Original Article

Screening of Serum Uric Acid in Obese Individuals in Rural Population

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Abstract

Introduction: Uric acid is a metabolic product of exogenous (brought in with food) or endogenous purine bases. Since uric acid is found in human serum in relatively low concentrations (reference range is 0.21 to 0.42 mmol/L in men and 0.16 to 0.36 mmol/L in women) it is necessary to use specific and sensitive methods for its determination in visceral individuals including obese persons.

Purpose: The purpose of this study is to estimate serum uric acid level in among obese individuals attending a medical college hospital.

Methods: An observational study was designed to study 240 subjects, aged 20 to 50 years. The study included 120 apparently healthy obese individuals with Body Mass Index of ≥25 and Waist Circumference more than 80 cm and 90 cm in females and males respectively. Another 120 individuals with body mass index ≤25, waist circumference less than 80 cm and 90 cm in females and males respectively enrolled as controls. Uric acid was measured in serum. Data were analyzed statistically using statistical package for the social sciences version 17.

Results: The mean value of serum uric acid in obese men and women were 7.57 mg/dl and 6.19 mg/dl which was higher than the mean of control group 4.17 mg/dl (males) and 4.10 mg/dl (females).

Conclusion: Serum uric acid was elevated in obese individuals indicating the marker for metabolic syndrome. However further studies are suggested with large number of samples to confirm or refute the present observation.

Keywords: BMI, Hyperuricemia, Metabolic syndrome, Obesity, Waist circumference

INTRODUCTION

Uric acid is the end product of Purine metabolism in humans. Hyperuricemia can result from either increased uric acid synthesis or decreased uric acid excretion, or from a combination of both. Association between serum uric acid levels and metabolic syndrome (MetS) had been reported in previous cross-sectional studies.[1] Obesity is a principal causative factor in the development of metabolic syndrome.

Earlier studies have brought out the prevalence of hyperuricemia from urban population. Uric acid is an organic compound that is endogenously produced as a purine metabolite. Mainly the uric acid is secreted in liver and excreted via kidneys and intestines. Basically the uric acid is a weak acid that have a high dissociation and circulates in plasma in the form of monovalent sodium salt.

Uric acid exit from the pool is mainly controlled by the kidneys. In the kidney, uric acid and urate are initially filtered and additionally secreted. WHO (World Health Organization) highlighted that more than 1.4 billion adults were overweight.[2-4] The synthesis of fatty acids in the liver is associated with the de novo synthesis of purine, thus accelerating UA production. Uric acid serum concentrations are independently related to leptin concentration[5,6] thus suggesting that would be a pathogenic factor responsible for UA increase in obese patients.

However serum UA has not been reported as an independent cardiovascular risk factor, but only an

additional factor associated with cardiovascular disease, like dyslipidemia, hypertension and insulin resistance. Hence the present study was proposed to bring out the status of hyperuricemia in rural population.

MATERIALS AND METHODS

This was the prospective observational study conducted in the tertiary care hospital. We enrolled 285 patients who attended tertiary hospital, Trichy for Master Health Checkup and 240 were included in the final study. These individuals were classified into two groups according to the BMI and WC. The study subjects included were 120 apparently healthy obese individuals (study group) aged between 20 and 50 years with Body Mass Index of ≥25 (revised cut-offs for Asians) and Waist Circumference more than 80 cm and 90 cm in females and males (Misra *et al.,* 2009) respectively. Another 120 individuals with BMI ≤ 25 were enrolled as controls (age and sex matched). Controls were also selected based on WC less than 80 cm and 90 cm in females and males respectively.

A detailed history was elicited for any Co-morbid diseases and concomitant drug intake. All participants signed an informed, written consent to participate in the clinical examinations and biochemical investigations before entering the study. Pre designed questionnaire was used to assess conventional risk factors, demographic profile (age, sex, and rural residence, dietary history), and drug history. Systemic and anthropometric examination was done for all individuals. Weight was measured using SECA Integra 815 portable scale with accuracy of 0.01 kg.

Height was measured by using portable stadiometer with an accuracy of 0.1 cm. Waist circumference was measured at a level midway between the lowest rib and the iliac crest by an inch tape. Body mass index was calculated using the formula, Weight in kg/height in m^2. Blood samples were drawn from the subjects under strict aseptic precautions and allow them to clot and centrifuged at 2000 rpm for 15 minutes for biochemical analysis. The serum was separated and samples were processed within 1 hour from the time of collection. Serum uric acid was measured by uricase–peroxidase method (DiaSys Diagnostic systems GmbH & Co.KG, Piramal health care) where uric acid is oxidized to allantoin by uricase.

The generated hydrogen peroxide reacts with 4 aminoantipyrine and 2, 4, 6 tribromo-3-hydroxy benzoic acid to form quinoneimine. The color produced was measured at 546 nm. Some studies defined the range of hyperuricemia as >7.0 mg/dl in men or >6.0 mg/dl in women (Xuemei *et al.,* 2008). These may be commonly used in clinical laboratories and have been proposed in previously-published studies in relation to CVD outcomes to define hyperuricemia. The statistical analysis was done using Statistical Package for the Social Sciences (SPSS) version 17.

RESULTS

Age and Sex matched subjects were divided into 2 groups (study and control) based on BMI and W.C as mentioned in materials above. Each group consists of 120 subjects, among whom male subjects were 56 (obese males) and female subjects were 64 (obese females) as shown in Table 1.

