Association of serum uric acid with waist-hip ratio: A promising index for assessing cardiovascular disease risk profile

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Received: October 05, 2021; Accepted: November 02, 2021

ABSTRACT

Background: Abdominal obesity is associated with insulin resistance, in turn, hyperinsulinemia and visceral adiposity lead to an increased uric acid (UA) absorption in renal tubules. Aim and Objectives: Accumulation of visceral fat is an underlying component of metabolic syndrome. Furthermore, the waist-hip ratio is an indirect tool for assessing visceral fat. The present study evaluates the association of UA levels with the waist-hip ratio. Materials and Methods: 160 subjects aged 18–60 years were enrolled in the study (those having any anatomical deformity, diabetes, and/or hypertension for more than 5 years were excluded from the study). Their anthropometric parameters, blood pressure, lipid profile, fasting plasma glucose, and serum UA levels were measured. Results: The study population was divided into three groups based on UA levels. The waist-hip ratio in a group of the hyperuricemic population was more as compared to groups of normal and below normal UA levels population and the association of UA level with waist-hip ratio was found to be significant ($P = 0.045$). Conclusion: The over-inflow of free fatty acid to the liver from accumulated visceral fat may be linked to the de novo purine synthesis through the pentose phosphate pathway, which may accelerate the production of UA.

KEY WORDS: Waist-hip Ratio; Serum Uric Acid; Visceral Fat

INTRODUCTION

The syndrome X/metabolic syndrome is a group of risk factors for cardiovascular disease (CVD), including obesity, hypertension, elevated triglycerides, and low levels of high-density lipoprotein cholesterol (HDL-C). The metabolic syndrome includes high blood pressure, hyperglycemia, abdominal obesity, hypertriglyceridemia, and decreased HDL-C.

Based on the population and definitions used,¹ the preponderance of this syndrome is 18% in women and 8–13% in men. Metabolic syndrome has been recognized as one of the highest prevailing problem in many countries worldwide.²–⁴ Visceral adiposity is believed to be the main cause of the cardio vascular risk leading to syndrome of insulin resistance/central obesity. In accordance with International Diabetes Federation⁵ or National Cholesterol Education Program-Adult Treatment Panel-III, clinical definitions of metabolic syndrome have been of enormous worth in the diagnosis, control, and research on various metabolic risk factors. Although, there are evidences suggesting other prothrombotic, inflammatory, and atherogenic characteristics of the syndrome which are not expressed by these clinical definitions and need further investigation, specifically for useful clinical markers.⁶
The fat distribution of upper-body has been related to increased cardiovascular risk, and waist-hip ratio has been used as an index for this adverse risk profile. The abdominal obesity related with insulin resistance and triglyceride may increase the uric acid (UA) level by the decreased insulin sensitivity.

The objective of current study was to evaluate the relationship of waist-hip ratio as a parameter in anticipating metabolic syndrome.

**MATERIALS AND METHODS**

This was a cross-sectional observational study conducted in the Department of Pathology and Physiology of KGMU, Lucknow, Uttar Pradesh, from December 2016 to April 2017. Subjects aged 18–60 years who came to sample collection center of Pathology Department, KGMU, Lucknow, for investigations for different ailments were selected as study population. 160 subjects were enrolled for the study. Subjects <18 years or more than 60 years of age, any known anatomical deformity which can interfere with anthropometric data, history of diabetes, and/or hypertension >5 years were excluded from the study.

Ethical clearance was approved from the ethical committee of KGMU before the beginning of the research activity (ECR/262/Inst/UP/2013). A written informed consent was taken from all the participants on standardized consent form of institutional research cell after briefing the subjects about the nature of the study.

Demographic characteristics such as age and gender were collected along with pertinent history and findings recorded on premeditated pro forma. Weight, height, hip circumference, and waist circumference (WC) were measured. Waist-hip ratio and body mass index were calculated.

