Association Between Serum Uric Acid And Obesity

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ABSTRACT
Background: Hyperuricemia is commonly associated with dyslipidaemia, diabetes mellitus, coronary artery diseases and hypertension. As these diseases are also commonly associated with obesity, so need arises to see whether there is any independent association between serum uric acid and obesity.
Objective: This study aimed to estimate the association between serum uric acid and obesity.
Methods: A cross-sectional study was performed included a convenient sample of 150 outpatients visiting Al-Kadhimia teaching hospital (77 males and 73 females) aged 20-70 years. Blood samples were collected from the subjects and serum uric acid was estimated. Body mass index was calculated and patients were categorized as normal weight, overweight and obese according to body mass index scale.
Results: The results showed that serum uric acid was significantly higher in males than females ($p=0.008$). Serum uric acid levels had been increased significantly with advancing age ($p<0.001$). This study showed a highly significant positive linear correlation between subjects' serum uric acid levels and their body mass index ($r=0.798$, $p<0.001$).
Conclusion: It was concluded that there is a significant positive association between serum uric acid and obesity. Therefore it is important to establish preventive measures towards reducing obesity and overweight rather than treating health consequences, such as elevated serum uric acid.
Key words: Uric acid, obesity, body mass index.

الخلاصة

خلفية الدراسة: يرتبط فرط حامض اليوريك في الدم عادةً مع إضطراب دهون الدم، وداء السكري، وأمراض الشرايين التاجية، وإرتفاع ضغط الدم. كما ترتبط هذه الأمراض بدورها عادةً مع السمنة، لذلك دعت الحاجة لمعرفة ما إذا كان هناك أي إرتباط غير مهم بين حمض اليوريك في الدم والسمنة.

هدف الدراسة: تهدف هذه الدراسة إلى تقييم العلاقة بين حمض اليوريك في الدم والسمنة.

طريقة الدراسة: أجريت دراسة مقطعية شملت 150 شخصاً من مراجعي مستشفى الكاظمية التعليمي (77 ذكر و73 أنثى) تراوحت أعمارهم بين 20–70 سنة. وقد تم جمع عينات الدم من المشتركين في الدراسة وتم قياس مستوى حمض اليوريك في مصول الدم. وتم قياس الطول والوزن لهم أيضاً، ثم تم حساب مؤشر كتلة الجسم، ثم صُنِفَ المرضى الى ثلاثة مجاميع: مجموعة الوزن الطبيعي ومجموعة الوزن الزائد ومجموعة السمنة وفقاً لمقياس مؤشر كتلة الجسم لديهم.

النتائج: أظهرت النتائج أن معدل حمض اليوريك في مصل الدم أعلى بنسبة معنوية إحصائية في الذكور عنه في الإناث ($p=0.008$). وكان مستوى حمض اليوريك في مصل الدم يزداد بنسبة ذات دلالة إحصائية مع إزدياد العمر ($p<0.001$). وأظهرت هذه الدراسة وجود علاقة خطية إيجابية بنسبة ذات دلالة إحصائية بين مستوى حمض اليوريك في مصل الدم ومؤشر كتلة الجسم ($r=0.798$, $p<0.001$).

الإستنتاج: نستنتج من هذه الدراسة وجود علاقة إيجابية ذات دلالة إحصائية بين حمض اليوريك في الدم والسمنة؛ ولذلك فمن المهم وضع تدابير وقائية للحد من السمنة وزيادة الوزن بدلاً من معالجة العواقب الصحية؛ كإرتفاع حمض اليوريك في مصل الدم.

INTRODUCTION
Obesity has in the last decade become a global problem, according to the World Health Organization approximately 1.2 billion people in the world are overweight, and at least 300 million of them are obese. Obesity is one of the ten most preventable health risks. It is a polygenic, multi-factorial disease occurring by the interaction of genes and environmental factors(Ayse *et al*., 2011).

Obesity may be defined as a disease of extensive fat accumulation to the extent that health and wellbeing are affected. However, the degree of excess fat, its distribution within the body, duration and the associated health consequences vary considerably between obese individuals. Obesity has long been recognized as an associated factor with a variety of adverse health consequences; chiefly among them diabetes mellitus, hypertension, dyslipidaemia, increased cardiovascular events, and elevated serum uric acid (SUA)(Omar *et al*., 2006).

