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Association Between Serum Uric Acid And Blood Glucose Level In Young Obese Individuals.

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ABSTRACT

Obesity is a medical condition which increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, obstructive sleep apnea, certain types of cancer and osteoarthritis. There is scarcity of information about the association between serum uric acid level and blood glucose levels in young adult obese population. In this study, body mass index, Blood Glucose and serum uric acid level were estimated using standard procedures in fifty young adult obese individuals. The data was analyzed using Pearson correlation to find the association between serum glucose and uric acid level in obese individuals. The association between blood sugar and the serum uric acid level in male obese subjects showed a positive significant association ($r=0.092$, $p=0.65$) but in females it was insignificant ($r=0.142$, $p=0.507$). The association between the serum uric acid with fasting blood glucose in obese subjects is insignificant in both males and females. Although, the previous studies reported the positive association between serum uric acid and fasting blood glucose in obese subjects belongs to older age group, it was confirmed from the present study that, the association is insignificant in younger age group.

Keywords: Obesity, Young Obese Adults, Body Mass Index, Blood Glucose, Serum Uric Acid

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INTRODUCTION

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems [1]. Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, obstructive sleep apnea, certain types of cancer and osteoarthritis [1]. It has reached epidemic proportions in India in the 21st century, with morbid obesity affecting 5% of the country's population. India is following a trend of other developing countries that are steadily becoming more obese. Unhealthy, processed food has become much more accessible following India's continued integration in global food markets. This, combined with rising middle-class incomes, is increasing the average caloric intake per individual among the middle class and above income households. Diabetes mellitus is a group of disorders characterized by chronic hyperglycemia associated with disturbance of carbohydrate, fat and protein metabolism due absolute or relative deficiency of insulin secretion or its action. Diabetes causes long term dysfunction of various organs like heart, kidneys, eyes, nerves and blood vessels [2].

In humans and higher primates, uric acid is the final oxidation product of purine metabolism and is excreted in urine. However, the pathophysiology of hyperuricemia or elevated serum uric acid levels is not clearly understood. It was reported that, the serum uric acid is positively associated with serum glucose in healthy subjects, but this association is not consistent between healthy and diabetic individuals, as a low serum uric acid is reported in the hyperglycemic stage [3,4]. Since most individuals experience a phase of impaired glucose tolerance before progression to diabetes, it is not clear whether raised serum uric acid predicts the risk of type 2 diabetes [5,6].

Obesity has been considered as an aggravating related or etiological factor in disorders of lipid metabolism, diabetes, and gout. These clinical conditions, in turn, seem to be interrelated. Attempts were made to correlate various measurements of body fatness with biochemical measurements relative to these conditions such as serum cholesterol, triglycerides, serum uric acid, fasting plasma glucose, or glucose tolerance etc. have led to conflicting results.

Obesity is often accompanied by hyperuricemia. Uric acid is a product of metabolic breakdown of purine nucleotides. In humans, uric acid is the final oxidation product of purine catabolism [7,8]. Elevated serum uric acid (hyperuricemia) is closely associated with visceral fat accumulation [9,10] and various metabolic disorders, such as glucose intolerance, elevated blood pressure, dyslipidemia, and atherosclerotic cardiovascular diseases, conceptualized as metabolic syndrome [11,12].

It was reported using mouse models that, adipose tissue could produce and secrete uric acid through xanthine oxido-reductase (XOR) and that the production was enhanced in obesity. For some time, it has been recognized that serum uric acid (UA) is positively associated with serum glucose levels in healthy subjects. Recent studies have demonstrated that UA levels are higher in subjects with pre-diabetes and early Type 2 diabetes than in healthy controls [13,14]. Furthermore, an elevated serum UA level was found to increase chances for developing Type 2 diabetes in individuals with impaired glucose tolerance.

