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Research Article

STUDY OF SERUM URIC ACID LEVEL IN METABOLIC SYNDROME

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A B S T R A C T

The metabolic syndrome is a global public health problem. Metabolic syndrome is associated with increased insulin levels due to insulin resistance. Hyperinsulinemia reduces the renal excretion of uric acid. Hyperinsulinemia reduces the renalexcretion of uric acid. Hyperuricemia may precede the onset of diabetes, hypertension, coronary artery disease, and gout in such individuals. Objectives of the study was to -

1. To estimate the uric acid levels in metabolic syndrome.
2. To study the relationship between serum uric acid levels with different components of metabolic syndrome.

Materials and Methods: The present study is a cross sectional observational study undertaken in rajarajeshwari medical college and hospital Bangalore including 60 individuals 30-60 years of age with features of metabolic syndrome who underwent clinical, anthropometric and biochemical evaluation

Results: In this study hyperuricemia was found to be more prevalent in men than women. This study also shows serum uric acid is markedly associated with metabolic syndrome, elevated waist circumference and high triglyceride were statistically significantly associated with higher uric acid concentration.

Conclusion: Considering the worldwide increase in the incidence of metabolic syndrome and the potential link to hyperuricemia, more emphasis should be put on the evolving morbidity prevalence of hyperuricemia in our country.

INTRODUCTION

The prevalence of hyperuricemia has been increasing in recent years, not only in advanced countries but also in developing countries(1). The metabolic syndrome (MS) represents a group of predisposing factors: abdominal obesity or central adiposity, hyperglycemia or diabetes and hypertension or pre-hypertension (>130mmhg and >85mmhg)(2) . Uric acid is the end product of purine metabolism in humans. Although definition of hyperuricemia is arbitrary, it is usually defined as a serum uric acid level greater than 7.0 mg/dl in men and greater than 6.0 mg/dl in women(3). This difference has been linked to the uricosuric effect of estrogens in women. Excess serum accumulation can lead to various diseases, and most notably uric acid is involved in the pathogenesis of gouty arthritis(4). Metabolic syndrome is associated with increased insulin levels due to increased insulin resistance. Hyper insulinemia reduces the renal excretion of uric acid and sodium(3). Studies done by Alderman *et al* suggested that hyperuricemia may precede the onset of type 2 diabetes, hypertension, coronary artery disease, and gout in individuals with metabolic syndrome(5)

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MATERIAL AND METHODS

The present study is a cross sectional observational study undertaken in rajarajeshwari medical college and hospital Bangalore including 60 individuals 30-60 years of age with features of metabolic syndrome who gave informed consent and underwent clinical, anthropometric and biochemical evaluation

Exclusion criteria

1. Renal disorders
2. Alcoholics
3. Smokers
4. Gout
5. Thyroid disorders
6. Hepatic disorders
7. Drugs which causes increased uric acid levels such as diuretics, theophylline, ascorbic acid, levodopa, methyldopa, nicotinic acid, phenothiazines, were excluded.
8. Drugs which decrease serum uric acid levels such as allopurinol, azathioprine, corticosteroids, mannitol, probenecid, and warfarin etc. were excluded

Measurement methods

1. To measure waist circumference, locate the top of right iliac crest. Place a measuring tape in a horizontal plane around abdomen at level of iliac crest. Before reading the tape measure, ensure that the tape is snug but does not compress the skin and is parallel to floor. Measurement is made at the end of a normal expiration.
2. Blood pressure was measured using a sphygmomanometer after the subjects had rested for more than 5 min. For those with a systolic blood pressure ≥140mmHg and a diastolic blood pressure ≥90 mmHg, blood pressure was measured on a further 2 occasions after resting, and average values were then taken

The collected blood samples were used for estimation of FBG, glycosylated haemoglobin (HbA1c%) and fasting lipid profile

The presence of MetS was ascertained using the modified national cholesterol education program adult treatment panel (NCEP ATP) III criteria (ethnic-specific cut-offs for WC viz. >90 cm in males and >80 cm in females) with the presence of three or more of the risk factors were considered diagnostic

1. Central obesity (waist circumference >90 cm for males and >80 cm for females)
2. Low HDL cholesterol (males<40mg/dl woman<50mg/dl, or under treatment)
3. Triglycerides (>150mg/dl, or under treatment)
4. Increased blood pressure (>130/85 mmHg or under treatment)
5. Fasting blood glucose (>100 mg/dL or under treatment)
6. Hyperuricemia is defined as serum uric acid level ≥7 mg/dl (in men) or ≥6.0 mg/dl (in women)

Statistical analysis

Descriptive data is described as mean ± SD, comparisons between the quantitative data were done by t-tests and categorical variables were done by chi-square tests.

