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Original/*Obesidad*

Association between serum uric acid levels and obesity among university students (China)

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Abstract

Objective: **to evaluate the association between serum uric acid and obesity among university students who participated in routine health screening in 2013.**

Methods: **in this cross-sectional study, 3529 subjects were analyzed. Obesity categories were classified by BMI levels references in China. And serum uric acid levels were classified by serum uric acid quartiles. Two-sample T-test and Wilcoxon Rank sum test were used to compare age, biochemical and anthropometric parameters of subjects of two genders. Rank correlation used to analyze relationship between serum uric acid and obesity.**

Results: **there were 1285 males (mean age, 19.8 ± 1.3 years) and 2244 females (mean age, 19.9 ± 1.3 years) in this study. Association between 2nd serum uric acid quartile and normal in male are significant and coefficient was 0.519. The 3rd serum uric acid quartile and normal in female was associated significantly(r = 0.173, p = 0.010). And associations between overweight and 3rd and 4th serum uric acid quartiles in female were significant(r = 0.128, p = 0.038 in 1st quartile and r = 0.282, p = 0.004 in 4th quartile). The 4th serum uric acid quartile and Obesity in two gender groups were significantly associated(r = 0.291, p = 0.000 in male and r = 0.484, p = 0.001 in female).**

Conclusion: **high serum uric acid was positively associated with obesity in overweight and obesity group. However, the association was weak between two variables because serum uric acid influenced obesity with other related factors together.**

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Key words: *Serum uric acid. Obesity. Association. University students.*

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ASOCIACIÓN ENTRE LA CONCENTRACIÓN DE ÁCIDO ÚRICO EN SUERO Y LA OBESIDAD ENTRE LOS ESTUDIANTES UNIVERSITARIOS (CHINA)

Resumen

Objetivo: **evaluar la asociación entre el ácido úrico en suero y la obesidad entre los estudiantes universitarios que participaron en los exámenes de salud de rutina en 2013.**

Métodos: **en este estudio transversal, 3.529 sujetos fueron analizados. La obesidad categorías fueron clasificados por el IMC niveles referencias en China.Y los niveles de ácido úrico en suero fueron clasificados por el ácido úrico en suero cuartiles. Dos Sample T - test y Wilcoxon Rank sum test se utiliza para comparar los parámetros antropométricos, bioquímicos y de los sujetos de ambos sexos. Rango correlación utilizado para analizar la relación entre el ácido úrico en suero y la obesidad.**

Resultado: **hay 1.285 hombres (edad media, 19,8 ± 1,3 años) y 2.244 mujeres (edad media, 19,9 ± 1,3 años) en este estudio. Asociación entre el segundo cuartil de ácido úrico en suero y normal en el macho son significativos y se 0,519 coeficiente. El tercer cuartil de ácido úrico en suero y normal en mujeres se asoció significativamente (R = 0,173, p = 0,010). Y asociaciones entre sobrepeso y 3º y 4º de ácido úrico sérico cuartiles en mujeres fueron significativa (R = 0,128, p = 0,038 en 1er cuartil y R = 0,317, p = 0,004 en cuarto cuartil). El cuarto cuartil de ácido úrico en suero y la obesidad en dos grupos de género fueron asociados significativamente (R = 0,286, p = 0,000 en macho y R = 0,484, p = 0,001 en mujeres).**

Conclusión: **alta de ácido úrico en suero fue asociado positivamente con la obesidad en el sobrepeso y la obesidad. Sin embargo, la asociación entre dos variables es débil porque el ácido úrico en suero influenciado la obesidad con otros factores conexos.**

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Palabras clave: *Ácido úrico en suero. Obesidad. Asociación. Estudiantes universitarios.*

Introduction

The global public has paid close attention to the prevalence of obesity[1]. Obesity was been studied that associated to many chronic diseases, for example, breast cancer[2], COPD[3], depressive disorder[4] and so on. In United States, the country has put in large invest to prevent youth obesity by promoting health eating and physical activity.

Serum uric acid is an end product which is produced by endogenous metabolism and exogenous urine in human beings [5].In various populations, serum uric acid level was strongly linked to vary kinds of MS[6-8]. An independent risk factor for female abdominal obesity and MS is the elevated level of serum uric acid[9]. According to a epidemiological study on MS, serum uric acid were significantly related to several indices, such as body mass index (BMI)[10], waist circumference[11], and dyslipidemia[12]. However, there is still lack of study on association between obesity and serum uric acid among university students.

