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Original Research Article

Evaluation of Serum Uric Acid Levels and their Association with Metabolic Syndrome Components: A Cross - Sectional Study

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Abstract:

Background: High Serum Uric (SU) acid level (AL) is associated with metabolic syndrome (MS), a group of risk factors for cardiovascular disease. Understanding the link between SU AL and MS components is crucial to understanding pathophysiological causes and developing preventive interventions.

Methods: Kishanganj's MGM Medical College and LSK Hospital conducted an 18-month cross-sectional study with 100 participants. SU, AL and MS components like insulin resistance, dyslipidemia, hypertension, and abdominal obesity were assessed using enzymatic/colorimetric methods. Statistics were used to examine MS risk factor-uric acid associations.

Results: The study indicated that 40% of the 100 subjects, with an average age of 45, had SU As above normal at 6.2 mg/dL. Most MS components were hypertension (45%), dyslipidemia (70%), insulin resistance (60%) and abdominal obesity (55%). Both abdominal obesity ($r = 0.35$, $p < 0.001$) and dyslipidemia ($r = 0.25$, $p = 0.012$) were strongly linked with uric AL. A significant link exists between MS and increased uric AL (6.8 mg/dL) compared to those without (5.5 mg/dL, $p < 0.001$), despite controlling for age, sex, and BMI.

Conclusion: Our findings emphasise SU acid's potential as a MS diagnostic and treatment target. Understanding causal pathways, overcoming methodological constraints, and exploring uric acid metabolism therapy help alleviate MS-related disorders.

Keywords: abdominal obesity, cross-sectional study, dyslipidemia, hypertension, insulin resistance, MS, SU AL.

Introduction

The kidneys remove uric acid, a purine metabolic by-product. Gout, high blood pressure, heart disease, and MS are among clinical conditions connected to elevated SU acid [1].

MS—a collection of risk factors that includes insulin resistance, dyslipidemia, hypertension, and abdominal obesity—increases cardiovascular morbidity and death worldwide [2]. The relationship between MS and high blood uric acid has garnered attention in recent years. Studies have indicated inconsistent or bidirectional correlations indicating that higher uric AL may contribute to MS and its components [3].

The complicated link between MS and uric acid metabolism must be studied to develop new therapy targets and pathological causes [4,5].

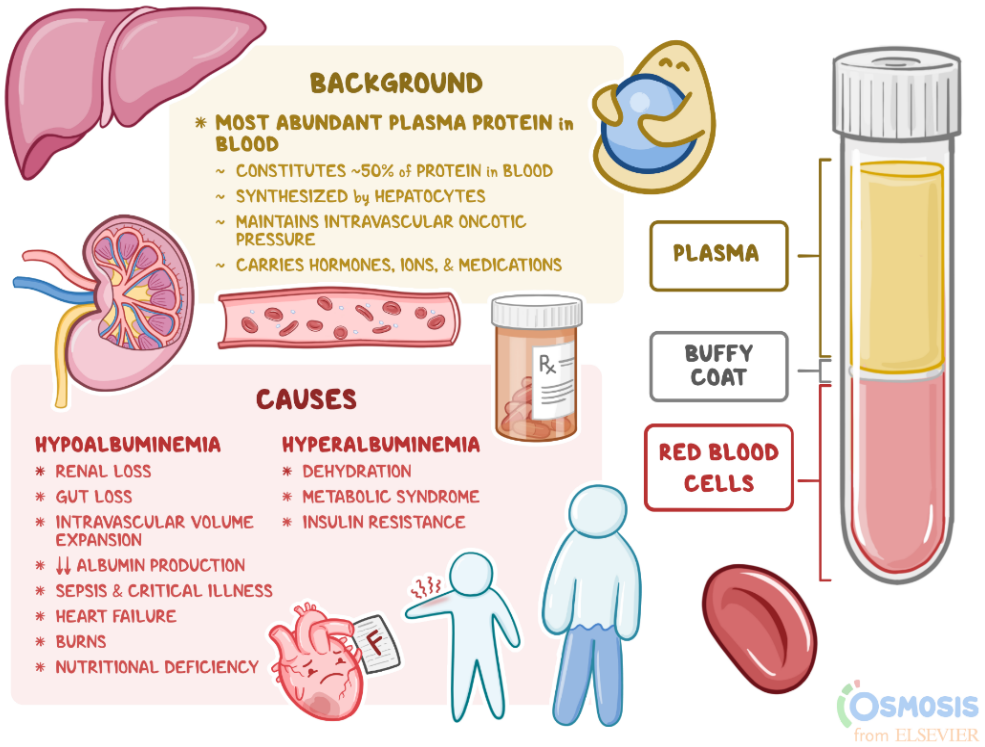

Figure 1: Serum Albumin (source: [6])