Pearson's correlation coefficients were obtained for each of the metabolic syndrome components and the respective uric acid concentration. Logistic regression procedures were used to examine the risks of having metabolic syndrome. All analyses were completed separately for male and female patients. Variables with P values of <0.05 were considered significant.

Statistical analyses were performed using SPSS (V. 13.0) software.

DISCUSSION

It has been described that hyperuricemia is associated with metabolic syndrome components such as obesity, dyslipidemia, hyperglycemia and hypertension which are the components of metabolic syndrome.(6) In this study, we found elevated waist circumference and increased triglycerides to be at greater risk of having hyperuricemia. which was in line with the study by Feig and Johnson (2003)(7). Studies conducted to evaluate the relationship between leptin (gene which the cause of obesity) and the cluster of hyperuricemia in order to clarify the pathogenic mechanisms associating obesity with hyperuricemia, they found that the serum uric acid concentration is independently associated with the serum leptin concentration (Fruehwald-Schultes *et al*., 1999)(7). It was suggested that leptin could be a pathogenic factor responsible for hyperuricemia in obese patients.

We found that the incidence of hyperuricemia in males was higher than that in females. This result was in line with Conen *et al*.(2004)'s research(1). The pathogenic mechanism may be due to oestrogen promoting uric acid excretion (Sumino *et al*., 1999), so it may be more important for women to prevent hyperuricemia.(8)

It was shown in our study that uric acid was negatively correlated with serum HDL-C, but this association was not evident among women. This finding was consistent with Rho *et al*.(2005)'s research.(4) The mechanisms of this condition may due to the relationship between decreased HDL-C levels and insulin resistance syndrome.(4)

A study done by Krishnan *et al*.(2007) found that men with hyperuricemia had more risk for incident hypertension. Each unit increase in serum uric acid was associated with a 9% increase in the risk for incident hypertension.(9) Although the mechanism by which uric acid plays a pathogenetic role in hypertension was unclear, hyperuricemia is associated with deleterious effects on endothelial function, platelet adhesion and aggregation, or oxidative metabolism (Alderman and Redfern, 2004)(10). In our research, it was found that uric acid concentration was statistically significantly positively correlated with blood pressure among men, but this association did not evident among women.

Results

The overall prevalence of hyperuricemia was 52.5%. Hyperuricemia was more common in men (55.9%) than in woman (48%) (p=0.549)

Table 1 Prevalence of hyperuricemia by gender group

Groups	Hyperuricemia	Non-hyperuricemia	Total	Prevalence (%)	P value
Males	19 (61.3%)	15 (53.6%)	34	55.9%	0.549
Females	12 (38.7%)	13 (46.4%)	25	48%	
Total	31	28	59	52.5%	

Inference: overall prevalence of hyperuricemia was 52.5%. Hyperuricemia was more common in men (55.9%) than in woman (48%) (p=0.549)

Elevated waist circumference and high triglyceride were significantly associated with high uric acid concentration in both men and women. Men with high blood pressure and low HDL-C had higher uric acid concentrations but this association was not evident among women. There was no statistical significance between HDL-C among women and uric acid concentration. Among men, uric acid concentrations were positively correlated with waist circumference, diastolic blood pressure, and serum triglyceride concentrations. Uric acid was not statically correlated FBS. Uric acid concentrations were most strongly correlated with serum triglyceride concentrations (r=0.372) and waist circumference (r=0.506). Among women, positive correlations were noted for the serum uric acid concentrations with waist circumference and triglyceride.

As shown in Table 2, elevated waist circumference and high triglyceride were statistically significantly associated with higher uric acid concentration in both men and women. Men with high blood pressure and low HDL-C had higher uric acid concentrations than those without such conditions, but this association was not evident among women. There was no

statistical significance between HDL-C among women and uric acid concentration

Table 2 Means of uric acid (mg/dl) according to selected features of metabolic syndrome Hyperuricemia

