



SECONDARY METABOLITES CONTENT AND EFFECTS OF ZURIAT FRUIT (*Hyphaene thebacia*) BREWING ON THE REDUCTION OF BLOOD GLUCOSE AND HISTOPATHOLOGY OF β -PANCREATIC CELLS OF MALE MICE (*Mus musculus*)

Ni Wayan Sukma Antari^{1*}, Ida Ayu Manik Damayanti¹, Ni Luh Adi Satriani²

¹Bachelor of Clinical and Community Pharmacy, Institut Teknologi dan Kesehatan Bali, Jl. Tukad Balian No.180, Renon, Denpasar Selatan, Denpasar, Bali 80227, Indonesia

²Bachelor of Nursing, Institut Teknologi dan Kesehatan Bali, Jl. Tukad Balian No.180, Renon, Denpasar Selatan, Denpasar, Bali 80227, Indonesia

*sukma.antari91@gmail.com

ABSTRACT

Diabetes mellitus is caused by genetic factors, such as having a family history of the disease, being overweight (obesity), autoimmune diseases, and abnormalities in pancreatic β -cells. This study was conducted to examine the secondary metabolite content and effects of Zuriat fruit (*Hyphaene Thebacia*) infusion on reducing blood glucose and histopathology of pancreatic β -cells in male mice (*Mus musculus*). The results were analyzed using powder weights of 2 g/kg body weight and 5 g/kg body weight. This study employed a true experimental study design in a laboratory setting, where the research was conducted rigorously, controlling all factors that could interfere with internal validity. The study design used a posttest-only control group design, where the test was conducted after treatment. The results were processed using the One-Way ANOVA test. Administering a brew of zuriat fruit (*Hyphaene thebacia*) with a powder weight of 2 grams and 5 grams can reduce blood glucose levels in male mice. Administration of a brew of zuriat fruit (*Hyphaene thebacia*) with a powder weight of 2 grams and 5 grams can increase pancreatic β -cells. Administering zuriat fruit infusion has been shown to lower blood glucose levels in male mice compared to the control group.

Keywords: diabetes mellitus; hyphaene thebaica; mus musculus

How to cite (in APA style)

Antari, N. W. S., Damayanti, I. A. M., & Satriani, N. L. A. (2026). Secondary Metabolites Content and Effects of Zuriat Fruit (*Hyphaene Thebacia*) Brewing on the Reduction of Blood Glucose and Histopathology of β -Pancreatic Cells of Male Mice (*Mus musculus*). *Indonesian Journal of Global Health Research*, 8(2), 1339–1344. <https://doi.org/10.37287/ijghr.v8i2.2419>.

INTRODUCTION

Health is the main problem faced by society today. One disease that is very worrying is diabetes mellitus which is caused by food or drinks that contain high levels of sugar. According to data from the International Diabetes Federation (IDF) 2021, the prevalence of diabetes mellitus in adults aged 20-79 years is 19,465,100 people. The Ministry of Health of the Republic of Indonesia (2024) states that in Indonesia in 2021 it is estimated that the prevalence of DM will increase by 10.06% or 19.46 million of the Indonesian population. Based on preliminary observation data from the Bali Provincial Health Service, there were 53,736 sufferers throughout 2021. Denpasar City is the area with the most sufferers in Bali Province and has experienced a significant increase in cases over the last three years, namely in 2019 (6,405 sufferers), 2020 (7,227 sufferers), and 2021 (15,366 sufferers), with the number of male sufferers being more, namely more than 53% of the total sufferers, compared to female sufferers who only 47% (Pramesti et al., 2023).

Diabetes mellitus is caused by genetic factors, such as having family members with a history of this disease, having a higher body weight (obesity), autoimmune disease and abnormalities in the pancreatic β -cells. In addition, diabetes mellitus can cause serious complications, such as heart disease, stroke, and organ damage, which further emphasizes the importance of preventing and managing this disease effectively (Nifadila Dachi et al., 2022). Diabetes is divided into several main

types, namely type 1 and type 2 diabetes. Type 1 diabetes is caused by the destruction of pancreatic β -cells by an autoimmune process, which is then followed by insulin deficiency. The influencing factors are genetics, immunology and the environment (Faida & Santik, 2020). Another type of diabetes mellitus is type 2 diabetes which is characterized by insulin resistance and also decreased insulin secretion (Marx et al., 2023).