Objective

- Find out how many people in the study population had metabolic syndrome symptoms and how common it was for their serum uric acid levels to be high.
- To find out more about the link between metabolic syndrome and its specific symptoms, such as insulin resistance, dyslipidemia, hypertension, and abdominal obesity.

This study examines the link between blood uric AL and MS components in a cross-sectional population. Over 18 months, we will evaluate a group of people from Kishanganj's MGM

This 18-month study included 100 outpatients from MGM Medical College and LSK Hospital in Kishanganj. We will collect and assess anthropometric measurements, blood pressure, lipid profile, SU acid and fasting blood glucose using statistical methods. To add to the growing body of knowledge on metabolic disorder pathogenesis, this study clarifies the link between SU AL and MS components. It will also guide MS prevention and treatment.

Literature Review

A lot of attention has been paid to the link between MS and blood uric AL in both clinical and epidemiological studies. Several studies have looked into the link between MS and high uric AL, but the results have been mixed [7]. This means that more studies are needed to figure out what is going on and what the real-world effects are. A study by [8] on a Chinese community found that higher levels of uric acid were linked to a higher risk of MS components like abdominal obesity, dyslipidemia, and insulin resistance. The researchers also found a link between blood uric AL and the number of people who had MS. In the same way, [9] did a meta-analysis and found a strong link between MS and high uric AL. This supports the idea that uric acid plays a part in the start or worsening of metabolic problems.

On the other hand, different studies have found different things. One example is the 10-year longitudinal cohort study by [10], which looked for a link between MS and blood uric AL in middle-aged Americans. They didn't find anything. A study by [11] on a Japanese community found that there was no significant link between SU AL and MS components, even after possible confounders were taken into account. This is more proof that MS may be caused by other things that are more important.

Even though there is more and more research on the topic, there are still some questions that need to be answered about the link between MS and SU AL. As a start, large-scale prospective studies with extended follow-up are needed to find out when and how the link between uric acid and MS components started. Inflammation, oxidative stress, and dietary factors are also possible mediators or confound that need more research to fully understand how they affect this relationship [12].

To find out what effect drug therapies that target SU AL have on MS outcomes, very strict study

trials need to be carried out. To learn more about how different groups are more likely to get sick and how different treatments work, it is important to look into how genetic and racial differences affect the link between uric acid and MS parts.

Because of these things, the current study aims to add to what is already known by looking at blood uric AL and MS components in a group of people who go to MGM Medical College and LSK Hospital in Kishanganj. To help us understand the complicated connection between MS and uric acid metabolism, as well as to guide future research and clinical practice, we want to talk about flaws in the way previous studies were done and what might have caused them to be inconsistent.

Methods

Study Design: People from MGM Medical College and LSK Hospital in Kishanganj were asked to take part in the study. Their blood uric AL and MS components were checked using a cross-sectional method. Cross-sectional study looks at links between variables and prevalence at a certain point in time by collecting data at a single point in time.

Study Population: People who went to the outpatient departments of MGM Medical College and LSK Hospital, Kishanganj, over the course of 18 months make up the study group. Convenience sampling will be used to choose 100 people to be in the group.

Inclusion Criteria

- Age 18 years and above.
- Individuals willing to provide informed consent for participation.

Exclusion Criteria

- Known history of gout or other conditions affecting uric acid metabolism.
- Pregnancy.
- Severe chronic kidney disease (eGFR < 30 mL/min/1.73 m²).
- Use of medications known to affect uric AL (e.g., diuretics, allopurinol).

Data Collection Methods

SU Acid Measurement: Blood samples will be collected from participants after an overnight fast. SU AL will be measured using enzymatic/colorimetric methods on automated clinical chemistry analyzers. The reference range for SU AL will be defined according to standard laboratory protocols.

