

## ASSOCIATION BETWEEN OBESITY AND SERUM URIC ACID LEVELS AMONG COMMUNITY RESIDENTS IN THE CATCHMENT AREA OF THE KOTA TIMUR COMMUNITY HEALTH CENTER, GORONTALO CITY

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### ABSTRACT

Obesity is a major public health problem associated with metabolic disorders, including hyperuricemia. Excess adiposity may increase serum uric acid levels through insulin resistance and impaired renal urate excretion. However, evidence from Indonesian primary healthcare settings remains limited. This study aimed to determine the association between obesity and serum uric acid levels among community residents in the catchment area of the Kota Timur Community Health Center, Gorontalo City. A quantitative analytical observational study with a cross-sectional design was conducted among 15 obese respondents selected using purposive sampling. Body Mass Index (BMI) was calculated from anthropometric measurements, while serum uric acid levels were measured using capillary blood samples with a Family Dr. Uric Acid Meter. Data were analyzed descriptively, and the association between BMI and serum uric acid levels was examined using the Spearman rank correlation test. Most respondents were female (53.3%) and aged 40–45 years (33.3%). Abnormal serum uric acid levels were found in 53.3% of respondents. The Spearman rank correlation test showed no significant association between obesity and serum uric acid levels ( $p = 0.592$ ). Obesity, as measured by BMI, was not significantly associated with serum uric acid levels among obese community residents. Further studies with larger sample sizes and additional metabolic and lifestyle variables are needed to clarify this relationship.

**Keywords:** obesity; body mass index; serum uric acid; hyperuricemia; primary healthcare.

### INTRODUCTION

Obesity has become one of the most significant public health challenges worldwide because of its increasing prevalence and its contribution to numerous non-communicable diseases. According to the World Health Organization (WHO), the prevalence of obesity has nearly tripled since 1975, affecting more than 650 million adults globally by 2016. Recent epidemiological studies further indicate that approximately

two billion individuals are overweight, with obesity continuing to rise across both developed and developing countries [1][2][3]. This trend has become a major concern because obesity substantially increases the risk of metabolic disorders, cardiovascular disease, type 2 diabetes mellitus, musculoskeletal disorders, and premature mortality.

Indonesia has experienced a similar upward trend in obesity prevalence over the past two decades. National Health

Research (Riskesdas) data demonstrated a substantial increase in obesity prevalence among adults, rising from 18.8% in 2007 to 31.0% in 2018. Urban populations are particularly affected, largely due to lifestyle changes characterized by excessive caloric intake, sedentary behavior, and reduced physical activity [4][5]. Women also exhibit a higher prevalence of obesity than men, reflecting biological, hormonal, and behavioral factors that contribute to excessive fat accumulation [5]. In Gorontalo Province, obesity represents an important public health issue, with previous provincial health reports showing that Gorontalo City had the highest prevalence of obesity among districts and municipalities. Furthermore, data from the Gorontalo City Health Office in 2023 indicated that the Kota Timur Community Health Center recorded the highest number of obesity cases, totaling 554 individuals, highlighting the importance of investigating obesity-related health consequences within this community.

Obesity is closely associated with elevated serum uric acid levels, commonly referred to as hyperuricemia, which has emerged as an important metabolic disorder. Hyperuricemia results from excessive production or impaired renal excretion of uric acid and serves as a major risk factor for gout, chronic kidney disease, hypertension, and cardiovascular disorders [6]. Several epidemiological studies have consistently demonstrated that obesity is positively associated with serum uric acid concentration, suggesting that individuals with excessive adiposity have a significantly greater likelihood of developing hyperuricemia than those with

normal body weight [7][8]. This association is explained by increased adipose tissue activity, oxidative stress, chronic low-grade inflammation, and insulin resistance, all of which contribute to increased uric acid production and reduced renal urate excretion [9][10].

