

Potential of Rosella Extract (*Hibiscus sabdariffa* L.) for Herbal Medicine: Focus on Body Weight, Islet of Langerhans Cells Count, and Relative Organ Weight in Diabetes Mellitus Rats

Trinsawati Mundijo^{1*}, Siti Rohani², Sinta Julia Liona Putria³, Nurshadrina Amalia Putri³, Rury Tiara Oktariza¹

¹Department of Cell Biology and Histology, Faculty of Medicine, Universitas Muhammadiyah Palembang, Palembang, Indonesia

²Department of Pharmacology, Faculty of Medicine, Universitas Muhammadiyah Palembang, Palembang, Indonesia

³Medical student, Faculty of Medicine, Universitas Muhammadiyah Palembang, Palembang, Indonesia

*E-mail: trisna.akbar911@gmail.com

Abstract

Rosella (*Hibiscus sabdariffa* L.) is useful as an antidiabetic, but research reports on relative body weight, Islets of Langerhans cells, and relative organ weight are still limited. To investigate the potential of Rosella extract for use in herbal medicine in rat models of diabetes mellitus, as confirmed by body weight, Islets of Langerhans cells, and relative organ weight. Thirty adult male *Rattus norvegicus* L. rats divided into 6 main groups, as a normal control group (KN), a negative control group (K-) induced by alloxan, a positive control (K+) induced by alloxan and glibenclamide, and 3 treatment groups given alloxan and Rosella extract at doses of 15% (P1), 30% (P2), and 60% (P3). All rats were weighed until the end of the treatment for 14 days. On the last day, we collected the relative weights of the liver and kidney organs, as well as the histopathological islet Langerhans cells count. Data were analyzed univariately to describe the effect of Rosella extract on the study variables. The body weight tended to increase but was still within the normal range for rat body weight. The Islet Langerhans cells count value was highest in the treatment group with a 30% dose of 2396.6. Meanwhile, the relative weight of the kidney and liver organs in all groups given Rosella extract tended to be the same as the normal group. The Rosella extract has the potential as a herbal medicine through confirmation of normal body weight, islet Langerhans cell count, kidney and liver relative weight in rat diabetes mellitus models.

Keywords: Body Weight, Kidney, Liver, Langerhans, Rosella

1. Introduction

Indonesia is one of the countries with the highest biodiversity; one of these is Rosella (*Hibiscus sabdariffa* L.). Rosella (*Hibiscus sabdariffa* L.) is in the *Malvaceae* family and has potential as an antidiabetic.¹ This condition is due to the substances in it that act as antioxidants, preventing free radicals. Free radicals are one factor contributing to chronic diseases, which is a diabetes mellitus. Previous studies reported that Rosella has health benefits with flavonoids, saponins, tannins, and alkaloids.²

The World Health Organization (WHO) states that diabetes mellitus (DM) is a chronic metabolic disease characterized by high blood glucose levels. Currently, 171 million people have DM, and this is expected to increase to 366 million in 2030.³ Diabetes mellitus can be prevented by implementing various activities

such as a healthy diet, regular exercise, maintaining ideal body weight, stress management, regular blood sugar checks, and the use of herbal medicines.^{2,3}

The Rosella extract can prevent the development of liver damage in a rat model with Deficiency Vitamin B12.⁴ The other hand, the Rosella extract was reported to be safe and had no significant effect on the vital signs and blood chemistry profile in rats.⁵ The previous studies found that Rosella extract has antidiabetic activity comparable to 0.45 mg/kg BW glibenclamide.¹ In line with these research results, another study found that Rosella extract (*Hibiscus sabdariffa* L.) effectively regenerates pancreatic β cells and reduces blood glucose levels in diabetic rats.^{6,7}

Nowadays, research about the safety of Rosella extract with body and organ weight, and islet Langerhans cells count, is still limited.

Based on these facts, we investigated the potential of Rosella extract as an herbal medicine, confirmed through body weight, islet Langerhans cells count, and relative kidney and liver organ weight.

2. Method

The study is an experimental study using thirty male *Rattus norvegicus* L. rats with 100–110 g. All rats were acclimatized for 1 week with *ad libitum* access to food and water and treated at the Animal House, Faculty of Medicine, Universitas Muhammadiyah Palembang.

We have Ethical approval from the Humanities and Islamic Medicine Bioethics Committee, Faculty of Medicine, Universitas Muhammadiyah Palembang, with protocol number 058/EC/KBHKKI/FK-UMO/XI/2024.

After 1 week of acclimatization, all rats were fasted for 8 hours, and then the fasting glucose level was measured using an Easy Touch device from blood samples taken from the rats' tails (lateral vein) as the initial glucose level. The anesthetic compound used was a combination of ketamine and xylazine at a dose of 100 mg/kgBW ketamine with 10 mg/kgBW xylazine. The rats were then fasted for 12 hours and made hyperglycemic by inducing alloxan at a dose of 3 mg/kgBW for 3 days. Blood glucose levels were then measured again.

All rats were fed and given water *ad libitum* and Rosella flower extract for 14 days,

with randomly divided into 6 groups consisting of aquadest (KN), alloxan (K-), alloxan and glibenclamide (K+), Rosella extract 15% (P1), 30% (P2), and 60% (P3). The rats were weighed every morning during treatment, and at the end of the study, we collected the relative organ weights from the liver and kidney. The histological observations of the pancreas were performed by counting islets of Langerhans cells using ImageJ.