Uric Acid (UA) seems inextricably linked to hypertension, dyslipidemia, and disordered glucose metabolism, which play a causal role in the pathogenesis of cardiovascular disease. As such, UA may be merely a marker of risk for cardiovascular disease. Using data from the First National Health and Nutrition Examination Study (NHANES I), Freedman and colleagues demonstrated that, each 60 $\mu\text{mol/L}$ increment in uric acid level was associated with a 48% increase in risk for incident ischemic heart disease among women [13,15]. Furthermore, clinical evidence suggests that uric acid plays a role in platelet adhesiveness, formation of free radicals and oxidative stress [16]. Several studies have shown an inverse relation between UA excretion and insulin level [17]. Several epidemiologic studies have reported that high serum levels of uric acid are strongly associated with prevalent health conditions such as obesity, insulin resistance, metabolic syndrome, diabetes, essential hypertension and renal disease. Population-based studies have shown that hyperuricemia is an independent risk factor for cardiovascular disease (CVD). This association has been found to be particularly robust among individuals at high risk for CVD, including those with obesity [18], hypertension, diabetes and renal disease.

Though it was reported that hyperuricemia is associated with various metabolic risk factors, to our knowledge the association between serum uric acid level and blood glucose levels in young adult population of obese individuals is not well documented, therefore the present study is undertaken to establish the association

between serum uric acid level and blood glucose level in young obese individuals.

MATERIALS AND METHODS

This cross-sectional study was conducted after the approval from institutional ethical committee. Fifty obese subjects among the staff and student community between the age group of 18 to 40 years of either sex was recruited for the study after an informed and written consent duly signed by each participant. Subjects whose BMI is $>30 \text{ kg/m}^2$ and subjects without any other organic diseases, without medications for diabetes and/or renal dysfunctions, nonsmokers are included in the study.

Under aseptic precautions, approximately 5 ml of blood will be collected without anticoagulant in appropriate sterile vials by venous arm puncture. The serum was separated by centrifugation at 1500 RPM for 15 mins and stored at 4°C for the estimation of serum uric acid level and blood glucose level.

The body mass index was measured as, Height and weight were measured with a standard height-weight scale, and body mass index (BMI, kg/m^2) was calculated as weight divided by height squared. Obesity was defined as a BMI greater than 30 kg/m^2 .

Blood Glucose level was estimated by Glucose -Oxidase method. The serum uric acid level was estimated by Uricase/POD method. The experiments were performed using commercially available kits as per the manufacturer's guidelines.

Statistical Analysis

The data was analyzed using Pearson correlation for finding out the statistical significance between serum glucose and uric acid level in obese individuals using SPSS Version-16. P value less than 0.05 was considered the level of significance.

RESULTS

In the present study, 50 healthy obese individuals between the age group of 18-40 years of either sex were recruited. The body mass index was measured in all the subjects to meet the inclusion criteria. The fasting blood sugar and the serum uric acid level were estimated using the above-mentioned standard procedure. The results showed that blood sugar and the serum uric acid level were positively associated but, the statistical analysis showed no significant association among the obese individuals.

The number of age and sex matched subjects recruited in the present study was balanced. The male was 52% and females were 48% (Fig-1). The number of subjects recruited in the present study was 40 between the age group of 18-24 years and 9 between the age group of 25-31 years and 1 between the age group of 32-38 years of age (Fig-2). This indicates that all the subjects were young adults.

The association between blood sugar and the serum uric acid level in male obese subjects when analyzed showed a positive association but, it was not found to be statistically significant ($r=0.092$, $p=0.65$, Fig-3, Table-1). The association between blood sugar and the serum uric acid level in female obese subjects when analyzed also showed a positive association but, was statistically insignificant ($r=0.142$, $p=0.507$, Fig-4, Table-1).

Table-1: Statistics showing the association of mean fasting blood sugar level and serum uric acid level in young obese male and female subjects. N=50.

