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RESEARCH ARTICLE

The relationship of uric acid levels with lipid parameters and body mass index in healthy individuals*

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ABSTRACT

Aim: The relationship between hypertension, dyslipidemia, atrial fibrillation, obesity, and diabetes, which are cardiovascular risk factors, and a high serum uric acid level has been reported in the literature. However, the effectiveness of the adjustments to be made in uric asid levels on these diseases has not been clearly demonstrated yet. This study focuses on the relationship between serum uric acid levels and body mass index and lipid profile of healthy individuals.

Methods: Records of healthy volunteers obtained form the Family Medicine outpatient clinic were reviewed. Body mass index, serum uric acid, low-density lipoprotein, high-density lipoprotein, total cholesterol and triglyceride levels were analyzed retrospectively.

Results: Data from a total of 126 participants (90 female [71.4%], 36 male [28.6%]) were examined. Serum uric acid levels were correlated with body mass index (p=0.000, r=0.571) and serum triglyceride levels (p=0.001, r=0.397). No correlation was found between serum uric acid and lipoproteins and total cholesterol.

Conclusion: This study found that increased serum uric acid levels are associated with increased body mass index and increased serum triglyceride levels. Additionally, serum uric acid levels were higher in men. We recommend the routine assessment of uric acid levels during periodic health examinations.

Keywords: Body mass index, triglyceride, uric acid

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INTRODUCTION

Uric acid (UA) is the end product of the catabolism of adenosine and guanosine nucleotides (1). In recent years, the acceptance of UA levels as an independent risk factor for cardiovascular diseases has been discussed. Studies have found that elevated UA levels are associated with comorbidities such as hypertension, atrial fibrillation, dyslipidemia, coronary artery disease, obesity, and diabetes (2). It has also been shown that UA is associated with mortality in all patients with coronary artery disease (3). There are studies in the literature stating the opposite of these studies (4).

Hyperuricemia is defined as higher than 6.8 mg/dL, and as it rises, urate crystals begin to accumulate (5). European guidelines recommend UA level as ≤ 6 mg/dL (6). Although elevated UA levels are most commonly associated with gout disease, it has also been associated with hypertension, vascular diseases, renal disease, and cardiovascular events. UA crystals accumulate in the urinary tract and human tissues and cause diseases. In addition, UA has an antioxidant and pro-inflammatory mechanism of action (7).

Asymptomatic hyperuricemia is a high (>6.8 mg/dL) UA level without signs of crystal deposition disease (8). Although asymptomatic hyperuricemia is not considered a disease, it is considered a predisposing factor (9). The need for treatment and whether it can reduce the risk of comorbidity have not been clarified yet (10,11).

In this study, we aimed to evaluate the relationship between UA levels and body mass index (BMI), triglyceride, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and total cholesterol levels in healthy individuals.

MATERIAL AND METHODS

Study design

The necessary permission was obtained from the Bolu Abant Izzet Baysal University Clinical Research Ethics Committee (2020/284) for our study. We designed this study as a cross-sectional study.

One hundred and twenty-six healthy participants who applied to the family medicine outpatient clinic of Izzet Baysal Training and Research Hospital between October 2019 and March 2020 were included in the study. Patients with comorbidities requiring continuous medication were excluded from the study.

Height and weight serum uric acid levels measured after 12 hours of fasting, LDL, HDL, total cholesterol, triglyceride levels, and other hematological parameters were evaluated retrospectively. Body mass index (kg/m^2) was calculated by dividing weight (kg) by the square of height (m^2).

Statistical analysis

SPSS version 25.0 was used for the statistical analysis of the data. Arithmetic mean ± standard deviation was calculated for numerical data. Categorical data were expressed as a percentage (%). The Mann-Whitney U test and t-test were used for statistical evaluation. P-values less than 0.05 were considered as statistically significant.

RESULTS

A total of 126 healthy individuals were included in our study. Mean age of the participants was 46.98±12.86. 28.6% (n=36) of the participants were male and 71.4% (n=90) were female. The UA levels were found to be higher in men than in women, and a statistically significant relationship was found (p=0.013) (Table 1).

The mean BMI values of the participants was 28.05±6.68 kg/m^2 (min: 16.00- max: 47.47). The mean UA levels was 5.21±1.19 mg/dL (min: 2.60- max: 8.60). The distribution of other hematological parameters are shown in Table 2.

We found a significant, positive correlation between BMI and UA (p=0.000, r=0.571). A significant correlation was found between UA levels and triglyceride levels (p=0.001). The relationship between UA levels and other parameters is shown in Table 3.

