Original Research Article

ASSOCIATION BETWEEN HbA1c (GLYCOSYLATED HEMOGLOBIN) AND SERUM URIC ACID IN NORMAL, PRE-DIABETIC AND TYPE II DIABETIC INDIVIDUALS

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A B S T R A C T

This study is aimed to determine association between HbA1c (Glycosylated Hemoglobin) and Uric acid levels in normal, Pre-Diabetic and Diabetic individuals, both males and females who come for regular health checkup in outpatient basis. Individuals were divided into 3 groups. Group-1 were individuals with HbA1c <5.6 %, Group-2 were individuals with HbA1c between 5.7 – 6.4 % and Group-3 were individuals with HbA1c >6.5%. Serum Uric acid was measured in fully-automated analyser and HbA1c by HPLC analyser. Uric acid causes a series of pathophysiological changes through inflammation, oxidative stress, vascular endothelial injury, and so on and thus subsequently promotes the occurrence and development of diseases. There was a significant correlation observed between Serum Uric acid and HbA1c levels in Pre-Diabetic individuals, thus making it a marker for detection of future Diabetes and by controlling Glucose levels in these individuals the Uric Acid levels can be controlled. There was no significant correlation observed between Serum Uric acid and HbA1c levels in Normal and Diabetic individuals. Thus high Serum Uric acid levels can be an alarm for Pre-Diabetic individuals of landing up with Diabetes in future if not treated on time.
Keywords: HbA1c (Glycosylated Hemoglobin), Uric acid(UA), Pre-Diabetic, Type 2 Diabetes mellitus (T2DM), Serum Uric Acid (SUA).

INTRODUCTION

Diabetes mellitus (DM) type 2 is increasing incidence and prevalence. DM is a leading cause of morbidity and mortality worldwide. About 2-3 % of the world's population is estimated to have DM. People with DM are at higher risk for cardiovascular disease, nephropathy and retinopathy.[1]

Hb A1C (Glycosylated haemoglobin) is a parameter, which is a measure of over the period 3 months due to the usual lifespan of erythrocytes of 120 days and is used to monitor control of blood glucose levels in patients with DM.[2] HbA1c has been recommended as a biomarker for detecting and monitoring diabetes, especially T2DM.[3]

Serum Uric acid is the final oxidation product of purine metabolism in the circulation. Elevated serum uric acids levels are associated with increased risk for cardiovascular disease and so the metabolic diseases such as metabolic syndrome and diabetes mellitus.[4]

Patients with hyperuricemia are significantly more likely to develop DM.[5] Some study suggests uric acid may be associated with glycol metabolic disorders, because of this association between uric acid and glucose metabolism.[6] However, there is not a linear association between uric acid and blood glucose levels. Hyperuricemia in patients with diabetes mellitus type 2 associated with increased risk for diabetic nephropathy.[7] Uric acid levels rise with increasing blood glucose concentrations in the normal and pre Diabetes population.[8] Serum uric acid levels are directly associated with serum insulin levels in diabetes, but the mechanism for this is not clear.[9]

We aimed to determine if there is an association between HbA1c and uric acid in normal, pre diabetic and Diabetic individuals who come for the annual health checks in Outpatient basis.

MATERIALS AND METHODS

This study was conducted in Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar. The individuals who come for the routine health checks were included in the study. Individuals both males and females were divided into 3 groups based on their HbA1c values. Group-1 were individuals with HbA1c <5.6 % (n=50), Group-2 were individuals with HbA1c between 5.7 – 6.4 % (n=50) and Group-3 were individuals with HbA1c >6.5% (n=50). HbA1c was measured in fully automated analyser by HPLC method and Serum Uric Acid was also measured fully automated analyser using Uricase enzymatic method.

Statistical Analysis

The statistical analysis was done by SPSS software. Data was expressed as Mean ±SD. Significance of difference between the two groups observed was assayed by using Student 't' test. P-value of < 0.05 was considered to be significant.

RESULTS

Group-1: The age ranged between 21-64 years with Mean 42 ± 10.7 years for males (n=35) and 21-54 years with Mean 37 ± 7.5 years for females (n=15).
Group-2: The age ranged between 29-79 years with Mean 50 ± 13.4 years for males (n=31) and 21-77 years with Mean 51 ± 13.9 years for females (n=19).
Group-3: The age ranged between 34-77 years with Mean 57 ± 13 years for males (n=35) and 33-75 years with Mean 55 ± 12.3 years for females (n=15).