Obesity and overweight are terms commonly used to describe individuals with increased body fat. The most widely used method to gauge obesity is the body mass index (BMI), It is defined as the weight in kilograms divided by the square of the height in metres (kg/m^2) (BMI,2014).

Uric acid (UA) is synthesized in the liver from purine compounds provided by the diet or by the endogenous pathway of purine synthesis de novo. Some UA is also produced in peripheral tissues, especially the intestine and kidney. UA that is produced in the liver is released into the circulation in its soluble form (monosodium urate), which is readily filtered by the glomerulus. The proximal tubular cells of the kidney reabsorb most of the UA resulting in a normal fractional excretion of approximately 10%(Edwards, 2008).

In adults, the reference range of SUA is typically 3.4-7.2 mg/dL (200-430 μmol/L) for males, and 2.4-6.1 mg/dL (140-360 μmol/L) for females (1mg/dL=59.48 μmol/L). SUA concentrations above the normal range is known as hyperuricemia (Harmonisation,2013).

Disorders of UA metabolism are often seen in conjunction with various genetic conditions, as well as factors associated with lifestyles such as an unbalanced diet abundant in purine, obesity, alcohol consumption, and taking one of the antiuricosuric drugs which contribute to hyperuricemia by decreasing the excretion of UA in the urine, thus raising the concentration of UA in blood plasma. These drugs include diuretics, pyrazinamide, ethambutol, and aspirin (Oda *et al*., 2009).

It has been seen that hyperuricemia is commonly associated with dyslipidaemia, diabetes mellitus, coronary artery diseases and hypertension(Amin *et al*.,2009). As these diseases are also commonly associated with obesity (Omar *et al*., 2007), so need arises to see whether there is any independent association between SUA and obesity. The objective of this study was to observe any significant association between SUA and obesity.

PATIENTS AND METHODS

A cross-sectional study was performed included a convenient sample of 150 outpatients were referring medicine department of Al-Kadhimia teaching hospital for the period from 1st January to 1st April 2014.

All subjects fasted overnight before blood sampling, 5 mL of blood sample was collected and SUA was estimated by enzymatic determination of UA.

Height and weight were measured in light clothing without shoes. The body height was measured by a stadiometer and body weight by digital electronic weighing scales.

Body mass index was calculated as weight in kilograms divided by the square of height in meters. After calculating BMI, patients were categorized as; Normal weight 18.5-24.9 kg/m^2, overweight 25.0-29.9 kg/m^2, and obese $\geq$30.0 kg/m^2, according to standard BMI classification by the World Health Organization(BMI,2014).

Subjects suffering from hypertension, diabetes mellitus, ischemic heart disease and dyslipidemea were excluded from the study, as these diseases are usually accompanied by increased SUA. The study also excluded patients taking one of the antiuricosuric drugs, as diuretics, pyrazinamide, ethambutol, and aspirin. Alcoholic patients were excluded too.

All data were analyzed by student T test, using the statistical package for the social sciences (SPSS) version 20.0. Level of significance was denoted as P value of <0.05.

RESULTS

In this study, a total of 150 outpatients referring medicine department of Al-Kadhimia teaching hospital were enrolled. Of them 77 were males (51%), and 73 were females (49%). The mean age of the study subjects was 41.7±11.54 year, with a range of 20-70 year. Mean SUA and BMI of subjects were 312.37±110.74 µmol/L and 28.27±4.88 kg/m^2, respectively. The majority of study people were in the age group 30-39 year (33.4%). Regarding BMI, the highest proportion of subjects were within obese group (36.7%) (Table 1).

The mean SUA level was significantly higher in males than females (335.70 µmol/L vs. 287.76 µmol/L, respectively) (p=0.008). In respect to age, the study showed that SUA levels increase significantly with advancing age (p<0.001) (Table 2).

This study showed a highly significant positive linear correlation between subjects' SUA levels and their BMI (r=0.798, p<0.001) (Fig. 1).