The relationship between obesity and hyperuricemia has important clinical implications because elevated uric acid levels frequently precede the development of gout and may contribute to the progression of metabolic syndrome. Individuals with obesity often exhibit higher leptin concentrations and insulin resistance, conditions that impair renal uric acid clearance and promote urate retention. Consequently, obesity not only increases serum uric acid levels but also accelerates the development of obesity-related metabolic complications. Previous studies have reported that obese individuals are significantly more likely to experience hyperuricemia than individuals with normal body mass index, emphasizing obesity as a modifiable risk factor for elevated uric acid levels [7][9].

Although the association between obesity and serum uric acid has been widely investigated in several countries, evidence from Indonesian primary healthcare settings remains limited, particularly at the community level. Most previous studies have focused on hospital-based populations or specific occupational groups, while studies involving community residents attending primary healthcare facilities are still scarce. Moreover, few investigations have specifically examined this relationship in Gorontalo City, despite the relatively high prevalence of obesity reported in the Kota

Timur Community Health Center service area. Understanding this association is essential for developing preventive strategies and early interventions aimed at reducing the burden of obesity-related metabolic diseases within the community.

Therefore, this study aimed to determine the association between obesity and serum uric acid levels among community residents in the Kota Timur Community Health Center, Gorontalo City. The findings are expected to provide evidence supporting obesity prevention programs, early screening for hyperuricemia, and community-based interventions to reduce the risk of metabolic diseases in primary healthcare settings.

## **RESEARCH METHODS**

### **Study Design**

This study employed a quantitative analytical observational design with a cross-sectional approach to examine the association between obesity and serum uric acid levels among community residents in the working area of the Kota Timur Community Health Center, Gorontalo City. A cross-sectional design allows the measurement of exposure and outcome variables simultaneously at a single point in time [11].

### **Study Setting and Participants**

The study was conducted in the working area of the Kota Timur Community Health Center, Gorontalo City. Data collection was carried out from August 8 to September 8, 2023. The target population consisted of obese community residents living within the health center's service area.

A total of 15 respondents who met the inclusion criteria participated in this study. Participants were selected using purposive sampling, whereby individuals with obesity who were willing to participate and fulfilled the study criteria were recruited.

### **Data Collection**

Primary data were collected through anthropometric measurements and point-of-care laboratory examinations. Body weight and height were measured to calculate Body Mass Index (BMI), which was used to classify obesity according to the World Health Organization (WHO) criteria.

Serum uric acid levels were measured using capillary blood samples obtained from fingertip puncture with a Family Dr Uric Acid Meter. Prior to blood collection, the puncture site was disinfected with 70% alcohol. The first drop of blood was discarded, while the second drop was applied to the test strip inserted into the uric acid meter. The measurement result was recorded immediately after analysis.

The equipment used in this study included a Family Dr Uric Acid Meter, uric acid test strips, lancet pen, sterile lancets, 70% alcohol swabs, dry cotton, and capillary blood samples.

### **Statistical Analysis**

Descriptive statistics were used to summarize respondents' demographic characteristics, anthropometric measurements, and serum uric acid levels using frequencies and percentages.

Prior to hypothesis testing, data distribution was assessed using the Shapiro–Wilk normality test, while the assumption of linearity between BMI and

serum uric acid levels was evaluated using the test for deviation from linearity.

Because one of the variables did not meet the assumption of normality, the relationship between obesity (BMI) and serum uric acid levels was analyzed using the Spearman rank correlation test. Statistical significance was established at  $p < 0.05$ . All statistical analyses were performed using IBM SPSS Statistics.

## RESEARCH RESULTS

This study was conducted among obese community residents within the service area of the Kota Timur Community Health Center, Gorontalo City. Data collection was carried out from August 8 to September 8, 2023, using capillary blood samples obtained from 15 respondents who met the inclusion criteria. Serum uric acid levels were measured using the Family Dr. Uric Acid Meter, while obesity status was determined based on Body Mass Index (BMI) calculations. The findings are presented as follows.