Assessment of MS Components

Abdominal Obesity: Waist circumference will be measured at the midpoint between the lower rib margin and iliac crest using a flexible tape measure.

Dyslipidemia: Fasting lipid profile including total cholesterol, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and triglycerides will be measured using standard enzymatic methods.

Hypertension: Blood pressure will be measured using automated sphygmomanometers after participants have been seated for at least 5 minutes. Hypertension will be defined as systolic blood pressure ≥130 mmHg and/or diastolic blood pressure ≥85 mmHg.

Insulin Resistance: We will use enzymes to find out what the morning blood glucose levels are in this experiment. To check for insulin resistance, we will use the homeostatic model assessment of insulin resistance (HOMA-IR) and other substitute measures.

Statistical Analysis Plan: Descriptive statistics will be used to describe the demographics, SU AL, and the prevalence of MS components. There are two ways to show continuous variables: medians with interquartile ranges or means with standard deviations. This depends on how the data is spread out. To show categorical factors, we will use frequencies and percentages.

To find out if there is a link between SU AL and MS components, the Pearson correlation coefficient for continuous factors and the chi-square test for categorical data will be used. Multiple linear or logistic regression analysis will be used to account for possible factors like age, gender, BMI, and medication use. By doing subgroup analyses, we will look at how demographic or clinical factors change the result.
It is statistically significant if the two-tailed p-value is less than 0.05. It will be done by a trained biostatistician who will use statistical tools like SPSS or R.

Results

Demographic Characteristics: A total of 100 participants were included in the study, with a mean age of 45 years (± 10.2), ranging from 25 to 65 years. The study population consisted of 55% males and 45% females. The majority of participants were from urban areas (65%) and had completed at least secondary education (80%).

Table 1: Demographic Characteristics

Characteristic	Value
Total Participants	100
Mean Age (years)	45 (± 10.2)
Gender (% male)	55
Residence	
- Urban (%)	65
- Rural (%)	35

SU AL: The mean SU AL in the study population was 6.2 mg/dL (± 1.3), with a range of 4.0 to 9.5 mg/dL. Approximately 40% of participants had SU AL above the upper limit of the normal range (> 7.0 mg/dL).

Prevalence of MS Components

Table 2: Prevalence of MS Components

MS Component	Prevalence (%)
Abdominal Obesity	55
Dyslipidemia	70
Hypertension	45
Insulin Resistance	60

The table shows how common certain parts of the MS were in the study group. The alarmingly high incidence rates are one of the many interesting results. Dyslipidemia makes up 70% of cases, insulin resistance 60%, and abdominal obesity 55%, and hypertension 45%.

These results show how complicated MS is and how hard metabolic diseases were on the people who were studied. The high rates of occurrence make it clear that we need to find and act on changeable risk factors as soon as possible in order to lower the death and illness caused by cardiovascular disease. To lower the number of illnesses in the community as a whole, these results show that we need screening and care methods that cover all aspects of MS.

Statistical Analyses

Association between SU AL and MS Components: A Pearson correlation study revealed a strong link between uric AL and abdominal obesity. This is because there is a positive correlation ($r = 0.35$, $p < 0.001$) between SU AL and waist circumference. There was a link with dyslipidemia because there was a positive association between uric AL in the blood and triglyceride levels ($r = 0.25$, $p = 0.012$).

The amounts of uric acid in the blood did not affect either the systolic or diastolic blood pressure ($p > 0.05$). It was also found that insulin resistance and fasting blood glucose levels were not significantly linked to SU AL ($p > 0.05$).

Table 3: Association between SU AL and MS Components

MS Component	Pearson Correlation Coefficient (r)	p-value
Abdominal Obesity	0.35	<0.001
Dyslipidemia	0.25	0.012
Hypertension	0.12	0.167
Insulin Resistance	0.08	0.345

SU AL in People with MS and People Who Did Not Have It. The average amount of uric acid in the blood of the 60 people who had MS was 6.8 mg/dL, which is a lot more than the 5.5 mg/dL number found in the 40 people who did not have MS ($p < 0.001$).

