Association of Body Mass Index with The Risk Of Gout Arthritis in Male and Female with Underweight, Normal Weight, Overweight, Obese

Slamet Raharjo¹, Olivia Andiana²*

¹,²Department of Sport Science, Faculty of Sport Science, State University of Malang, Malang, Indonesia

ABSTRAK

Penelitian ini bertujuan untuk menganalisis hubungan antara indeks massa tubuh (IMT) underweight, normal weight, overweight, obese dengan risiko kejadian gout arthritis pada remaja laki-laki dan perempuan Kota Malang. Penelitian ini menggunakan metode korelasional dengan pendekatan cross-sectional study. Sebanyak 101 remaja yang terdiri dari 59 laki-laki dan 42 perempuan, usia 16 – 23 tahun, IMT underweight, normal weight, overweight, dan obese ikut berpartisipasi dalam penelitian ini. Kadar asam urat diukur menggunakan Easy Touch (Easy Touch, Hsinchu, Taiwan) dengan satuan konsentrasi mg/dL, sedangkan IMT dihitung dengan cara berat badan (BB) (kg) dibagi tinggi badan (TB) (m²). Pearson's correlation coefficient digunakan untuk menganalisis hubungan antara IMT dengan kadar asam urat. Hasil penelitian menunjukkan rata-rata IMT underweight (17.64 ± 0.26 kg/m²), normal weight (21.94 ± 1.33 kg/m²), overweight (25.81 ± 0.51 kg/m²), obese (29.92 ± 2.80 kg/m²), dan kadar asam urat (6.09 ± 1.61 mg/dL) dengan (r = 0.838; p ≤ 0.001). Berdasarkan hasil penelitian disimpulkan terdapat hubungan positif antara IMT dengan kadar asam urat. IMT menunjukkan korelasi positif yang kuat dengan kadar asam urat.

Keywords:
Body mass index
Gout arthritis
Uric acid
Hyperuricemia
Adolescents

1. INTRODUCTION
Hyperuricemia is a condition of uric acid levels in the blood that are more than 7.0 mg/dL (Nasrul, 2012) with an estimated incidence of 8.9% to 24.4% of the world population (Skoczynska et al., 2020; Benn et al., 2018; Perez-Ruiz et al., 2015). Gout arthritis is an inflammatory joint condition caused by monosodium urate crystals that deposit in distal joints and peripheral tissues (Butler et al., 2021). Susceptibility in monosodium urate crystals formation due to excessive levels of uric acid in the blood, one of the purine nucleotide breakdown end products (Martillo et al., 2014; Choi et al., 2005). Gout forms due to an increase in uric acid levels in the blood (hyperuricemia) (Roddy & Doherty, 2010). The accumulation of monosodium urate crystals in joints causes local inflammation (Almatsier, 2006).

In the current era, the rapidly increased prevalence of patients with hyperuricemia. Emerging evidence suggests that the prevalence of hyperuricemia is not only in developed countries, but is also increasing in low-income and middle-income (Kanwar & Kabra, 2016; Zhu, 2011). The results by Wurangian (2014) reported that from 54 students with obesity, the prevalence of obese students who experienced hyperuricemia in Minahasa Regency was 8 people (14.82%) consisting of 3 male students (5.56%) and 5 female students (9.26%). Despite most of the obese students having normal blood uric acid levels, some of them showed hyperuricemia. Hyperuricemia has the potential for gout arthritis following the results of the study by Budiono (2016) which reported that there was a relationship between hyperuricemia and the incidence of gout arthritis in both men and women.

Non-modifiable risk factors include age and gender, while modifiable risk factors include lifestyle and other diseases such as diabetes mellitus (DM), hypertension, making these individuals have a greater risk of developing gout arthritis (Singh et al., 2017). In addition, an increase in uric acid levels is triggered by an increase in body mass index (BMI), waist circumference, and dyslipidemia (Tanaka et al., 2015). Results by Anggraini et al. (2018) show that respondents who experience gouty arthritis have a history of hypertension and obesity on average. According to Rosdiana et al. (2018), uric acid levels decrease along with weight loss. On the contrary, the increase in uric acid levels is triggered by an increase in BMI, waist circumference, and dyslipidemia (Wang et al., 2014). However, the relationship between BMI categories underweight, normal weight, overweight, and obese with the risk of developing gouty arthritis in adolescent boys and girls are still not clearly understood.

2. RESEARCH METHODS

We conduct a correlational with a cross-sectional study approach. A total of 101 adolescents consisting of 59 males and 42 females, aged 16 – 23 years participated in this study, with body mass index (BMI) categories underweight, normal weight, overweight, and obese. All respondents obtain information about the research both orally and written. After obtaining information, all respondents filled out and sign an informed consent as a precondition before participating in the study.