The aim of this study was to evaluate the overall of serum uric acid level and the association between serum uric acid and obesity.

Methods

Subjects and Methods

Participants

This cross-sectional study was based on school and conducted in a university student. Those students admitted routine health screening in 2013.And there were a total of 3529 subjects in this study, aged 16-26 year old. All subjects agreed to provide their personal information regarding the purpose and the procedures of our study, and written informed consent. This study was approved by local ethics committee.

Anthropometric measurements

Height was measured with a standard stadiometer following study protocols, and weight was measured in light clothing on an electronic scales. And body mass index (BMI) was calculated by dividing the weight (kg) by the height (m) squared. Staff trained for the survey measured anthropometry and supervised by school nurses. Serum uric acid was measured by the urinate method.

Definitions

The levels of BMI defined obesity categories which based on obesity references in China. The BMI cut-off points are under 18.5 for underweight and 24 and 28 for overweight and obesity, respectively. And serum uric acid was defined on serum uric acid quartiles.

Data management

We performed R software to analyses data. Separate statistical analyses were performed for different gender, serum uric acid levels and obesity category groups. Two-sample t-test and wilcoxon rank sum test were used to compare age, biochemical and anthropometric parameters of subjects of both genders. Two line graphs were drawn for the prevalence of obesity categories and serum uric acid levels among university students by gender. Spearman rank correlation coefficients were used to evaluate the association between serum uric acid levels and obesity. Statistical significance was set at a probability level of 0.05.

Results

The serum uric acid and anthropometric measurements of the 3529 subjects for the two gender groups are shown in Table I, which include 1285 male (mean age, 19.8±1.3 years) and 2244 female (mean age, 19.9±1.3 years).

The data showed that male had higher serum uric acid level and BMI than that of female. And there were significant differences in serum uric acid, height, weight and BMI between two gender groups.

In Table II, subjects were categorized according to serum uric acid quartiles. Table II showed age, anthropometric measurements, serum uric acid and BMI for four serum uric acid quartiles groups. The serum uric acid quartile groups showed significant differences in gender, serum uric acid and anthropometric measurements.

Figure 1 shows the mean serum uric acid level according to serum uric acid quartiles by gender groups was showed. And mean serum uric acid level of male was higher than that of female in different groups.

Table I
Mean (±SD) of age, serum uric acid, height, weight and BMI of university students by gender

	Male	*Female*	*P*
Number	1285 (36.4%)	2244 (63.6%)	
Age (years)	19.8±1.3	19.9±1.3	0.700
UA (μmol/L)	375.6±79.7	286.1±58.8	0.000
Weight (kg)	64.4±11.6	52.1±7.1	0.000
Height (cm)	171.5±6.9	159.3±6.1	0.000
BMI (kg/m^2)	29.8±5.3	24.1±3.3	0.000

Table II
Subjects categorized in differences serum uric acid quartiles

	UA				c^2	p
	27.7-263	*263-308.3*	*308.3-364.7*	*364.7-996.2*		
Number	881	880	885	883		
Gender (male /female)	78/803	115/725	380/505	672/211	1040.092	0.000
Age (years)	19.9±1.4	19.9±1.2	19.8±1.4	19.9±1.3	3.412	0.332
UA (μmol/L)	228.9±29.7	285.8±13.0	334.5±16.2	425.2±58.5	3307.499	0.000
Height (cm)	160.4±7.4	161.2±7.8	164.4±8.3	169.0±8.3	610.072	0.000
Weight (kg)	51.4±7.1	53.3±8.0	56.7±9.1	64.8±12.7	776.141	0.000
BMI (kg/m^2)	23.8±3.3	24.8±3.7	26.2±4.2	30.1±5.8	781.164	0.000