Table 1. Distribution of study subjects by age and BMI

racteristics		No.	
Age (year)	20-29	20	13.3
	30-39	50	33.4
	40-49	42	28.0
	50-59	24	16.0
	≥ 60	14	9.3
Total		150	100.0
BMI (Kg/m^2)	Normal (18.5-24.9)	44	29.3
	Overweight (25-29.9)	51	34.0
	Obese (≥ 30)	55	36.7
Total		150	100.0

Table 2. The mean differences of SUA (µmol/L) by gender and age

Subject characteristics		Mean ± SD	P value
Gender	Male	335.70 ± 104.61	0.008
	Female	287.76 ± 112.39	
Age (year)	20-29	223.95 ± 61.46	<0.001
		302.96 ± 96.42	
		319.69 ± 102.31	
		347.20 ± 141.97	
		390.64 ± 99.76	

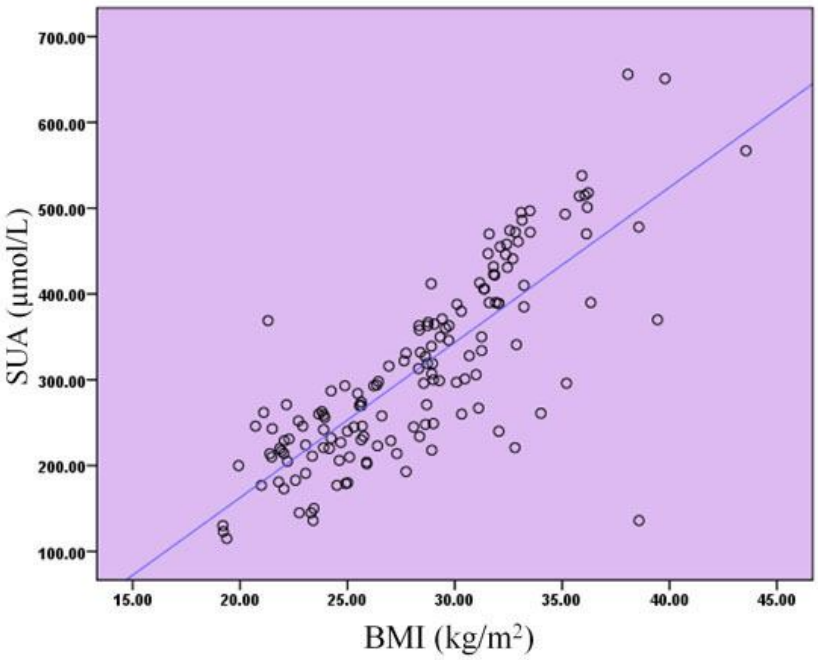

Fig. 1. The correlation between BMI and SUA
(r= 0.798, p<0.001)

DISCUSSION

Obesity has long been recognized as an associated factor with a variety of clinical conditions and adverse health consequences, and hyperuricemia is one of these conditions.[2] This study showed a significant positive association between obesity and SUA. The results of this study are comparable in most respects to many other related works. (Santi MJ *et al.*,2005) observed that SUA concentration showed positive association with BMI. Similarly (Choi *et al.*,2004) showed by their study that the SUA was significantly increased in the overweight and obese people.

SUA is not only associated with obesity but it is also positively and significantly associated with many other clinical conditions, as diabetes mellitus, hypertension, and ischemic heart disease. Although these conditions are also associated with obesity but SUA is independently associated with all these conditions (Akkasilpa *et al*., 2004). So, it can be concluded that obese patients, who are also hyperuricemic, suffer more commonly from diabetes mellitus, hypertension and ischemic heart disease as compared to patients who are obese but not hyperuricemic. Increased levels of SUA also increases morbidity and mortality in these patients (Suliman *et al*., 2006; Deleaval and Buriner, 2005). It is recommended that SUA should be routinely measured in all obese and overweight patients in order to prevent or at least delay complications due to raised SUA.

SUA is also a reliable indicator for the pre-metabolic syndrome in obese patients.[13] Mechanism by which how SUA is increased in obese patients is not known, but it has been observed that UA is a significant determinant factor of changes in BMI, and SUA concentrations predict subsequent weight gain (Asuo *et al*., 2003). So, it is possible that increased levels of SUA may be a cause of weight gain rather than result of it, at least in some cases. More work needs to be done in this regard in order to establish the mechanism of the association between Obesity and SUA.

In this study the mean of SUA was significantly higher among males than females. This result is consistent with a study carried out in Tehran (Masoud *et al*., 2012).
This study confirms that SUA levels increase significantly with advancing age (Kuzuya *et al*., 2002).
From this study we can conclude that there is a significant positive association between SUA and Obesity. Therefore it is important to establish preventive measures towards reducing obesity and overweight rather than treating health consequences, such as elevated SUA.

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