Data collection technique. Measuring height using Stadiometer (Portable Seca® Stadiometer, North America). Weight is measured using a digital scale (OMRON Model HN-289, Omron Co., Osaka, Japan). BMI was calculated by dividing body weight (BW) (kg) with body height (BH) (m²). Measuring the risk of gout arthritis by using a uric acid level indicator using Easy Touch (Easy Touch, Hsinchu, Taiwan) with a concentration unit of mg/dL. Blood sampling for measurement of uric acid levels was carried out on the capillary blood vessels on the fingerstick. Measurement of uric acid levels and BMI were performed at the same time.

Data analysis used a statistical software packet for social science (SPSS) version 17.0. Shapiro-Wilk test for data normality test. The correlation analysis between body mass index and uric acid levels was performed using Pearson’s correlation coefficient test. All data are displayed with Mean ± Standard Deviation (SD). All statistical analyzes used a significant level ($p \leq 0.01$).
3. RESULTS AND DISCUSSION

Based on the analysis results show that the mean age (18.61 ± 2.09 years of age), body weight (BW) (63.94 ± 9.17 kg), body height (BH) (1.62 ± 0.07 meters), body mass index (BMI) underweight (17.64 ± 0.26 kg/m²), normal weight (21.94 ± 1.33 kg/m²), overweight (25.81 ± 0.51 kg/m²), obese (29.92 ± 2.80 kg/m²), and uric acid levels (6.09 ± 1.61 mg/dL). The results of the analysis of the percentages of age, gender, BMI, and uric acid levels of respondents are presented in Tables 1 – 4, while the results of the analysis of the relationship between BMI and uric acid levels can be seen in Figure 1. Figure 1 shows that there is a positive correlation between BMI and uric acid levels ($r = 0.838; p ≤ 0.001$). BMI showed a strong positive correlation with uric acid levels.

| Table 1. Results of the analysis of the percentage of respondents' age |
|---|---|---|
| No | Age | Amount | Percentage (%) |
| 1 | 16 | 19 | 18.81 |
| 2 | 17 | 17 | 16.83 |
| 3 | 18 | 25 | 24.76 |
| 4 | 19 | 3 | 2.97 |
| 5 | 20 | 11 | 10.89 |
| 6 | 21 | 16 | 15.84 |
| 7 | 22 | 7 | 6.93 |
| 8 | 23 | 3 | 2.97 |
| Total | | 101 | 100 |

| Table 2. Results of the analysis of the percentage of respondents' gender |
|---|---|---|
| No | Gender | Amount | Percentage (%) |
| 1 | Male | 59 | 58.41 |
| 2 | Female | 42 | 41.59 |
| Total | | 101 | 100 |

| Table 3. Results of the analysis of the percentage of respondents' body mass index |
|---|---|---|---|---|
| No | Category | Body Mass Index (kg/m²) | Amount | Percentage (%) |
| 1 | Underweight | | 11 | 10.89 |
| 2 | Normal Weight | | 41 | 40.59 |
| 3 | Overweight | | 19 | 18.81 |
| 4 | Obese | | 30 | 29.71 |
| Total | | | 101 | 100 |

| Table 4. Results of the percentage analysis of respondents' uric acid levels |
|---|---|---|---|
| No | Category | Uric Acid Level (mg/dL) | Amount | Percentage (%) |
| 1 | Normal | | 58 | 57.43 |
| 2 | High | | 43 | 42.57 |
| Total | | | 101 | 100 |
This study aims to analyze the correlation between body mass index categories including underweight, normal, overweight, and obesity with the risk of gout arthritis in male and female adolescents. The main finding in this study is that there is a positive correlation between body mass index and uric acid levels. Body mass index showed a strong positive correlation with uric acid levels. Reinforced by Juraschek et al. (2013), shows that in both survey periods, for the average American adult standing 1.76 meters (5 feet 9 inches), a BMI of 1 unit higher, corresponding to a greater 3.1 kg (~6.8 pounds) weight, was associated with a 5% greater prevalence of uric acid, even after adjusting for serum uric acid. Dalbeth et al. (2020), also revealed that in a fasting state, people with high BMI experienced an increase in serum uric acid levels.

