

ASSESSMENT OF SERUM URIC ACID STATUS IN OBESE INDIVIDUALS

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ABSTRACT

Background: Obesity means accumulation of excessive body fat and is a major risk factor for chronic diseases like diabetes, hypertension, heart disease, etc. Recently researchers had found interesting link between obesity and hyperuricemia. **Aim** of this study is to explore the relationship between serum uric acid and obesity among general population. **Materials & Methods:** A case control study consists of age and gender matched 40 non obese individuals and 40 obese individuals. The anthropometric variables like height, weight, waist circumference and hip circumference were collected. Serum uric acid level was analyzed in blood samples using standard kits in fully automated analyzer. Data was statistically analyzed using 't' test and correlation coefficient. **Results:** We observed a significantly high serum uric acid levels ($p < 0.05$) in obese group when compared to the non obese group. In the obese group, we found a significant increase in the BMI and waist hip ratio in comparison with the non obese group. A positive correlation was reported between uric acid and BMI ($r = 0.505$, $p < 0.01$), uric acid and waist circumference ($r = 0.350$, $p < 0.05$), uric acid and hip circumference ($r = 0.325$, $p < 0.05$) & uric acid and waist hip ratio ($r = 0.463$, $p < 0.01$). **Conclusion:** In the current study, serum uric acid levels are increased in obese individuals in comparison with non obese individuals. Increased visceral fat leads to insulin resistance which in turn results in hyperuricemia due to retention of uric acid in renal tubules.

KEYWORDS: BMI, Hyperuricemia, Obesity, Visceral fat & Waist hip ratio.**INTRODUCTION**

Obesity is a disease in which excess amount of fat accumulated in the body. Obesity imposes adverse effect on various organs and leads to health crisis like diabetes, hypertension, renal dysfunction, cardiac disease, etc. Obesity is most commonly caused by excessive food intake, lack of physical activity, medical problems, etc.^[1,2] According to World Health Organization (WHO) guidance, people are considered obese when the BMI is above 30 Kg/m². From 1975 to 2016, the incidences of obesity increase more than four folds from 4% to 18% globally. In 2016, WHO stated that around 650 millions of people in the world are suffering from obesity. Prevalence of obesity among all age group including children and teenagers are increasing at an alarming rate in India.^[3,4]

Hyperuricemia is a disease related to obesity with metabolic derangements in human. Uric acid is an end product of purine metabolism in human. 75% of uric acid is produced endogenously by continuous breakdown of senescent cells and remaining 25% of uric acid is obtained through diet. Uric acid is produced in liver and excreted through kidneys in urine. Serum uric acid levels

in male are slightly higher than the females. This may be due to the effect of sex hormones. Estrogen (Female sex hormone) decreases serum uric acid in females by increased excretion of uric acid through kidneys. Androgen (Male sex hormone) raises the serum uric acid levels in males.^[5,6,7]

Several studies in Bangkok, Thailand, China, Japan and US had identified a strong association between elevated uric acid and obesity.^[2,8] Obesity is an initiator of insulin resistance. In obese individuals, adipose tissue produces molecules like non esterified fatty acids, cytokines, etc. These molecules may directly end up in initiation of insulin resistance.^[6] Hyperinsulinemia is induced by insulin resistance and is also consequence of obesity.^[9] Increased insulin levels activates the uric acid transporters such as urate/anion exchanger (URAT1), multispecific anion transporter (OAT4 & OAT10) and organic anion and urate transporter (OAT1 & OAT3) in the renal tubules. This results in decreased excretion of uric acid by the renal system which in turn leads to increased serum uric acid levels.^[10,11] Degree of insulin resistance is inversely proportional to the renal excretion of uric acid.^[12] JH Chen, et al study reported a significant

relationship between hyperuricemia and insulin resistance in obese population.^[13]

Hyperinsulinemia may also decrease the rate of oxidative phosphorylation activity resulting in elevated adenosine levels. This promotes purine degradation which end up in elevated serum uric acid levels.^[14,15] In obese individuals, adipose tissue is responsible for fatty acid synthesis which is linked to de novo purine synthesis through increased HMP shunt pathway activity. Finally leads to increased rate of purine degradation and elevated production of uric acid.^[16,17] Hence, obesity leads to insulin resistance which in turn results in hyperuricemia. Purpose of this study was to examine the serum uric acid level in obese individuals and its association with obesity among general population.

