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**Effect of Combination of Porang Tuber Glucomannan (*Amorphophallus muelleri* blume) with Moringa Leaf Extract on Red Blood Cell Count in Obese White Rats (*Rattus norvegicus*) Strain Wistar**

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**ABSTRACT**

**KEYWORDS:**

*Glucomannan*  
*Moringa Leaf*  
*Obesity*  
*Red Blood Cells*  
*White Mice*

As times have changed, so have lifestyles that have adverse health effects, including obesity. Obesity is known to potentially affect the number of red blood cells in the body. Obesity can cause iron deficiency in children and adolescents, which can develop into anemia. The aim of this study was to determine the effect of obesity on the number of red blood cells and to investigate the effect of a combination of glucomannan and moringa leaf extract on the number of red blood cells in obese white Wistar strain rats. The research method used was a true experimental design in the form of a post-test only control group with three treatment groups: the control group, treatment group P1 and treatment group P2. The results of the calculations showed differences in the number of red blood cells in each treatment. In the control treatment, there were 7.16/L. In the P1 treatment, the RBCs were 3.24 million/L. In contrast, the P2 treatment yielded a result of 5.02 million red blood cells per liter. It can be concluded that the combination of Porang Tuber Glucomannan with Moringa Leaf Extract can reduce body weight and normalize the number of red blood cells

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**1. INTRODUCTION**

Globalization has had a profound impact on the lifestyle of the majority of Indonesians in the contemporary era. It is indisputable that the use of technology and the prevalence of fast food have a discernible impact on health. One of the adverse consequences of an unhealthy lifestyle is obesity. In 2018, the prevalence of obesity among individuals aged 18 years and above in Indonesia was 21.8% (Widyawati et al., 2022). Meanwhile, data from the WHO (2022) indicate that 2.5 billion adults aged 18 years and over are overweight. In a study conducted by Lucas (2022), the influence of lifestyle on the development of obesity in adolescents was investigated. The findings indicated that lifestyle plays a role in the development of obesity, particularly the use of electronic devices and exercise. Moreover, research conducted by Hamalding (2019) also indicates a correlation between physical activity, fast food consumption, television viewing, and the use of electronic devices and weight gain. Individuals who are obese are at a significantly elevated risk of developing degenerative diseases such as diabetes (Selman, 2022). Additionally, a high body mass index (BMI) is strongly correlated with an increased risk of developing cardiovascular disease, liver and kidney dysfunction, and hypertension (Domingo-Ortí, 2021). Furthermore, obesity has been linked to alterations in the number of white blood cells and red blood cells in the body. It has also been observed to result in iron deficiency in children and adolescents, which can potentially lead to iron deficiency anemia (Rogozińska, 2021).

Kohsari's (2021) research on the relationship between red blood cell index, anemia, and obesity-related diseases indicates that obese individuals tend to experience a decrease in the number of red blood cells. Syah's (2022) research, which examined the relationship between obesity and anemia in secondary school adolescents in Bekasi, revealed that 12.5% of obese adolescents suffered from anemia. In contrast, Jeong (2022) examined the relationship between body mass index (BMI) and various hematological parameters, including red blood cells. The findings of Jeong's study indicated that children with obesity and overweight exhibited a higher number of red blood cells than children with a normal weight. The objective of this study was to ascertain the impact of obesity on the number of red blood cells and to determine the effect of a combination of porang tuber glucomannan (*Amorphophallus muelleri* blume) with moringa leaf extract on the number of red blood cells in obese Wistar strain white rats.

## 2. MATERIALS AND METHODS

### 2.1. Preparation of samples

The research was initiated in September 2022 and concluded in May 2023. The research was conducted in multiple locations, including the biology education laboratory of Universitas Muhammadiyah Surakarta, CV Chemmix Pratama, the Laboratory of Animal Experiments of Universitas Sebelas Maret, and the laboratory of Universitas Setia Budi Surakarta. The research commenced with the preparation of porang flour using a combination of moringa leaves. Subsequently, the Wistar white rats were acclimated for a period of one week, after which the treatment group was fed a high-fat diet for a further two weeks. Moreover, glucomannan and moringa leaf extract preparations were manufactured and evaluated in comparison to each dose. The control group was provided with a standard diet, whereas the treatment group was given a high-fat diet with glucomannan and moringa leaf extract at 120 mg/kg and 80 mg/kg, respectively. The treatment group was administered a high-fat diet in conjunction with glucomannan and moringa leaf extract at a dosage of 50 mg/kgBB, as previously described by Nugraheni et al. (2014). This was modified by Nahar et al. (2016) to 50 mg/kgBB. The treatment was administered for a period of five weeks, after which blood samples were collected for the purpose of calculating the number of red blood cells. Blood samples were obtained via the orbital sinus, with a maximum volume of 2 cc, and were stored in a microtube devoid of anticoagulant. After a 30-minute period of standing at room temperature, the serum was separated by centrifugation at 1500 rpm for 15 minutes.