Data were analyzed and presented in tables, figures, narratives, and visualized with GraphPad Prism 9.

3. Result

In our study, we observed body weight, islet Langerhans cells count, and relative organ weight, including the liver and kidney, as shown in Table 1 and Figures 1 and 2.

In Figure 1, our study found that body weight increased in each group for each treatment. The average body weight increased after intervention. In Table 1, we show that there is an increase in cell count in the group of rats with diabetes compared to the normal group.

Our results for relative kidney and liver weight in Figure 2 show that in relative Kidney weight, the diabetic groups (K- and K+) had the highest weight compared to the others. On the other hand, the relative liver weight was the lowest in the group K- compared to all groups

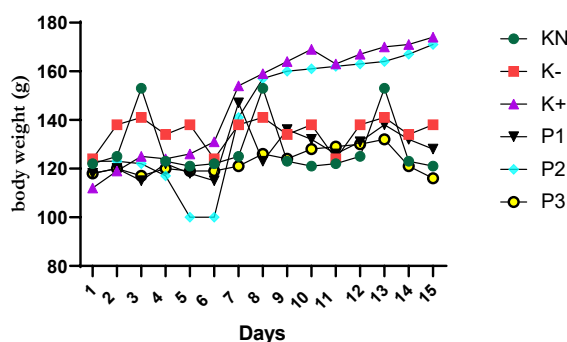
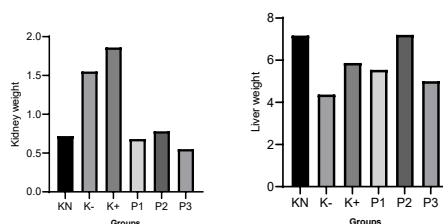


Figure 1. Body Weight in Rats

Table 1. Results of the Islet Langerhans cells count

No	Group	Average cell count
1	KN	2053
2	K-	440.6
3	K+	2449.6
4	P1	771.5
5	P2	2396.6
6	P3	2062.8

*Note: Aquadest (KN), alloxan (K-), alloxan and glibenclamide (K+), Rosella extract 15% (P1), 30% (P2), and 60% (P3)

**Figure 2: Relative Kidney and Liver Weight in Rats**

4. Discussion

Our study found that all rats experienced fluctuating weight gain between 100 g and 174.5 g. Weight measurement was carried out as one of the parameters to assess whether there were significant differences between the normal and control groups. Body weight of experimental animals is one sensitive parameter that can be measured to detect the toxic effects.⁸

The average cell counts of Islet Langerhans cells between the KN and K- groups is highest in KN. These results are similar to those of the K+ group treated with glibenclamide. Compared with the three treatment groups, P2 and P3 produced higher results and were similar to KN, with P2 achieving the highest at 2396.6 cells. This indicates that Rosella extract to DM model rats tends do not influence Islet Langerhans cell counts. These results suggest that the extract administered does not affect the cell count of Islet Langerhans cells. However, further study is needed regarding the histological characteristics of cells in the islets of Langerhans, including whether they serve as cellular or molecular markers.

In the average liver weight in rats, we found that the K- and K+ groups were lower than the KN group. However, compared with

the treatment groups, liver weight tended to be the same, especially in the P2 group. The liver is an organ with the potential to be damaged, characterized by cellular necrosis and alterations in hematological markers and blood chemistry profiles.^{9,10}

A different result was shown for relative kidney weight. It is known that relative kidney weight in the KN tends to be similar across the three treatment groups (P1, P2, and P3) at all doses. This differs between the K- and K+ groups, which tend to be higher. The kidney is one of the organs that is potentially affected by the biotransformation of a variety of chemicals and drugs.^{11,12}

This study investigated the potential of Rosella extract as an herbal medicine in a DM model in rats. This was done because rats as test animals can serve as an alternative to in vitro testing before testing on humans. The use of test animals in biomedical research on a laboratory scale is very important because they can represent human physiology well.^{13,14}

This study was conducted by relative weighing of the liver and kidney organs. Relative organ weight measurement can be one parameter that provides a general description of the effects of a compound, whether there are abnormalities in the

organs, such as enlargement or shrinkage. However, this cannot be used as the only parameter in determining organ damage or repair.¹⁵

Regarding our study, we stated that roselle has the potential to be a candidate herbal medicine to prevent or treat diabetes. A previous study reported the same result: roselle is a promising product that can be used to treat diabetes,^{16,17,18,19,20} which is attributed to the flavonoid components as antidiabetic.²¹ Another study reported that Roselle extract has the potential to protective effect on the pancreas in rat models with diabetes mellitus,²² and as a therapy for metabolic syndrome.²³

In the future, further research can explore cellular and molecular markers to investigate the safety of Rosella extract, which is the histopathological cells such as cellular necrosis, hematological markers, and blood chemistry profiles.

5. Conclusion

The Rosella extract has the potential as a herbal medicine through confirmation of normal body weight, islet Langerhans cell count, kidney and liver relative weight in rat diabetes mellitus models.

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