serum uric acid levels as a predictor for type 2 DM for its primary prevention[13].

In this study patients with poor metabolic control and longer duration of diabetes were more susceptible to develop variouscomplications including hypouricemia.

Our study also shows that lower levels of serum uric acid was seen in patients with longer duration of diabetes when compared with shorter duration of diabetes,3.02 ± 1.089 (>9yrs) vs 4.11 ± 1.072 (0 to 4 years) The difference was statistically significant. The possible reason may be due to increased excretion of uric acid over the years and modification of diet in renal disease.

In this study all 100% (7) patients of IGT had raised serum uric acid levels when compared to only 12% (6)in control group and 0% in patients with type 2 DM. The mean value of mean serum uric acid level was 3.54 ± 0.819, 6.5 ± 0.2 and 4.398 ± 0.76 in patients with type 2 DM patients with IGT and controls respectively the results were statistically significant.

CONCLUSION

Serum uric acid concentration is slightly reduced in patients with type 2 DM, particularly in patients with poor glycemic control. This may be due to increased excretion of uric acid during hyperglycemia and glycosuria and modification of diet in renal disease. Serum uric acid concentration is increased in patients with IGT and factors contributing to it are still unclear

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