In this study, researchers will carry out histopathology or measure the number of pancreatic β -cells. Pancreatic β -cells are one of the endocrine cells located in the pancreatic islets of Langerhans. Oxidative stress is one of the causes of damage to pancreatic β -cells. An increase in glucose in the blood occurs due to insulin production which occurs in the pancreatic β -cells, such as after eating. Helping cells in the body to properly absorb glucose from the bloodstream is the function of insulin, so it can reduce blood sugar levels (Faida & Santik, 2020). Insulin therapy is really needed in managing diabetes due to loss of β cell function, so research is needed to look at the comparison of the use of traditional herbal medicines and conventional medicines. The conventional drugs that will be used are selected from the sulfonylurea class of drugs.

Indonesia has biodiversity with various plant species spread across various ecosystems. One plant that can be used as an alternative treatment for DM is doum palm or zuriat fruit. Zuriat fruit is classified as a fruit that has high antioxidant activity so it is good for warding off free radicals and also reducing oxidative stress which can cause diabetes (Hassan, 2020). Zuriat fruit contains flavonoid and polyphenol compounds as natural antioxidants in the body. Flavonoid and alkaloid compounds work by warding off peroxide radicals, causing the fat bonds in cell membranes to become damaged. The glycosides and flavonoids contained in zuriat fruit act as an antidote to hydroxyl radicals which can prevent diabetes (Damayanti et al., 2022).

Zuriat fruit will be given to experimental animals in the form of steeping, because the steeping method will not damage the flavonoid compounds contained in zuriat fruit (Suyono Saputri & Murniasari, 2022). The steeping method is also often used by people to consume traditional medicinal plants because the method of presentation is practical and simple, making it easier for people to consume them. In previous research conducted by (Hassan, 2020), the best extract dose obtained was 1 g/kg BW and 2 g/kg BW which was effective in reducing blood glucose in mice, with a research duration of 6 weeks. Based on the background above, researchers will conduct research aimed at examining the effectiveness of infusion of zuriat fruit (*Hyphaene thebacia*) on reducing blood glucose and pancreatic β -cell histology in male mice (*Mus musculus* L) using powder weights of 2 g/kg BW and 5 g/kg BW. This study was conducted to examine the secondary metabolite content and effects of Zuriat fruit (*Hyphaene Thebacia*) infusion on reducing blood glucose and histopathology of pancreatic β -cells in male mice (*Mus musculus*). The results were analyzed using powder weights of 2 g/kg body weight and 5 g/kg body weight.

METHOD

This study uses a true experimental study design laboratory method, where the research will be carried out seriously by controlling all factors that can interfere with internal validity. The research design used is a posttest only control group design where the test is carried out after being given treatment. This study used 4 treatment groups, namely: a negative control group, a positive control group (given glibenclamide) and 2 treatment groups using zuriat powder with a dose of 2 g / kg BW and 5 g / kg BW, for observation on β -pancreatic cells, a preparation incision was made and the number of β -pancreatic cells was counted. The results were processed using the One-Way ANOVA test.

RESULT

a. Blood Glucose Level Results

Based on the Man-Whitney test analysis of blood glucose levels in male mice, the results obtained on day 28 showed no significant difference between the positive control and the P2

group. This data shows that before treatment, all mice experienced the same increase in blood glucose levels due to alloxan administration. However, after treatment, blood glucose levels decreased, resulting in a significant difference between the negative control group and all other treated test groups.

The results showed a decrease in blood glucose levels in all test groups (Positive Control, P1, P2) after 28 days of treatment. The highest decrease in blood glucose levels occurred in the positive control group on day 28. In the treatment group given a natural infusion of zuriat fruit (*Hyphaene thebacia*), the P2 group, with a powder weight of 5 grams, experienced a decrease similar to the positive control group. This was followed by a decrease in blood glucose in the P1 group, with a powder weight of 2 grams. This shows that the zuriat fruit (*Hyphaene thebacia*) can have an effect on reducing blood glucose levels in male mice (*Mus musculus*).

Table 1.
Results of the Mann Whitney Blood Glucose Test

Group		P	Information
Control (-)	Control (+)	0,002	Significant
	P1	0,002	Significant
	P2	0,002	Significant
Control (+)	P1	0,002	Significant
	P2	1,000	Not Significant
P1	P2	0,003	Significant

b. Histopathological Observation of Pancreatic β -Cells

Table 2.
Post Hoc LSD Test Results of Pancreatic β -Cell Count

Group		P	Information
Control (-)	Kontrol (+)	0,000	Different Meanings
	P1	0,000	Different Meanings
	P2	0,000	Different Meanings
Control (+)	P1	0,000	Different Meanings
	P2	0,000	Different Meanings
P1	P2	0,000	Different Meanings

Based on the results of the LSD test analysis on the number of pancreatic β -cells, a significant difference was found between the negative control group and all test groups (positive control, P1, P2). These data indicate that each treatment provided the same results, namely increasing pancreatic β -cells.