### Respondent Characteristics

#### Distribution of Respondents by Sex

The distribution of respondents according to sex is presented in Table 1.

**Table 1. Distribution of Respondents by Sex**

Sex	Frequency (n)	Percentage (%)
Male	7	46.7
Female	8	53.3
Total	15	100.0

*Source: Processed primary data (2023).*

As presented in Table 1, female respondents slightly outnumbered male respondents. Of the 15 participants included in this study, 8 respondents (53.3%) were female, whereas 7 respondents (46.7%) were male. These findings indicate that the study population

was relatively balanced by sex, although women represented the majority.

#### Distribution of Respondents by Age

The age distribution of respondents is presented in Table 2.

**Table 2. Distribution of Respondents by Age**

Age (years)	Group	Frequency (n)	Percentage (%)
40–45		5	33.3
46–50		4	26.7
51–55		4	26.7
56–60		2	13.3
Total		15	100.0

*Source: Processed primary data (2023).*

Table 2 shows that respondents aged 40–45 years constituted the largest age group, accounting for 5 respondents (33.3%). This was followed by respondents aged 46–50 years and 51–55 years, each representing 4 respondents (26.7%). The smallest proportion was observed among respondents aged 56–60 years, with 2 respondents (13.3%). Overall, the majority of respondents were between 40 and 55 years of age.

#### Distribution of Respondents by Body Weight

The distribution of respondents based on body weight is shown in Table 3.

**Table 3. Distribution of Respondents by Body Weight**

Body Weight (kg)	Frequency (n)	Percentage (%)
58–68	8	53.3
69–80	5	33.3
81–90	1	6.7
91–100	1	6.7
Total	15	100.0

*Source: Processed primary data (2023).*

As presented in Table 3, the majority of respondents had a body weight ranging from 58 to 68 kg, accounting for 8 respondents (53.3%). Respondents weighing 69–80 kg comprised 5

individuals (33.3%), whereas only one respondent (6.7%) each was found in the 81–90 kg and 91–100 kg categories.

#### Distribution of Respondents by Height

The distribution of respondents according to height is presented in Table 4.

**Table 4. Distribution of Respondents by Height**

Height (m)	Frequency (n)	Percentage (%)
1.41–1.53	5	33.3
1.54–1.65	8	53.3
1.66–1.76	2	13.3
Total	15	100.0

Source: Processed primary data (2023).

Table 4 indicates that most respondents had a height between 1.54 and 1.65 m, representing 8 respondents (53.3%). A total of 5 respondents (33.3%) had a height ranging from 1.41 to 1.53 m, while 2 respondents (13.3%) were between 1.66 and 1.76 m in height.

#### Serum Uric Acid Examination Results Among Obese Respondents

The results of serum uric acid measurements among respondents with obesity are presented in Table 5.

**Table 5. Serum Uric Acid Examination Results Among Respondents with Obesity**

Serum Uric Acid Status	Frequency (n)	Percentage (%)
Normal	7	46.7
Abnormal	8	53.3
Total	15	100.0

Source: Processed primary data (2023).

As shown in Table 5, 8 respondents (53.3%) had abnormal serum uric acid levels, while 7 respondents (46.7%) exhibited normal serum uric acid levels. These findings suggest that abnormal serum uric acid levels were slightly more prevalent than normal values among obese individuals included in this study.

#### Statistical Analysis

#### Normality Test

Before conducting correlation analysis, a normality test was performed using the Shapiro–Wilk test. The results are presented in Table 6.

**Table 6. Results of the Shapiro–Wilk Normality Test**

Variable	n	p-value	Interpretation
Serum uric acid level	15	0.320	Normally distributed
Body Mass Index (BMI)	15	0.005	Not normally distributed

Source: Processed primary data (2023).