The mean age group, BMI and WC of obese male and obese female was 35.46 ± 7.86 and 36.09 ± 7.28; 29.05 ± 1.64 and 28.84 ± 2.07; 99.07 ± 4.57 and 88.82 ± 4.20 respectively as shown in Table 1. The mean value of serum uric acid in obese men was 7.57 mg/dl which was higher than the mean value of control group (4.17 mg/dl) with `p`value of 0.001. Similarly, the mean of serum uric acid in female study group (6.19 mg/dl) was significantly more than the control group with mean of 4.17 mg/dl. This difference in the serum uric acid level between control and study group gives a significant 'p' value of <0.0001 as shown in Table 2. Out of the sixty four female obese individuals, ten subjects had uric acid levels more than the normal range (>7 mg/dl) and thirty nine individuals were within the range of 6.0-6.9 mg/dl as shown in Table 3.

Table 1: Demographic characters of the subjects included

Demographic characters	All	Cases	Controls	p
Total number	240	120	120	0.10
Male sex	112	56	56	0.10
Female sex	128	64	64	0.10
Male (age in years)	34.90±7.76	35.46±7.86	34.33±7.62	0.47
Female (age in years)	34.72±6.89	36.09±7.28	33.35±6.19	0.16
Body mass index in males	25.93±3.36	29.05±1.64	22.81±0.73	0.000
Body mass index in females	25.53±3.67	28.84±2.07	22.22±0.91	0.000
Waist circumference in males	87.40±12.71	99.07±4.57	75.73±5.28	0.000
Waist circumference in females	80.64±9.12	88.82±4.20	72.46±3.75	0.000

Table 2: Serum uric acid level between control and study group

Parameters	All	Cases	Controls	p value
Serum uric acid in males (mg/dl)	5.87±1.79	7.57±0.65	4.17±0.53	0.001
Serum uric acid in females (mg/dl)	5.12±1.4	6.19±1.10	4.10±0.56	0.001

Table 3: Serum uric acid levels among males and females included

Males	Uric acid	Females	Uric acid	p value
14	>7 mg/dl	10	>8 mg/dl	0.001
38	6-6.9 mg/dl	39	7-7.9 mg/dl	0.001
4	Upto 5.9 mg/dl	15	Up to 6.9 mg/dl	0.001

DISCUSSION

Elevated uric acid is a known risk factor for vascular diseases and it adds as a marker of oxidative stress. We report four main findings from the present study.

1. The mean of serum uric acid in male obese group was 7.57 mg/dl which was significantly more than the control group 4.17 mg/dl ($p < 0.001$).
2. The mean of serum uric acid in female obese group was 6.19 mg/dl which was significantly more than the control group 4.10 mg/dl ($p < 0.001$).
3. Serum uric acid level was positively correlated in both males and females of study group with significant Pearson's r value of = 0.66 and 0.63 respectively.
4. Serum uric acid is correlated significantly with waist circumference ($r=0.52$, $p=0.001$) but poorly correlated with BMI ($r=0.18$).

Some studies highlighted the importance of uric acid as a marker of increased cardiovascular risk. Subsequently, other studies suggested that individuals with high normal uric acid levels are at risk of metabolic syndrome. In agreement with previous studies, we found that the higher serum uric level was positively and significantly associated with healthy obese individuals. These results demonstrate that serum UA level is a strong marker of the risk for developing MetS. Hyperuricemia is observed in individuals with insulin resistance, probably because hyperinsulinemia would cause lower renal UA excretion. High levels of serum UA were associated with endothelial dysfunction, anti proliferative effects, impaired nitric oxide production,[7] lipid peroxidation and smooth muscle proliferation.[1,8]

Hyperuricemia leads to impaired endothelium-mediated vasodilation[8] even in the absence of existing cardiovascular disease. Similarly, endothelial dysfunction may underlie the causes of other aspects of hyperuricemia-related cardiovascular diseases. Research in nutrition of some studieshas shown that WC is a stronger marker of health risk than BMI. Higher waist circumference and BMI are associated with higher insulin resistance and it reduces renal uric acid excretion, thus increasing its concentration. We suggest that greater emphasis should be placed on WC in assessing the obese individuals for cardiovascular risk. One possible explanation for the association between higher waist circumference and hyperuricemia were suggested[9,10] that serum UA concentration were independently related to leptin concentration, indicated the pathogenic factor responsible for UA increase in obese patients.

This has the potential of improving patient care without increasing the cost to the healthcare system. The interpretation of this investigation suggested that individuals with high normal uric acid levels are at risk of metabolic syndrome including heart diseases and stroke. Life style modifications may be required to meet out these issues. Developing countries like India are facing the increasing incidence of obesity and metabolic disturbances leads to cardiovascular diseases.

The awareness regarding obesity related to high uric acid level and modify the life style including avoid the junk food may considered as better preventive interventions. Hence, interventional strategies are urgently needed among apparently healthy obese individuals with hyperuricemia for prevention of cardiovascular diseases. High uric acid may become surrogate marker of atherosclerosis.

CONCLUSION

Elevated levels may also be found after ingestion of a diet rich in purine, or a marked decrease in total dietary intake, resulting in increased tissue breakdown. In general hyperuricemia are associated the clinical disorders including acute and chronic nephritis, urinary obstruction, gout, diabetic ketoacidosis, high purine diet, leukemia, malignant tumors especially with extensive necrosis, acute infections, alcohol ingestion and certain toxins and some diuretics. The decreased serum uric acid levels are associated with pernicious anemia, acute yellow atrophy of the liver, salicylate and cinchophen therapy. Thus, screening of individuals with hyperuricemia may provide the wonderful marker for the clinician to treat the patients and to avoid the risk of co-morbidity.

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