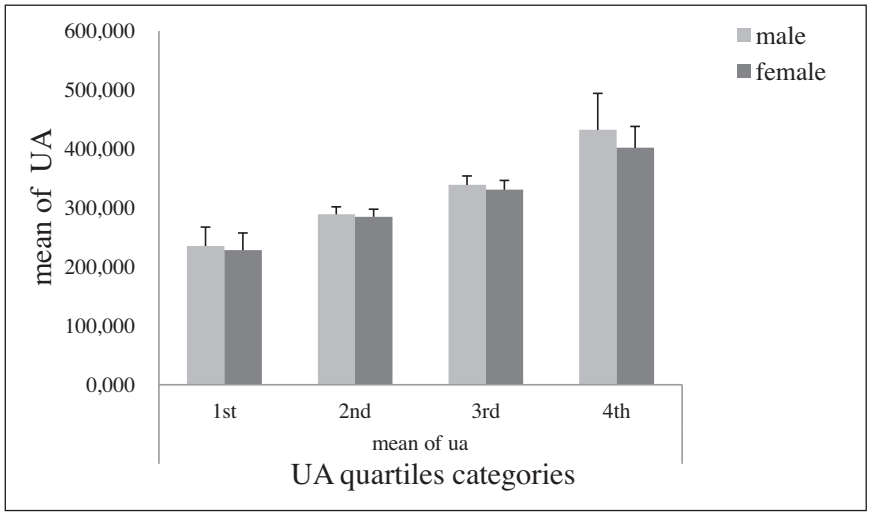

Fig. 1.—Mean of serum uric acid according to serum uric acid quartiles by gender.

Prevalence of serum uric acid according to obesity groups was shown in Table III. Majority of subjects in underweight and normal group had lower serum uric acid level (80% in underweight group, 38.3% in normal group). However, in overweight and obesity group, most of subjects were in 2nd serum uric acid quartile group. And there was a trend finding in table 3 that with serum uric acid level growing, subjects was

Table III
The prevalence of serum uric acid for university students according body type

		Prevalence (%)				total	*	p
		underweight	*normal*	*overweight*	*obesity*			
	Number	20	1251	1284	974	3529		
M	UA(27.7-263μmol/L)	0(0.0)	11(0.9)	35(2.7)	32(3.3)	78(2.2)	59.513	0.000
	UA(263-308.3μmol/L)	0(0.0)	25(2.0)	60(4.7)	70(7.2)	155(4.4)		
	UA(308.3-364.7μmol/L)	0(0.0)	51(4.1)	146(11.4)	183(18.8)	380(10.8)		
	UA(364.7-996.2μmol/L)	0(0.0)	36(2.9)	172(13.4)	464(47.6)	672(19.0)		
F	UA (27.7-263μmol/L)	16(80)	479(38.3)	260(20.2)	48(4.9)	803(22.8)	101.421	0.000
	UA (263-308.3μmol/L)	1(5)	367(29.3)	290(22.6)	67(6.9)	725(20.5)		
	UA(308.3-364.7μmol/L)	1(5)	222(17.7)	216(16.8)	66(6.8)	505(14.3)		
	UA(364.7-996.2μmol/L)	2(10)	60(4.8)	105(8.2)	44(4.5)	211(6.0)		

*Linear-by-linear Association by gender.