MATERIALS AND METHODS

Ethic approval: This study was conducted at Sri Muthukumaran Medical college hospital and research institute from November 2019 to March 2020. Ethical approval was obtained from Sri Muthukumaran institutional ethics committee. All participants were informed about the study and gave their written consent before included in this study.

Study design & participants: Current study comprises of two groups – Non obese group and Obese group. 1) NON OBESE GROUP:- A total of 40 patients (23 males & 17 females) visiting Sri Muthukumaran hospital for Master health checkup (MHC) were recruited in this group. Inclusion criteria are 30 years and above non obese, healthy individuals. Exclusion criteria are pregnant and lactating women. 2) OBESE GROUP:- 40 obese patients, aged 30 years and above (26 males & 14 females) who attended MHC at Sri Muthukumaran hospital were enrolled in this group. Participants suffering from other illness like diabetes mellitus, hypertension, renal dysfunction, alcoholic, cardiac disease, cushing syndrome and any malignancy were excluded from this group.

Methodology

Blood samples were centrifuged and serum uric acid levels (Reference range Male – 3.0 to 7.0 mg/dl & Female – 2.0 to 6.0 mg/dl) are analyzed by uricase method using Konelab 20 auto analyzer on the same day of collection. Anthropometric measurements – Height was measured with a 0.1cm accuracy using a wall stadiometer. Body weight was measured while participants were wearing light weighted cloths and no shoes. Weight was measured as kilograms using electronic weighting machine. Body mass index (BMI) is calculated by dividing weight (Kg) and Height (m²). BMI is a standard indicator of obesity. WHO had categorized body fat accumulation according to BMI as underweight – BMI \leq 18.49 Kg/m² ii, normal weight – BMI 18.5 to 24.9 Kg/m² iii, over weight – BMI 25 to 29.9 Kg/m² and iv, obese – BMI \geq 30 Kg/m². Waist and hip circumference was measured using an elastic tape as per WHO guidance. Waist hip ratio was calculated as waist circumference (cm) divided by hip circumference (cm).

Statistical analysis: Our study results of all the parameters were presented as Mean \pm Standard deviation. Statistical comparison between non obese group and obese group were analyzed using student's 't' test. Interrelationships between anthropometric variable and serum uric acid were assessed by correlation coefficient test.

RESULT

Table 1 shows mean \pm SD and p value of BMI, Waist circumference, hip circumference, waist hip ratio and uric acid in both non obese group and obese group. We observed a significant increase in the obese group uric acid levels in comparison with non obese group (p <0.05). Correlation of serum uric acid with BMI, Waist circumference, hip circumference and waist hip ratio in the obese group is shown in table 2.

Table 1: Baseline characteristics of non obese group and obese group.

PARAMETERS	NON OBESE GROUP (n = 40)	OBESE GROUP (n = 40)	P VALUE
Gender	M - 23 F - 17	M - 26 F - 14	-
Age (years)	37 \pm 10.8	46 \pm 9.7	-
BMI (Kg/m ²)	22.2 \pm 1.8	34.3 \pm 2.3	<0.001
Waist Circumference (cm)	77 \pm 6.3	97 \pm 7.8	<0.001
Hip Circumference (cm)	86 \pm 9.2	108 \pm 7.1	<0.001
Waist hip ratio	0.87 \pm 0.07	0.93 \pm 0.05	<0.01
Serum uric acid (mg/dl)	4.2 \pm 1.6	5.3 \pm 1.2	<0.05

We observed a significant positive correlation between serum uric acid and Waist circumference ($r = 0.350$, $p < 0.05$) in the obese group (Fig 1). Figure 2 demonstrate a positive correlation between serum uric acid and waist hip circumference in the obese group.

Table 2: Correlation between serum uric acid and other parameters among the obese group.