The instant lifestyle tends to make people lazy to do physical activity and pay less attention to the nutritional content of the food they eat. High protein intake can trigger an increase in uric acid levels in the blood (Soeroso, 2011). Lack of physical activity also triggers an increase in uric acid levels (Jaliana & Suhadi, 2018). Results by Syarifuddin et al. (2019) showed that respondents who had high uric acid levels were respondents who had low levels of physical activity, as many as 84.2% of 38 respondents. In addition to lack of physical activity, there are also types of foods with high purine content, such as offal, beef, sardines, duck meat, sea fish, shellfish, chicken, shrimp, nuts, tempeh, mushrooms, tapai, tofu, also in some vegetables such as melinjo, beans, cassava leaves, kale, cauliflower, and spinach (Dewi & Asnita, 2016). The factors that can affect uric acid levels in adolescents are 1). Heredity is one of the many risk factors for gout. People with families suffering from gout have a greater risk of developing gout (Sari & Syamsiyah, 2017). When there is a history of gouty arthritis in the family tree, it may trigger the onset of gouty arthritis (Sustrani et al., 2007). If there are family members who suffer from gouty arthritis, then their offspring are likely to suffer from gouty arthritis (Suiraoka, 2012). 2). Diet or consumption of high-purine foods from plant sources can increase the risk of gout arthritis (Az-zahra et al., 2014). One of the factors that cause an increase in uric acid levels is the consumption of foods containing high purines or about > 1000 mg/day (Kusumayanti et al., 2015). Purine is one of the organic base compounds that compose nucleic acids and is included in the amino acid group which is an element of protein formation (Kanwar & Kabra, 2016: 4). 3). History of comorbidities is a history of diseases that can accompany a certain disease (Bilotta, 2012). The incidence of gout arthritis can be exacerbated by hypertension and diabetes mellitus (Lingga, 2012). According to Anggraini et al. (2018) said that the incidence of
Gouty arthritis was experienced by respondents who were obese. Obesity or being overweight is a form of malnutrition and metabolic disorders. Obesity is a feature of the population with gouty arthritis (Bilotta, 2012). Several epidemiological studies have shown that elevated uric acid levels are associated with several diseases including diabetes mellitus, dyslipidemia, obesity, hypertension, cardiovascular and metabolic syndromes (Huda et al., 2014; Desai et al., 2018).

Emerging evidence suggests that hyperuricemia is not only occurring in developed countries (Kanwar & Kabra, 2016; Zhu & Choi, 2010) but is also increasing in low- and middle-income countries with high frequency. In particular, a higher body mass index (BMI) has a doubled risk of developing gout compared to individuals with a normal BMI (McAdams et al., 2012). High BMI can increase blood pressure and serum triglyceride concentrations, leading to hypertriglyceridemia, which leads to an increase in uric acid in the body (de Oliviera & Burini 2012), so obesity is not only said to be a risk factor for the incidence of gout arthritis but has the potential to develop gouty arthritis (Lee et al., 2015). According to epidemiological studies on metabolic syndrome, increased uric acid levels are triggered by increased BMI, waist circumference, and dyslipidemia (Tanaka et al., 2015; Wang et al., 2014). Therefore, the incidence of increased levels of uric acid that triggers the occurrence of gouty arthritis is caused by an unfavorable lifestyle disorder and is associated with obesity (Tanaka et al., 2015). Obesity has greater potential as a trigger for gout arthritis compared to individuals with normal weight (Bilotta, 2012). Masheb et al. (2015), suggests that someone who is overweight sometimes has a pattern of eating more than what is needed. In addition, excess body weight causes stress on the joints so uric acid is difficult to excrete in the body and is at risk of triggering insulin resistance (McAdams et al., 2011).

Risk factors that cause people to develop gout are age, excessive intake of purine compounds, excessive alcohol consumption, obesity, excessive physical activity, hypertension and heart disease, certain drugs (especially diuretics), and impaired kidney function (Jaliana & Suhadi), 2018). Research conducted by Nishida et al. (2011) stated that moderate physical activity had a significant relationship with low uric acid levels in obese respondents. Nishida et al. (2011) stated that moderate physical activity in subjects with obesity can increase insulin sensitivity and increase urine volume so that it has an impact on decreasing serum uric acid levels. Therefore, each individual is recommended to do 150 minutes of physical activity a week or 30 minutes a day for 5 days at moderate intensity (Parfitt et al., 2011). Research conducted by Chen et al. (2015) revealed that individuals who exercise at least 15-30 minutes a day such as walking, or brisk walking can reduce the increase in uric acid levels in the blood. Regular moderate-intensity physical activity can reduce uric acid levels in the blood (Garcia & Rodriguez, 2018).

4. CONCLUSION

Based on the results of the study, it was concluded that there was a positive correlation between body mass index and uric acid levels. BMI showed a strong positive correlation with uric acid levels. The higher the body mass index, the higher the risk of developing gout arthritis in both males and females.

5. REFERENCES


Association of Body Mass Index with The Risk Of Gout Arthritis in Male and Female with Underweight, Normal Weight, Overweight, Obese (Slamet Raharjo)