	Men			Women		
	n	Uric acid(mg/dl)	P value	n	Uric acid(mg/dl)	P value
Waist circumference			0.006*			0.016*
≥90cm (men)/≥80cm (women)	24	6.79 ± 1.038		21	5.99 ± 1.004	
<90cm (men)/<80cm (women)	10	5.59 ± 1.217		4	4.58 ± 0.948	
Blood Pressure			0.001*			0.04*
SBP≥130mmHg	22	6.90 ± 0.843		13	6.19 ± 0.945	
SBP<130mmHg	12	5.59 ± 1.351		12	5.30 ± 1.123	
DBP≥85mmHg	17	6.88 ± 0.923	0.006*	7	6.44 ± 0.336	0.03*
DBP<85mmHg	17	5.99 ± 1.322		18	5.50 ± 1.198	
Fasting plasma glucose			0.023*			0.03*
≥110mg/dl	16	6.93 ± 0.829		13	6.22 ± 0.957	
<110mg/dl	18	6.0 ±1.343		12	5.28 ± 1.089	
Triglyceride			<0.001**			0.001*
≥150mg/dl	20	7.10 ± 0.474		13	6.46 ±0.581	
<150mg/dl	14	5.49 ± 1.324		12	5.01 ±1.059	
HDL-C			0.014*			0.726
<40mg/dl (men)/<50mg/dl (women)	23	6.78 ± 0.857		11	5.85 ± 1.257	
≥40mg/dl (men)/ ≥50mg/dl (women)	11	5.72 ± 1.54		14	5.69 ± 1.022	

Table 3 Pearson's correlation coefficients (r) for each component of metabolic syndrome in relation to uric acid concentrations (mg/dl)

	Men		Female	
	Pearson's correlation (r)	p-value	Pearson's correlation (r)	p-value
Waist circumference	0.506	0.002**	0.623	0.001**
Systolic Blood Pressure	0.294	0.092	-0.005	0.982
Diastolic Blood Pressure	0.429	0.011*	0.289	0.161
HDL-cholesterol	-0.415	0.015*	-0.100	0.635
Triglyceride	0.372	0.030*	0.589	0.002**
Fasting plasma glucose	0.335	0.053	0.332	0.105

Inference: Among men, uric acid concentrations were statistically significantly positively correlated with waist circumference, diastolic blood pressure, and serum triglyceride concentrations Among women, statistically significant positive correlations were noted for the serum uric acid concentrations with waist circumference and triglyceride

Table 3. summarizes Pearson's correlation coefficients between metabolic syndrome components and serum uric acid concentrations. Among men, uric acid concentrations were statistically significantly positively correlated with waist circumference, diastolic blood pressure, and serum triglyceride concentrations. Uric acid was negatively correlated with serum HDL-C.

Uric acid concentrations were most strongly correlated with serum triglyceride concentrations (r=0.372) and waist circumference (r=0.506). Among women, statistically significant positive correlations were noted for the serum uric acid concentrations with waist circumference and triglyceride. Serum triglyceride concentrations (r=0.589) and waist circumference (r=0.623) were most strongly correlated with uric acid concentrations.

Among men, uric acid concentrations were positively correlated with waist circumference, diastolic blood pressure, and serum triglyceride concentrations. Uric acid was not statically correlated FBS. Uric acid concentrations were most strongly correlated with serum triglyceride concentrations (r=0.372) and waist circumference (r=0.506). Among women, positive correlations were noted for the serum uric acid concentrations with waist circumference and triglyceride.

Binary logistic regression procedure was used to evaluate the relative risk of metabolic syndrome in relation to serum uric acid concentration in men and women, respectively.

As shown in Table 4, men with hyperuricemia had a 27.954-fold increased risk of metabolic syndrome as compared with men without hyperuricemia [odds ratio (OR)=27.954,P=0.025]. Women with hyperuricemia had a 11.82-fold increased risk of metabolic syndrome (OR=11.82, P=0.004) as compared with those without hyperuricemia.

Table 4 Risk of metabolic syndrome according to uric acid concentration

	Sig.	OR ratio
Uric acid (men)	0.025*	27.954
Uric acid (women)	0.004*	11.820

Inference: men with hyperuricemia had a 27.954-fold increased risk of metabolic syndrome as compared with men without hyperuricemia [odds ratio (OR)=27.954, P=0.025]. Women with hyperuricemia had a 11.82-fold increased risk of metabolic syndrome (OR=11.82, P=0.004) as compared with those without hyperuricemia.

CONCLUSION

The uric acid levels were not related with the presence of metabolic syndrome and its components for which differences in sex was observed. The results highlighted the importance of uric acid as a biomarker in patients withcardio metabolic risk factors.

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