PARAMETERS	r Value	p Value
Uric acid & BMI	0.505	<0.01
Uric acid & Waist circumference	0.350	<0.05
Uric acid & Hip circumference	0.325	<0.05
Uric acid & Waist hip ratio	0.463	<0.01

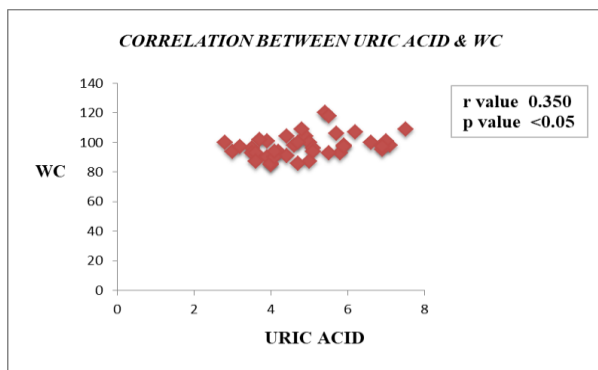


Figure 1: Correlation between serum uric acid & Waist circumference (WC).

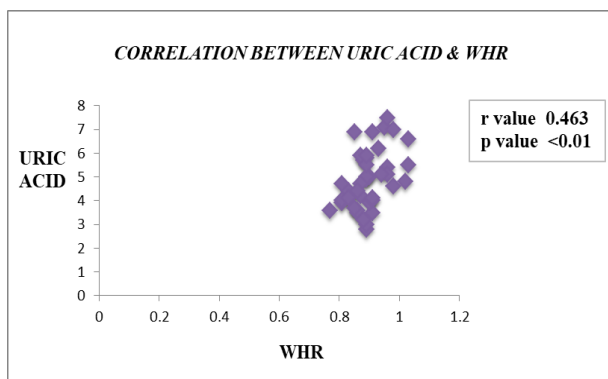


Figure 2: Correlation between serum uric acid & waist hip ratio (WHR).

DISCUSSION

In the current study, obese group had significantly higher serum uric acid than the non obese group. Our study result was similar with the result of previous studies.^[18,10,20] In comparison with non obese group, we observed a significant increased BMI in obese group. JA Miranda, et al and Amin-ul-Haq, et al results are also in accordance with the present study.^[4,6] Waist circumference (WC) and hip circumference (HC) are significantly higher in obese group when compared with non obese group. Result of the present study was consistent with other studies.^[3,21] Mean of waist hip ratio (WHR) in obese group was higher than that in non obese group. EI Onwubuya, et al had also reported same

results.^[22] Waist circumference and waist hip ratio are indices of visceral adiposity and body fat accumulation. Increased visceral fat stimulates influx of free fatty acid in liver which might lead to elevated triglycerides synthesis.^[23,24] Triglycerides synthesis indirectly alters uric acid metabolism. Visceral fat accumulation is also associated with insulin resistance which indirectly increases the serum uric acid levels.^[25,26]

In the present study obese group, there was a significant correlation between serum uric acid and BMI. Same finding was also reported in EI Onwubuya et al study.^[22] Serum uric acid showed significant correlation with waist circumference in this study, which is similar to the result of another study.^[27] A significant positive correlation was observed between serum uric acid and hip circumference in our study (Same as Mehmet Inanir study results).^[3] Current study demonstrated a correlation between serum uric acid and waist hip ratio. This finding is in accordance with the results of other works.^[22,27] Several studies confirm statistical significant association of elevated serum uric acid with obesity.^[28,29,30] Findings of the present study indicate that obesity indices such as BMI, waist circumference, hip circumference and waist hip ratio had a strong association with increased uric acid levels in serum. Hence, we conclude that obesity is significantly related with elevated serum uric acid levels in obese individuals.

CONFLICTS OF INTERESTS

Authors declare no potential conflicts of interest with the content of this research article.

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CONCLUSION

In nutshell, possible link between obesity and elevated serum uric acid levels are insulin resistance and hyperinsulinemia. Excess visceral fat accumulation causes increased fatty acid synthesis which indirectly results in increased purine synthesis and high uric acid production. Outcome of this study clearly indicate a significant positive association between hyperuricemia and obesity. In future, well designed and large scale longitudinal studies should be conducted to recommend serum uric acid analysis in obese individuals to prevent hyperuricemia and its related complications.

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