DISCUSSION

The positive control group, given the conventional drug Glibenclamide, experienced a significant decrease in blood glucose levels. This is because Glibenclamide is a hypoglycemic drug that stimulates insulin secretion by closing ATP-sensitive potassium channels in pancreatic β -cells (Irawan, 2022). The usual dose of Glibenclamide in humans is 5 mg/kg body weight. This dose was then converted to the dose for test animals, male mice. The decrease in blood glucose levels in mice given Glibenclamide was supported by histopathological observations, which showed improvement and an increase in β -cells in the islets of Langerhans toward near-normal levels.

In the treatment group with the administration of zuriat fruit infusion, the results showed a decrease in blood glucose levels starting from the 7th day to the 28th day with the powder weight of each treatment being 2 grams and 5 grams, all treatment groups experienced a decrease in blood glucose levels, but in the treatment group with a powder weight of 5 grams showed a reduction effect that was almost the same as the positive control group given Glibenclamide drug treatment, indicated by

a value ($p>0.05$) in the test results of all groups on all days, where there was no significant difference.

The improvement of pancreatic β -cells, indicated by reduced blood glucose levels and increased β -cell counts, was due to the antioxidants contained in zuriat fruit. The IC₅₀ in boiled water was 74,098 ppm (Damayanti et al., 2022). Antioxidant activity can scavenge free radicals that cause damage to pancreatic β -cells, allowing the remaining β -cells to function. These antioxidants protect the remaining β -cells and prevent oxidation in them, thus minimizing damage. Antioxidants also enable the regeneration of remaining β -cells through mitosis or the formation of new islets through proliferation (Indrayoni & Damayanti, 2021).

Based on the research results, it was found that zuriat fruit infusion with a high powder weight was more effective than a low powder weight in reducing blood glucose levels and increasing β -cell count. This aligns with research conducted by el Halim Hassan (2020), which found that the greater the weight of the powder used, the faster the reduction in blood glucose levels. This is due to the bioactive compounds contained in zuriat fruit, namely flavonoids, which have antioxidant and hypoglycemic activities. Flavonoid compounds can accelerate β -cell proliferation and regeneration by modulating Bcl-2 expression and inhibiting caspases (Ghorbani et al., 2019). Therefore, flavonoids play a crucial role in increasing pancreatic β -cell function. In addition to flavonoids, terpenoids have shown potential in restoring β -cell mass and function. This is supported by research conducted by Dinesh et al. (2024), which found that terpenoids can suppress enzymes such as α -glucosidase and aldose reductase, as well as inhibit the MAPK pathway, all of which reduce glucotoxic stress in β -cells. Therefore, terpenoids can improve insulin sensitivity while promoting new β -cell neogenesis. Another compound that plays a role is saponin, where saponin has been proven to stimulate β cell regeneration through several biological interventions, because saponin triggers β cell proliferation and inhibits liver gluconeogenesis, so it can reduce blood glucose levels (Bhatt, et al. 2025).

CONCLUSION

This study shows that the infusion of zuriat fruit (*Hyphaene thebaica*) contains various secondary metabolites that have the potential to provide antidiabetic activity, especially flavonoids, phenolics, tannins, saponins, and other bioactive compounds that act as antioxidants. These compounds are thought to contribute to reducing oxidative stress, increasing insulin secretion, and protecting pancreatic β -cells from damage caused by hyperglycemia. These findings are in line with various studies showing that *Hyphaene thebaica* is rich in flavonoids such as myricetin, luteolin, and apigenin, which have the potential to increase insulin secretion and improve pancreatic β -cell morphology.