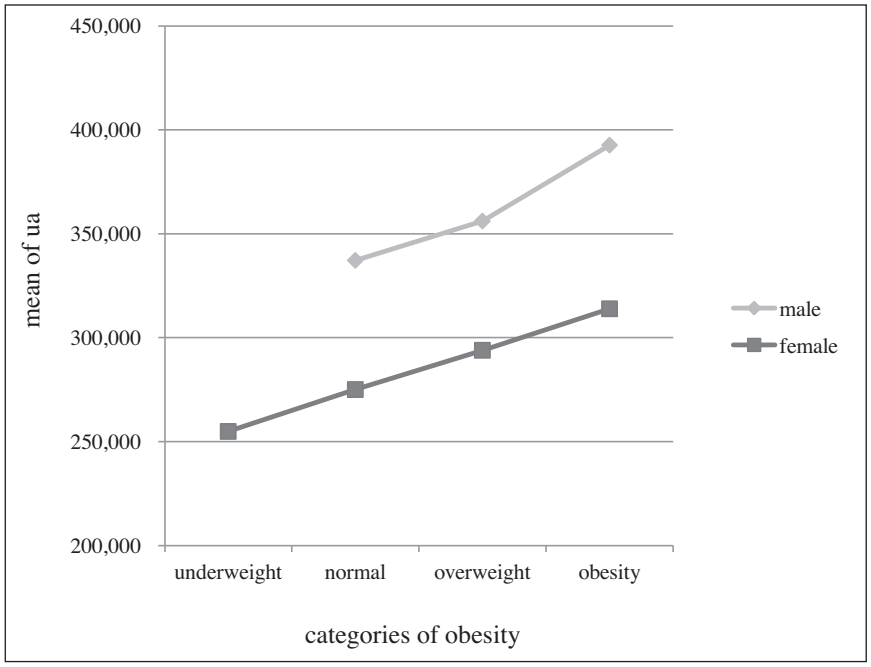

Fig. 2.—The changing trend of serum uric acid with different categories of obesity.

descending in each obesity group. But for underweight group, it might attribute to fewer subjects in this group. And serum acid uric was changing with obesity according to trend test.

Figure 2 was shown how serum uric acid in two gender groups changed with different obesity group. Serum uric acid was growing in both male and female according to different obesity groups. Serum uric acid was rising faster from overweight to obesity especially in male.

In figure 3, the trend of BMI with serum uric acid quartiles was shown. Mean of BMI was increasing with serum uric acid level in female but mild increasing trend in male group.

Discussion

Studies were well established and brought contributions to relationship between serum uric acid and MS in different population[13, 14], however, this is the first study focused on serum uric acid and obesity. In present study, we explored the prevalence of serum uric acid and the potential associations with obesity.

In this study, a positive significant association between serum uric acid and obesity has been found, especially in high serum uric acid level in overweight and obesity group. Similar result could be found in different studies[13, 15, 16]. And the association was stronger in females than males in both overweight and obesity group, which was consistent with findings in different populations such as people from Bangkok Thailand[17], middle age Chinese[9, 14] etc.

A previous study documented that males had higher serum uric acid level than females[18] and the same result had been found in our study. According to this study, serum uric acid had liner correlation with obesity, and with BMI growing, serum uric acid level was elevating. As a result, increased serum uric acid may

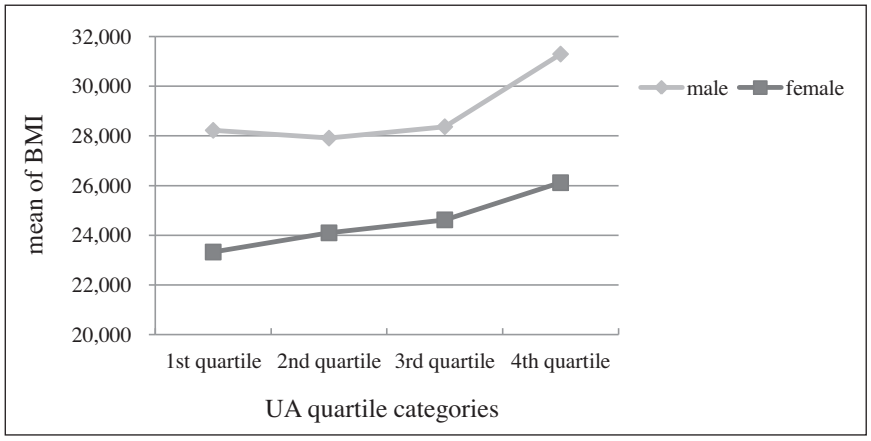

Fig. 3.—The changing trend of BMI with different serum uric acid quartile categories.

as an indicator of obesity, but in a obesity population from American demonstrated that serum uric acid influenced obesity but not independently impacted obesity[19]. And a cohort study from UK pointed out that a causal role was not been found whilst BMI and obesity[16].Thus it is still uncertain whether serum uric acid can be an indicator of obesity.

Majority studies explored the relationship between serum uric acid and obesity combining various MS components together[20, 21]. And in these studies, serum uric acid do had significant associations with BMI (obesity). In other words, serum uric acid associated with obesity based on the interaction of all related factors.

In conclusion, serum uric acid was strongly associated with obesity and further study should be established to explore deep relationship between serum uric acid and obesity by adding in more obesity related factors.

Conclusions

Serum uric acid maybe associated with obesity. However, the association also need research in future after adjust for confound factor.

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Conflict of Interest

None declared.

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