Association of Blood sugar with	Male		Female	
	r value	p value	r value	p value
Uric acid (mg/dl)	0.092	p =0.65 NS	0.142	p =0.51 NS

Note: p<0.05 was considered the level of significance. NS=Nonsignificant.

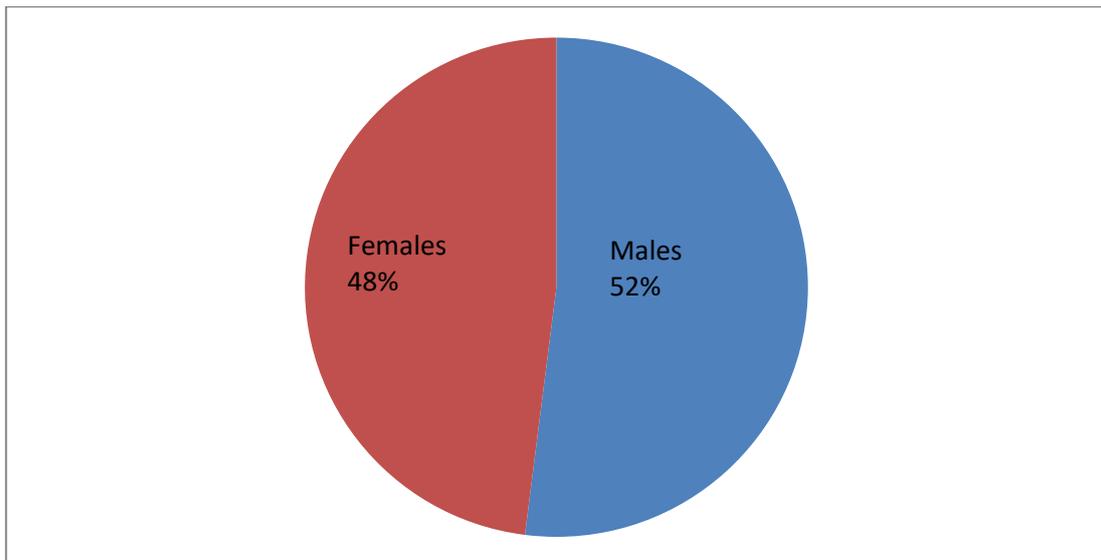


Figure 1: Percentage of male and female obese subjects recruited for the study. Total number of subjects was 50.