Table 4: Comparison of SU AL between Participants with and without MS

Group	Mean SU AL (mg/dL)	p-value
With MS	6.8	<0.001
Without MS	5.5	

Logistic Regression Analysis for Predictors of MS: Even after taking into account age, gender, and body mass index (BMI), there was still a link between MS and blood uric AL (OR = 2.45, 95% CI: 1.56-3.84, $p < 0.001$).

The study's subjects had a strong link between having high levels of uric acid in their blood and MS, specifically having abdominal obesity and dyslipidemia. More study is needed to learn more about MS and what causes it, as well as to find treatments that could help the body use uric acid better.

Discussion

The results help us understand better the link between MS risk factors and SU AL in the people who took part in this study.

To begin, the large impact of MS on the community is shown by the high rates of metabolic problems like dyslipidemia, insulin resistance, abdominal obesity, and high blood pressure. According to our study, SU AL were linked to some of the most important signs of MS, such as dyslipidemia and abdominal obesity. Even when other factors were taken into account, people with MS still had much higher levels of uric acid in their blood than people who did not have the disease. These results show that higher amounts of uric acid in the blood may play a part in the development and progression of MS. This means that uric acid could be used as a biomarker or therapeutic target for metabolic diseases.

Comparison with Previous Research

Table 5: Comparison Table: Present Study vs. Existing Studies

Study	Study Type	Sample Size	Findings	Limitations
Present Study	Cross-sectional	100	Positive association between SU AL and MS components, particularly abdominal obesity and dyslipidemia. Participants with MS exhibited significantly higher SU AL compared to those without MS.	Cross-sectional design precludes establishment of causality. Limited to single-center recruitment. Lack of comprehensive assessment of lifestyle factors and genetic predisposition.
[13]	Cohort Study	2000	Positive association between SU AL and prevalence of MS. Elevated uric AL correlated with increased risk of MS components, including abdominal obesity, dyslipidemia, and insulin resistance.	Limited generalizability due to single-center recruitment. Potential confounding factors not fully accounted for.
[14]	Meta-analysis	N/A	Significant association between elevated uric AL and presence of MS across multiple studies. Uric acid may contribute to development or progression of metabolic abnormalities.	Heterogeneity across included studies. Potential publication bias. Limited to observational data, precluding establishment of causality.
[15]	Longitudinal Cohort	5000	No significant association between SU AL and incidence of MS over 10-year follow-up.	Lack of detailed assessment of MS components. Potential confounding by unmeasured factors.

The next table shows how this study stacks up against three others that also looked at the link between MS and uric AL in the blood. Our cross-sectional study of 100 people shows a positive link between higher uric AL and MS symptoms, especially dyslipidemia and belly obesity. On the other hand, [13] a cohort study with 2000 participants and o found a significant link.

However, this study could not be applied to other situations because the subjects came from a single centre and there were possible confounding factors. We got the same results as [14] meta-analysis, which had problems with heterogeneity and possibly publication bias.

The longitudinal cohort study by [15] on the other hand, failed to find a meaningful correlation after ten years of follow-up. This shows how complicated the relationship is and how important it is to do more research to figure out the causal pathways and fix methodological flaws.

Limitations and Future Research Directions: There are some things that could go wrong with this probe that should be thought about. First, because this study was cross-sectional, we can't say for sure that uric AL and MS components are linked in terms of time. Longitudinal approaches are needed for future research. The study can't be used in other places because the people who took part were only from one centre. To make future studies more externally true, it would be smart to use a variety of cohorts from different parts of the world. The relationship between uric acid and MS might be too simple because the study didn't look at things like what people eat, how much they move, or their genetic makeup. Because the causes of metabolic diseases are complicated, more study is needed to fully understand how genetics and lifestyle affect these diseases. Interventional studies that test how well uric acid-lowering treatments work at preventing or improving MS could also help clinical practice and public health.

Conclusion

Our study found a strong link between high amounts of uric acid in the blood of patients from MGM Medical College and LSK Hospital, Kishanganj, and MS features, especially abdominal obesity and dyslipidemia. These results show how important uric acid is as a possible biomarker and treatment target for metabolic diseases. To lessen the effects of MS-related issues, though, more research is needed to figure out the exact processes that cause them, fix problems with the way the studies were done, and look into treatments that focus on uric acid metabolism.

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