### 2.2 Data Analizes

The methodology employed is a true experimental design arranged in a completely randomized design (CRD) in the form of a posttest-only control design. This design employs three treatment groups: a control group with normal feed, a treatment group receiving a high-fat diet supplemented with glucomannan and moringa leaf extract at a dose of 120 mg/kg body weight (BW), and a treatment group receiving a high-fat diet supplemented with glucomannan and moringa leaf extract at a dose of 50 mg/kg BW. The treatment group was administered a high-fat diet with glucomannan and moringa leaf extract at a dosage of 80 mg/kg BW, as previously described by Nugraheni et al. (2014). The control group was provided with a high-fat diet supplemented with glucomannan and moringa leaf extract at a dosage of 50 mg/kgBB, as previously described by Nahar et al. (2016, modified). The red blood cell count was determined using a hemocytometer, with the following formula:

Red Blood Cell Count:  $\frac{n}{v} \times p$

In this formula, (n) represents the total number of cells counted, (v) is the volume of the sample multiplied by the number of boxes, and (p) is the sample dilution in the haemocytometer pipette. Subsequently, the results of the calculation were subjected to one-way analysis of variance

(ANOVA) on SPSS version 20, followed by Duncan's multiple range test (DMRT) to ascertain the level of difference between treatment groups.

### 3. RESULTS AND DISCUSSION

#### 3.1. Results

The results of the calculations indicate that there are statistically significant differences in the number of red blood cells in each treatment group. In the control treatment, the number of red blood cells per liter was determined to be 7.16 million. In the P1 treatment (glucomannan dose ratio with Moringa Leaf Extract 50 mg/kgBB: 50 mg/kgBB), the number of red blood cells was found to be as high as 3.24 million/L. In contrast, the P2 treatment (comparison of glucomannan dose with Moringa Leaf Extract) yielded different results. The analysis using one-way analysis of variance (ANOVA) demonstrated a significant difference in the number of red blood cells between the 120 mg/kgBB and 80 mg/kgBB treatments. The former exhibited a higher number of red blood cells (5.02 million/L) than the latter (3.24 million/L). This discrepancy is demonstrated in Table 1.

**Table 1. ANOVA Analysis Results**

|                | Sum of Squares | df        | Mean Square | F        | Sig. |
|----------------|----------------|-----------|-------------|----------|------|
| Between Groups | 30.819         | 2         | 15.410      | 1447.666 | .000 |
| Within Groups  | .096           | 9         | .011        |          |      |
| <b>Total</b>   | <b>30.915</b>  | <b>11</b> |             |          |      |

Note: P 0.05

As illustrated in the table above, the calculated significance level is 0.000, which is less than 0.05 ( $P < 0.05$ ). This suggests a discrepancy in the number of red blood cells across the various treatments. Subsequently, a one-way analysis of variance was conducted, and Duncan's test was employed to ascertain the mean comparison between treatments.

**Table 2. DMRT Test Result (Duncan Multiple Range Test)**

| Treatment group | N | Erythrocyte Count       |        |        |
|-----------------|---|-------------------------|--------|--------|
|                 |   | Subset for alpha = 0.05 |        |        |
|                 |   | 1                       | 2      | 3      |
| P1              | 4 | 3.2400                  |        |        |
| P2              | 4 |                         | 5.0200 |        |
| Control         | 4 |                         |        | 7.1600 |
| Sig.            |   | 1.000                   | 1.000  | 1.000  |

The results of the DMRT test indicate that there is a statistically significant difference in the average number of red blood cells in rats across the various treatments. The P1 treatment exhibited an average red blood cell count of 3.2 million per liter (/L), while the P2 treatment demonstrated an average of 5.02 million/L. In contrast, the control treatment exhibited an average of 7.16 million red blood cells per liter.