Table 6 shows that the serum uric acid data had a p-value of 0.320, which exceeded the significance level of 0.05, indicating a normal distribution. Conversely, BMI data produced a p-value of 0.005, which was below 0.05, demonstrating a non-normal distribution. Based on these findings, non-parametric statistical analysis was considered appropriate for evaluating the relationship between BMI and serum uric acid levels.

#### Linearity Test

A linearity test was subsequently conducted to assess whether the relationship between BMI and serum uric acid levels met the assumption of linearity. The results are presented in Table 7.

**Table 7. Results of the Linearity Test**

Variable	n	p-value	Interpretation
BMI and serum uric acid level	15	0.397	Linear relationship

Source: Processed primary data (2023).

As presented in Table 7, the deviation from linearity yielded a p-value of 0.397, which was greater than the significance level of 0.05. Therefore, the relationship between BMI and serum uric acid levels was considered linear.

## Correlation Between Obesity and Serum Uric Acid Levels

The association between obesity and serum uric acid levels was analyzed using the Spearman Rank correlation test. The findings are summarized in Table 8.

**Table 8. Spearman Rank Correlation Analysis Between Obesity and Serum Uric Acid Levels**

Variable	p-value	Interpretation
BMI and serum uric acid level	0.592	No significant association

*Source: Processed primary data (2023).*

As shown in Table 8, the Spearman Rank correlation test produced a p-value of 0.592, which exceeded the significance threshold of 0.05. Therefore, the null hypothesis was accepted, indicating that there was no statistically significant association between obesity and serum uric acid levels among community residents in the Kota Timur Community Health Center, Gorontalo City. Although more respondents exhibited abnormal serum uric acid levels than normal values, obesity, as measured by BMI, was not significantly associated with serum uric acid concentration in this study population.

## DISCUSSION

### Respondent Characteristics

The findings showed that female respondents slightly predominated, accounting for 53.3% of the study population, while males represented 46.7%. Although the distribution was relatively balanced, this result suggests that obesity among adults attending the Kota Timur Community Health Center was slightly more common among women. Biological factors, including hormonal changes, differences in fat distribution, and

reduced estrogen levels during middle age, may contribute to the higher prevalence of obesity among women. In addition, lower physical activity and lifestyle factors may further increase obesity risk in females.

These findings are consistent with previous epidemiological studies reporting that obesity is generally more prevalent among women than men. Matta and Czernichow [1], reported that women are disproportionately affected by obesity worldwide because hormonal and socioeconomic factors influence body fat accumulation. Likewise, Ferdina et al. [4], demonstrated that obesity prevalence in Indonesia is higher among women, particularly in urban communities, indicating that female adults remain an important target for obesity prevention programs.

Regarding age distribution, most respondents were between 40 and 55 years old, with the largest proportion belonging to the 40–45-year age group (33.3%). Increasing age is recognized as an important determinant of obesity because metabolic rate gradually declines, muscle mass decreases, and fat accumulation becomes more prominent during middle adulthood.

Previous studies have similarly demonstrated that obesity prevalence increases with age. Mehrzad [2], explained that obesity commonly develops during adulthood due to long-term positive energy balance. Furthermore, Zeng et al. [12], reported that middle-aged adults are more likely to experience obesity-related metabolic disorders, including elevated serum uric acid concentrations, than younger individuals.

### **Serum Uric Acid Levels Among Obese Respondents**

This study found that 53.3% of obese respondents had abnormal serum uric acid levels, whereas 46.7% remained within the normal range. These findings indicate that elevated uric acid levels were slightly more frequent among obese individuals; however, not every obese participant experienced hyperuricemia. This suggests that obesity alone may not fully explain increased serum uric acid concentrations.

The literature indicates that obesity contributes to hyperuricemia through several metabolic pathways. Excess adipose tissue promotes insulin resistance, increases purine metabolism, and reduces renal uric acid excretion, leading to elevated serum uric acid concentrations. Deng et al. [13], further demonstrated that liver dysfunction associated with obesity partially mediates the relationship between body mass index (BMI) and serum uric acid. Similarly, Mahdavi-Roshan et al. [14], reported significant positive associations between serum uric acid, triglycerides, insulin resistance, and other metabolic abnormalities among obese individuals.