Table 1: Demographic details Plasma Glucose, HbA1c and Uric Acid levels in the 3 groups for males

PARAMETERS	GROUP-1 (n=35)		GROUP-2 (n=31)		GROUP-3 (n=35)	
	RANGE	MEAN±SD	RANGE	MEAN±SD	RANGE	MEAN±SD
Age(Years)	21-64	42 ± 10.7	29 - 79	50 ± 13.4	34-77	57 ± 13
FPG (mg/dL)	82 - 106	92 ±7.8	84 - 124	101 ± 10.3	103-350	168 ± 49.4
PPPG (mg/dL)	94 - 110	109 ± 16.8	92-138	114 ± 14.8	107-385	244 ± 74.7
HbA1c (%)	4.5-5.6	5.4 ± 0.3	5.7-6.4	6.0±0.2	6.5-13.5	8.7±1.7
Uric Acid (mg/dL)	4.1-8.7	6.3 ±1.1	4.8-8.8	7.1±1.1	3.3-8.3	5.7±1.3

Table 2: Demographic details, Plasma Glucose, HbA1c and Uric Acid levels in the 3 groups for females

PARAMETERS	GROUP-1 (n=15)		GROUP-2 (n=19)		GROUP-3 (n=15)	
	RANGE	MEAN±SD	RANGE	MEAN±SD	RANGE	MEAN±SD
Age(Years)	21-54	37 ± 7.5	21 - 77	51 ± 13.9	33-75	55 ± 12.3
FPG (mg/dL)	78 - 103	92 ±6.4	84 - 109	97 ± 7.3	105-196	132 ± 25.4
PPPG (mg/dL)	91 - 117	109 ± 11.9	90-145	120 ± 23.3	110-416	189 ± 77.1
HbA1c (%)	4.8-5.6	5.3 ± 0.3	5.7-6.4	6.0±0.2	6.6-10.2	7.5±1.1
Uric Acid (mg/dL)	2.7-5.7	4.7 ± 0.9	2.2-8.9	5±1.3	2.3-10.8	5.9 ± 2.0

Table 3: Correlation Between HbA1c and uric acid in Pre-Diabetic group

PARAMETERS	HbA1c
Uric Acid	r = 0.4709 p value =0.000326 (< .05)

Figure 1: Correlation graph between HbA1c and Uric Acid of Pre-Diabetic group

DISCUSSIONS

It was observed that an there was a significant increase in HbA1c in Pre-Diabetic group with an increase in Serum Uric Acid, but in Normal and Diabetic group no such correlation was observed.

HbA1c represents a reliable indicator of blood glucose levels in the body in the past 2-3 months. Serum Uric Acid is the final product of human purine metabolism and has the characteristics of antioxidation and pro-oxidation.[10] The pro-oxidation and pro-inflammatory effects of UA affect the sensitivity of surrounding tissue cells to insulin, affect glucose homeostasis in the body, and promote the occurrence of diabetes.[11,12] Several studies have confirmed that the association between SUA and HbA1c was inconsistent between men and women and between different blood glucose control levels.[13]

The following pathophysiological mechanisms could explain the relationship between HbA1c and SUA. The body's intake of a large number of high-sugar, high-calorie, high-carbohydrate foods will not only lead to an increase in SUA levels but also easily lead to an increase in blood glucose. These reasons indirectly indicated that there must be a specific correlation between HbA1c level and SUA.

Long-term high SUA levels in the body will affect endothelial function, stimulate the renin-angiotensin system,[14] and produce an inflammatory response and oxidative stress response, thereby inhibiting insulin production, leading to glucose homeostasis imbalance and accelerating the occurrence and development of diabetes.[15] As per study done by Zhou Y.et al in our study also the same was observed i.e. increase in HbA1c showed increase in SUA in Pre-Diabetic individuals.

CONCLUSION

Limited number of studies have evaluated the relationship between uric acid and diabetes, with results that have been inconsistent in the few studies that have looked at this association. Some studies revealed that there is a positive relationship between serum uric acid levels and diabetes, while other studies showed no association, and few others showed an inverse association. In our study positive relationship was observed between SUA and Glycated Hemoglobin in Pre-Diabetic individuals making it a marker to detect DM in future and thus Glycemic control may also help to reduce the risk of hyperuricemia in Pre-Diabetic individuals.

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