#### 3.2 Discussion

Obesity is a disease that results from the accumulation of excessive adipose tissue (WHO, 2024). The etiology of obesity is multifactorial, encompassing dietary habits, sedentary lifestyle, psychological factors, genetic predisposition, and pharmacological agents (Sari, 2021). Obesity

can result in the onset of a number of diseases, including diabetes, insulin resistance, and hypertension. It is established that obesity affects blood cell parameters (Jeong, 2022). Moreover, obesity is linked to chronic inflammation, which can lead to iron deficiency and subsequent anemia (Al-Attar, 2020). The typical red blood cell count in rats is documented to fall within the range of 7.8 to 10.6 million per liter (O'Connell, 2015). However, the three treatments exhibited an average red blood cell count that was below the normal range for rats. This suggests that the three rats in question were anaemic, or lacked red blood cells. As stated by Harahap (2018), anemia is defined as a condition wherein the body lacks red blood cells or hemoglobin. Although all three treatments were diagnosed with anemia, the severity of the condition differed among them. The P1 treatment exhibited the most severe level of anemia, with a red blood cell count of only 3.24 million per liter of blood. The control group demonstrated the highest number of red blood cells, with a concentration of 7.16 million per liter of blood. The data suggests that increasing the dose of glucomannan and moringa extract results in a closer approximation of the normal red blood cell count. Moreover, obesity has been demonstrated to exert a considerable influence on the number of red blood cells. This conclusion was also reached by Abro et al. (2020), who identified a significant correlation between obesity and the number of red blood cells.

It is well documented that the prevalence of obesity is increasing. It is therefore imperative that alternative products be developed to help prevent further increases in obesity. In this context, porang tubers (*Amorphophallus muelleri* Blume) may prove a valuable addition to the diet, as they have been demonstrated to possess anti-diabetic properties. Porang (*Amorphophallus muelleri* Blume) is a member of the Araceae family, which is rich in glucomannan fiber, with concentrations reaching up to 70% (Aini et al., 2020). The glucomannan present in porang has been demonstrated to possess the capacity to reduce cholesterol and glucose levels in the blood, facilitate weight loss, influence intestinal activity, and exert an impact on the immune system (Nissa and Majid, 2016). Moreover, porang tubers are a rich source of carbohydrates, possess low caloric value, and contain a substantial amount of fiber, rendering them a suitable dietary option for individuals with obesity or diabetes (Widiyawati et al., 2023).

In addition to porang tubers, moringa leaves have been demonstrated to possess anti-obesity properties when employed as an alternative food ingredient. Moringa leaves (*Moringa oleifera*) are a highly nutritious plant and are often referred to as the "miracle tree" due to the fact that all parts of its body can be utilized. Moringa plants contain a variety of compounds that have been demonstrated to possess antitumor, antiepileptic, anti-inflammatory, cholesterol-lowering, antioxidant, and antidiabetic properties (Jusnita, 2019). It is evident that Moringa plants have the potential to act as anti-obesity ingredients. The results of the study conducted by Mewally et al. (2017) indicated that an ethanol extract of moringa plants was capable of significantly reducing the body weight of mice. In a study conducted by Alkhudhayri et al. (2021), the anti-obesity effect of moringa leaf extract (*Moringa peregrina*) was tested on rats induced by a high-fat diet. The results indicated an anti-obesity effect, although not statistically significant. Additionally, the anti-obesity properties of moringa plants have been demonstrated to normalize the number of red blood cells affected by obesity. This finding is consistent with the results reported by Coulibaly et al. (2020), who examined the impact of moringa leaf powder (*Moringa oleifera*) on anaemic rats induced by obesity. The results demonstrated that the number of red blood cells returned to normal following the administration of moringa leaf powder.

The combination of porang tuber glucomannan with moringa leaf extract has been demonstrated to be highly efficacious in promoting weight loss, thereby preventing obesity and normalizing the number of red blood cells. These findings align with those of Wati and Setyaningsih (2024) and Anggitasari and Setyaningsih (2023), which indicate that the combination of moringa leaf extract and porang tuber glucomannan is highly efficacious in promoting weight loss and regulating the number of red blood cells.

#### 4. CONCLUSIONS

The findings of the study suggest that the combination of porang tuber glucomannan with moringa leaf extract may result in a reduction in body weight and the normalization of red blood cell count. Moreover, the study has demonstrated that obesity can influence the number of red blood cells. The P2 treatment, which combines glucomannan (*Amorphophallus muelleri* Blume) with Moringa leaf extract (*Moringa oleifera*) at a ratio of 120 mg/kgBB:80 mg/kgBB, has been identified as the most effective in normalizing the number of red blood cells.

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