Community-based studies also support these findings. Cheang et al. [15], observed that the prevalence of hyperuricemia increased progressively with obesity severity, while Liu et al. [16], demonstrated that obesity indicators, particularly BMI combined with central obesity measurements, were significantly associated with elevated serum uric acid levels.

### **Association Between Obesity and Serum Uric Acid Levels**

The Spearman Rank correlation analysis demonstrated no statistically significant association between obesity and serum uric acid levels ( $p = 0.592$ ). Although more than half of the respondents exhibited abnormal serum uric acid levels, BMI was not significantly associated with serum uric acid concentration in this study population.

This finding differs from numerous previous studies reporting a positive association between obesity and serum uric acid. Zeng et al. [12], found that higher BMI significantly increased the likelihood of hyperuricemia among Chinese adults during a nine-year longitudinal study. Similarly, Cheang et al. [15], reported that hyperuricemia prevalence increased substantially as obesity severity increased. Ali et al. [17], also demonstrated that serum uric acid levels were independently associated with obesity among Bangladeshi adults.

The discrepancy between the present findings and previous studies may be explained by several factors. First, the sample size was relatively small ( $n = 15$ ), reducing the statistical power to detect significant associations. Second, all participants had already been classified as obese, resulting in limited variability in BMI values and making correlation analysis less sensitive. Third, serum uric acid concentrations are influenced by multiple factors beyond obesity, including dietary purine intake, alcohol consumption, hydration status, renal function, physical activity, genetic predisposition, medication use, and metabolic disorders. These potential confounding factors were not controlled in

the present study and may have influenced the observed results.

Previous research supports this explanation. Deng et al. [13], suggested that the association between BMI and serum uric acid is mediated by metabolic factors, particularly liver enzyme abnormalities, rather than BMI alone. Mahdavi-Roshan et al. [14], also demonstrated that triglycerides, insulin resistance, and lipid profiles substantially contribute to elevated serum uric acid concentrations. Furthermore, Liu et al. [16], reported that the relationship between BMI and serum uric acid varies according to age and sex, while Chen et al. [18], found that the association becomes stronger under certain metabolic conditions, including altered phosphorus levels.

Therefore, although obesity is widely recognized as an important risk factor for hyperuricemia, the present findings indicate that obesity alone may not sufficiently explain variations in serum uric acid levels among obese community residents. Comprehensive assessment of metabolic, dietary, and lifestyle factors is necessary to better understand serum uric acid regulation within this population.

Overall, the findings suggest that routine screening for serum uric acid among obese individuals remains important because elevated uric acid may occur even in the absence of a statistically significant BMI association. Public health interventions should therefore emphasize comprehensive lifestyle modification, including weight management, balanced nutrition, increased physical activity, and regular metabolic monitoring rather than focusing solely on BMI reduction.

## CONCLUSION

This study found that abnormal serum uric acid levels were slightly more common than normal levels among obese community residents in the catchment area of the Kota Timur Community Health Center, Gorontalo City. However, statistical analysis using the Spearman rank correlation test demonstrated no significant association between obesity, as measured by Body Mass Index (BMI), and serum uric acid levels ( $p = 0.592$ ).

These findings suggest that obesity alone may not adequately explain variations in serum uric acid concentrations among obese individuals. Other factors, including dietary habits, renal function, physical activity, metabolic status, genetic predisposition, and lifestyle characteristics, may contribute to serum uric acid regulation and should be considered in future investigations.

Despite the absence of a statistically significant association, routine screening for serum uric acid among individuals with obesity remains important for the early detection of hyperuricemia and the prevention of related metabolic complications. Further studies with larger sample sizes and more comprehensive assessment of potential confounding variables are recommended to provide stronger evidence regarding the relationship between obesity and serum uric acid levels.

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