REFERENCES

- Ahriyasna, R., et al. (2023). Flavonoid dalam Rebusan Kawa Daun (*Coffea canephora*) Memperbaiki Kadar Glukosa Darah dan Regenerasi Sel Beta Pankreas Tikus Diinduksi Diabetes. *JURNAL Kesehatan Perintis (Perintis's Health Journal)*, 10(1), 60–67.
- Antari, N. W. S., et al. (2023). Gambaran Histologi Ovarium dan Fluktuasi Hormon Estrogen pada Mencit Betina (*Mus musculus* L.) yang diberi Ekstrak Buah Zuriat (*Hyphaene thebaica*) sebagai Antioksidan Alami. *MAHESA : Malahayati Health Student Journal*, 3(4), 1160–1170.
- Arib, M. F., Rahayu, M. S., Sidorj, R. A., & Afgani, M. W. (2024). Experimental Research Dalam Penelitian Pendidikan. *Innovative: Journal Of Social Science Research*, 4(1), 5497–5511.
- Banjarnahor, E., & Wangko, S. (2018). Sel Beta Pankreas Sintesis Dan Sekresi Insulin. *Jurnal Biomedik (Jbm)*, 4(3).
- Bhatt, S. . (2025). Annals of the National Academy of Medical Sciences (India) The potential of various herbal plants for potential - therapeutic treatment for diabetes management. October 2024.
- Cantika, M. T., Tutik, T., & Nofita, N. (2024). Uji Aktivitas Anti-Inflamasi Ekstrak Metanol Kulit

- Bawang Merah Terhadap Mencit Putih Jantan. *Jurnal Farmasi Malahayati*, 7(1), 118–131.
- Care, D., & Suppl, S. S. (2024). 2. Diagnosis and Classification of Diabetes: Standards of Care in Diabetes. *Diabetes Care*, 47(January), S20–S42.
- Damayanti, I. A. M., et al. (2022). Antioxidant activity of doum fruit extract (*hyphaene thebaica*) as an alternative to antidiabetic drinks. *International Journal of Chemical & Material Sciences*, 5(1), 10–13.
- Dinesh, T., et al. A Comprehensive Analysis of Therapeutic Plants and Substances to Enhance Pancreatic β -Cell Mass and Functionality in the Treatment of Diabetic Mellitus. 7(3), 1–16.
- Dira, A., & Puspitasari, L. (2021). Penurunan Glukosa Darah dan Peningkatan Jumlah Sel Beta Pankreas Dengan Pemberian Ekstrak Etanol *Pleurotus Ostreatus*. *Media Farmasi*, 17(2), 133.
- El Halim Hassan, et al. (2020). Effect of Doum Fruit (*Hyphaene Thebaica*) Extract on Some Biochemical Parameters, Enzyme Activities and Histopathological Changes of Pancreas in Alloxan Induced Diabetic Rats. *Food and Nutrition Sciences*, 11(03), 207–219.
- Faida, A. N., & Santik, Y. D. P. (2020). Kejadian Diabetes Melitus Tipe I pada Usia 10-30 Tahun. *Higeia Journal of Public Health Research and Development*, 4(1), 33–42.
- Ghorbani, A., et al. (2019). Flavonoids for preserving pancreatic beta cell survival and function: A mechanistic review. *Biomedicine and Pharmacotherapy*, 111(October 2018), 947–957.
- Hardianto, D. (2021). Telaah Komprehensif Diabetes Melitus: Klasifikasi, Gejala, Diagnosis, Pencegahan, Dan Pengobatan. *Jurnal Bioteknologi & Biosains Indonesia (JBBI)*, 7(2), 304–317. H <https://doi.org/10.29122/jbbi.v7i2.4209>
- Hartono, H., & Ediyono, S. (2024). Hubungan Tingkat Pendidikan, Lama Menderita Sakit Dengan Tingkat Pengetahuan 5 Pilar Penatalaksanaan Diabetes Mellitus Di Wilayah Kerja Puskesmas Sungai Durian Kabupaten Kbu Raya Kalimantan Barat. *The Shine Cahaya Dunia S-1 Keperawatan*, 9(01), 2018–2022.
- Indrayoni, P & Damayanti I., (2021). Pengaruh Ekstrak Averrhoa Bilimbi L. Terhadap Jumlah Sel Beta Pankreas Tikus Hiperglikemia. *Jurnal Riset Kesehatan Nasional*, 5(2), 159-163.
- Irawan, H. (2022). Review: Mekanisme Molekuler Obat Glibenklamid (Obat Anti Diabetes TIPE-2) Sebagai Target Aksi Obat Kanal Ion Kalium. *Jurnal Pendidikan Dan Konseling*, 4, 1707–1715.
- Jalung, F., et al., (2023). Uji Aktivitas Antipiretik Ekstrak Daun Bidara (*Ziziphus Spina Christi* L)