For biochemical analysis, after 8-h overnight fasting, blood sample of each subject was taken for estimation of fasting plasma glucose levels, lipid profile, and UA level. The statistical analysis of the data was completed using Statistical Package for the Social Sciences Version 15.0 statistical analysis Software.

**RESULTS**

The present study constituted 160 subjects, out of which 100 were males and 60 were females. Out of 160 subjects, 124 (77.50%) having normal serum UA levels were classified as Group I, 20 (12.50%) having serum UA below normal levels were classified as Group II and rest 16 (10.00%) had raised serum UA levels (above normal) were classified as Group III. Difference in waist: hip ratio of subjects of Group I (0.99 ± 0.05), Group II (0.97 ± 0.04), and Group III (1.01 ± 0.03) was found to be statistically significant [Tables 1 and 2].

**DISCUSSION**

The objective of this study was to evaluate the association of serum UA and waist-hip ratio. The present study showed significant association of waist-hip ratio with UA levels. The present study showed significant association of UA level with waist-hip ratio ($P = 0.045$) and it was identified as an independent risk factor of hyperuricemia.

The release of free fatty acids from upper-body subcutaneous fat was found to be larger than that from subcutaneous fat of lower-body.[7] Since obesity lead to various metabolic abnormalities, upper body obesity is assertively associated with hyperinsulinemia, glucose intolerance, diabetes hypertriglyceridemia, uric calculus, and gout disease as compared to lower body obesity. There are various parameters for assessment of the upper body obesity such as neck circumference, WC, waist-to-thigh ratio, waist-to-hip ratio, abdominal sagittal diameter, and sub scapular-to-triceps skin fold ratio. A study conducted in India showed that metabolic syndrome and risk of CVD in Asian Indians/South Asians are increased by their relative rise in body fat mass, intra-abdominal fat mass, truncal subcutaneous fat mass, and ectopic fat deposition. South Asian Phenotype is distinguished by higher WC, increased waist hip ratio and excessive body fat mass.[8] Qian et al. explained the pathophysiology of obesity that causes hyperuricemia: First, obesity interferes with urate protein synthesis and excretion directly,[9] second, it causes damage to kidneys via glomerulus dysfunction,[10] and third, it leads to the renin-angiotensin system dysfunction, which would finally result in the insignificant UA clearance.[11]

### Table 1: Group wise distribution of study population

<table>
<thead>
<tr>
<th>Group</th>
<th>Serum UA levels</th>
<th>Number of subjects</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>Normal levels (3.4–7.2 mg/dl males; 2.4–6.1 mg/dl females)</td>
<td>124</td>
<td>77.50</td>
</tr>
<tr>
<td>Group II</td>
<td>Below normal levels</td>
<td>20</td>
<td>12.50</td>
</tr>
<tr>
<td>Group III</td>
<td>Above normal levels</td>
<td>16</td>
<td>10.00</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>160</td>
<td></td>
</tr>
</tbody>
</table>

UA: Uric acid

### Table 2: Association of UA with waist-hip ratio

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group-I ($n=62$)</th>
<th>Group-II ($n=30$)</th>
<th>Group-III ($n=24$)</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Waist-hip ratio</td>
<td>0.99</td>
<td>0.05</td>
<td>0.97</td>
<td>0.04</td>
</tr>
</tbody>
</table>

SD: Standard deviation, ANOVA: Analysis of variance, UA: Uric acid
The cross-sectional nature of present study limits to some extent its interpretation as to causality of associations. The conclusions that have been made may not be completely applicable to a population due to relatively small sample size of this study.

CONCLUSION

In the present study, majority of the subjects with hyperuricemia presented with abnormal waist-hip ratio and the association was statistically significant. This suggests that waist-hip ratio may prove to be a promising marker in depicting hyperuricemia as well as metabolic syndrome in high-risk cases.

REFERENCES


Source of Support: Nil, Conflict of Interest: None declared.