Table 1. UA levels and gender assessments

	Gender	n	Mean± Standard Deviation	p
UA (mg/dL)	Male	36 (%28.6)	5.76±0.97	0.013
	Female	90 (%71.4)	5.00±1.21	

*UA: Uric acid

Table 2. Minimum, maximum values and mean±standard deviations of age, BMI, and other hematological parameters of the participants

	Minimum	Maximum	Mean± Standard deviations
Age	18	73	46.98±12.86
BMI (kg/m^2)	16.00	47.47	28.05±6.68
Glucose (mg/dL)	76	164	99.00±15.81
Urea (mg/dL)	7	26	12.54±3.587
Creatinin (mg/dL)	0.40	1.70	0.71±0.19
AST (U/L)	11	35	18.65±4.58
ALT (U/L)	6	47	16.16±7.835
LDL (mg/dL)	40	219	132.73±41.48
HDL (mg/dL)	27	70	47.95±10.60
Triglyceride (mg/dL)	46	307	146.56±64.24
Total Cholesterol (mg/dL)	88	315	207.98±46.02
Vit B12 (ng/L)	93	519	222.37±92.624
Ferritin (mg/dL)	3	235	38.46±41.45
UA (mg/dL)	2.60	8.60	5.21±1.19
Hemoglobin (g/dL)	9.7	17.4	14.05±1.47
Neutrophil (K/uL)	1.76	6.99	4.03±1.28
Lymphocyte (K/uL)	0.87	4.97	2.44±0.72
NLR	0.70	3.94	1.73±0.62
MPV (fL)	8.10	13.60	10.47±1.01

*BMI: Body Mass Index, UA: Uric acid, NLR: Neutrophil/ Lymphocyte Ratio, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, MPV: Mean Platelet Volume

DISCUSSION

It has not been clarified whether increased levels of UA is a risk factor for cardiovascular diseases (2). Studies have found that hyperuricemia increases when BMI increases, and that UA elevation and weight gain show parallelism (12). A study conducted in patients with chronic kidney disease showed that BMI, glucose levels and UA levels are related (13). Hikita et al. emphasized that both total and visceral fat mass and UA levels are closely related (14). Our results are similar to the literature. Hyperuricemia is detected before obesity and diabetes in most cases, therefore it was emphasized that patients with high UA levels should be followed very closely and treatment should be started early.

A study found that there was a significant and positive correlation between UA levels and BMI in men (15). In another study, UA levels were found to be higher in men than in women, and it was stated that hyperuricemia

Table 3. Evaluation of UA levels and BMI and other parameters

		Uric acid
BMI	r	0.571
	p	**0.000**
NLR	r	0.003
	p	0.980
MPV	r	-0.056
	p	0.662
LDL	r	0.117
	p	0.362
HDL	r	-0.085
	p	0.508
Triglyceride	r	0.397
	p	**0.001**
Total Cholesterol	r	0.210
	p	0.099

* UA: Uric acid, BMI: Body Mass Index, NLR: Neutrophil/ Lymphocyte Ratio, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, MPV: Mean Platelet Volume

can be considered among the indicators of metabolic syndrome (16).

In a study evaluating all age groups, it was shown that men have higher UA levels than women and that UA levels decrease with increasing age (17). In our study, UA levels were found to be higher in men than in women. A comparison based on increasing age was not included in our study. Studies have suggested that the reason for this gender difference may be estrogen, which induces UA excretion in women (18). The majority of the participants were in the reproductive period in our study and this may have caused it.

In a study evaluating the UA levels in Obstructive sleep apnea syndrome (OSAS) patients, it was found that as the severity of the disease increased, UA levels increased (19). It has been stated that UA levels should be evaluated as an independent risk factor in patients with non-alcoholic liver disease (20). Another curiosity is the relationship between different co-morbidities and the nature of their relationship.

One study showed that as HDL cholesterol levels decrease, UA values increase, and as total cholesterol and triglyceride levels increase, UA values increase (14). There are also several studies showing the relationship between high triglyceride levels and UA levels (13,21). The results of these studies are similar to those of our study. In another study, no relationship was found between UA and lipid levels. Many studies support the association between UA levels and cardiovascular risk. Nevertheless, the optimal approach to manage UA levels and their impact on comorbidities remains uncertain (10). Further studies involving larger populations are needed to provide clarity in this regard.

The main limitation of our study is the small sample size. Another limitation is that our study is planned cross-sectionally and performed in a single center, and the results cannot be generalized. Prospective studies with larger populations are needed.

CONCLUSION

In this study, we found that serum UA levels were positively correlated with BMI and triglyceride levels. We found that UA levels in men were higher than in women. We think that UA elevation should be evaluated during the periodic health examinations.

Ethical approval

This study has been approved by the Bolu Abant Izzet Baysal University Clinical Research Ethics Committee (approval date 24.11.2020, number 2020/284). Written informed consent was obtained from the participants.

Author contribution

Surgical and Medical Practices: NAG; Concept: NAG; Design: NAG; Data Collection or Processing: NAG; Analysis or Interpretation: NAG; Literature Search: NAG; Writing: NAG. The author reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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