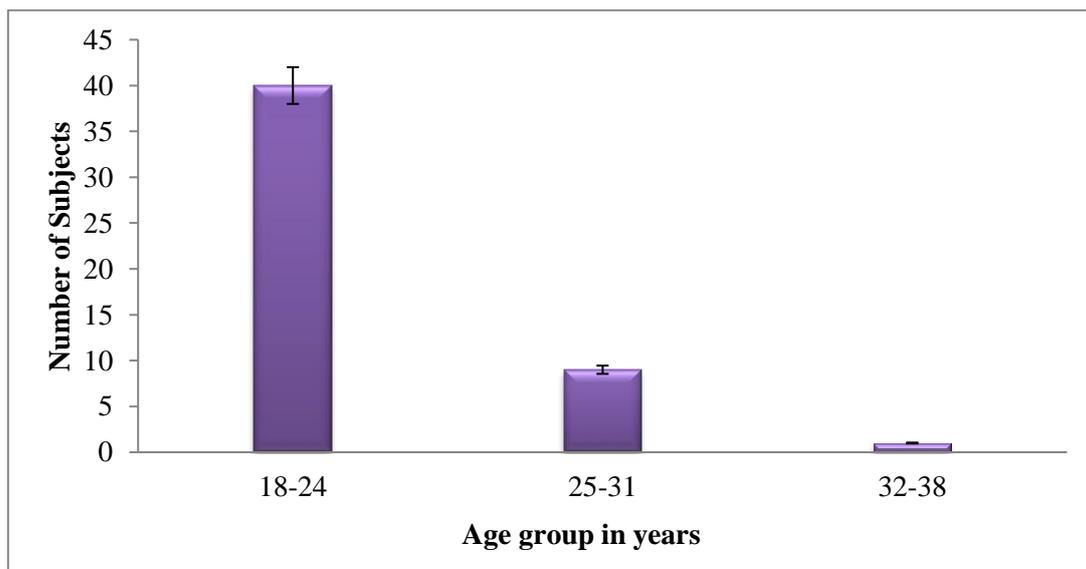


Figure 2: Bar diagram showing the number of subjects recruited in the different age group out of a total 50 subjects.

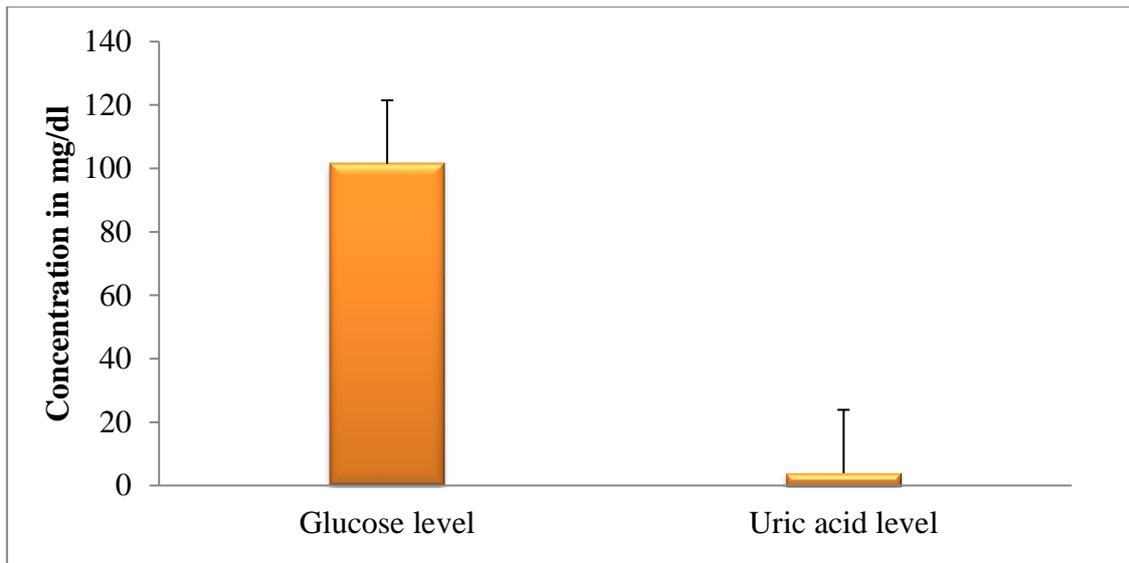


Figure 3: Comparison of mean fasting blood glucose and serum uric acid level in healthy obese male subjects. Values are expressed as Mean ± S.D. The association of blood sugar with the serum uric acid level in male obese subjects was insignificant ($r=0.092$, $p=0.65$).

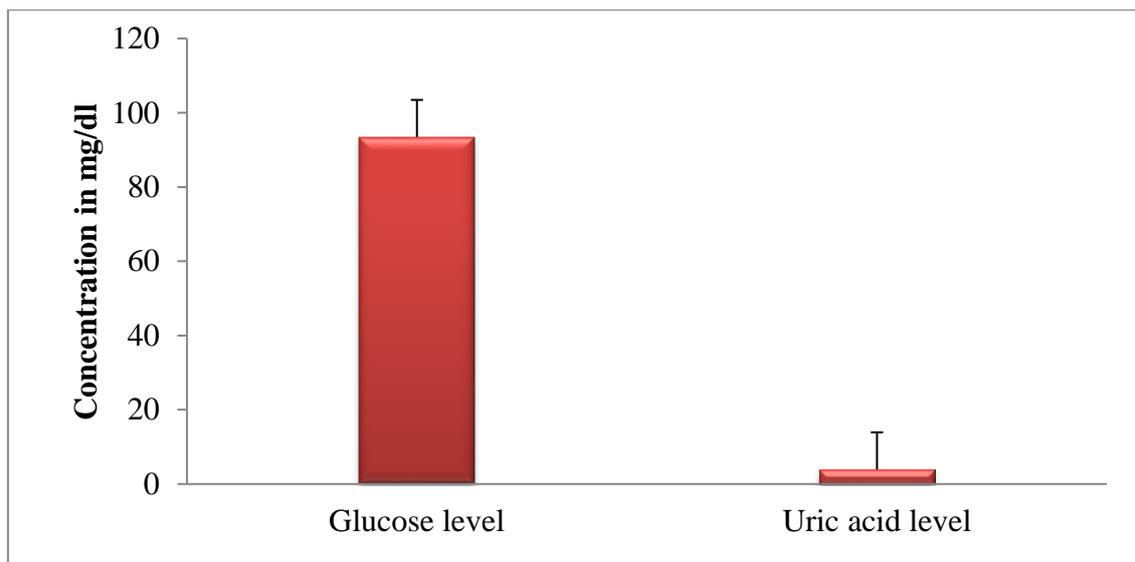


Figure 4: Comparison of mean fasting blood glucose and serum uric acid level in healthy obese female subjects. Values are expressed as Mean ± S.D. The association of blood sugar with the serum uric acid level in male obese subjects was insignificant ($r=0.142$, $p=0.507$).

DISCUSSION

Obesity has been linked to many chronic disorders such as diabetes, cardiovascular disease, and ischemic heart disease. Recent studies have introduced serum uric acid as a potential risk factor for developing diabetes, hypertension, stroke, and cardiovascular diseases. The value of elevated levels of UA in serum as a risk factor for diabetes development is still under scrutiny. Identifying the risk factors for the development of type 2 diabetes is essential for primary prevention [19, 20]. Metabolic syndrome and insulin resistance are well-established key risk factors for diabetes. Hyperuricemia, a highly prevalent condition in the adult population, is associated with obesity and insulin resistance [21].

Several epidemiologic studies have described the association between serum uric acid level and diabetes. But, in the present study, the association of serum uric acid level with fasting blood glucose in obese

subjects was explored. In the present study, it was observed that, association between the serum uric acid with fasting blood glucose in obese subjects was found to be insignificant.

The result obtained in the present study is different from the expected results, which might be due to the fact that, the recruited subjects belongs to the lower age group. It was reported that, the serum uric acid is positively associated with serum glucose in healthy subjects, but its association in healthy obese was lacking. Therefore, the purpose of this study was to investigate the association between the serum uric acid level and fasting blood glucose level in young healthy obese subjects. The results of this study showed an insignificant association between the serum uric acid and fasting blood glucose in obese male and female subjects ($p>0.05$). The serum uric acid level and the fasting blood glucose levels in young male and female subjects were not deviated from the normal physiological range. Hence, the estimation of serum uric acid levels will not be considered as an early indicator of diseases such diabetes mellitus in obesity.

Recent evidence suggests that uric acid plays a role in immune activation [22] and cytokine secretion [23,24]. Since, the individuals of the younger age group are immunologically active; there was no deviation in the uric acid level from the normal physiological range. Hence, the association was found to be insignificant. The large sample size with higher BMI belongs to wider range of age group to establish or to confirm the association between the serum uric acid with fasting blood glucose in obese subjects is warranted.

CONCLUSION

In the present study, we found that, the association between the serum uric acid with fasting blood glucose in obese subjects is insignificant in both males and females. Although, the previous studies reported the positive association between serum uric acid and fasting blood glucose in obese subjects belongs to older age group, it was confirmed from the present study that, the association is insignificant in younger age group.

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