Research Article

ANTI DIABETIC ACTIVITY OF ETHANOL EXTRACT OF RANGGAP BANANAS (*MUSA TROGLODYTARUM* L.)

Dolih Gozali¹, Resmi Mustarichie^{2*}

¹Department of Pharmaceutics, Faculty of Pharmacy, Universitas Padjadjaran, Indonesia

²Pharmaceutical Analysis and Medicinal Chemistry of Department, Faculty of Pharmacy, Universitas Padjadjaran, Indonesia

*Corresponding Author Email: resmi.mustarichie@unpad.ac.id

Article Received on: 05/09/18 Approved for publication: 22/10/18

DOI: 10.7897/2230-8407.0910230

ABSTRACT

Traditionally, Fei banana or ranggap banana (*Musa Troglodytarum* L.) was used for anti-diabetes treatment at Mount Galunggung, West Java. The purpose of this study was to verify the antidiabetic activity of the ethanol extract of ranggap banana. The study began with the collection of ingredients, maceration, phytochemical screening, and antidiabetic testing of male mice with the alloxan method. All mice measured initial fasting blood glucose levels first, then injected with alloxan at a dose of 145 mg/kg BW as subcutaneous. Then the antidiabetic effect was tested by dividing 7 male white mice (each group consisted of 3 mice), 2%, negative control (PGA 2% + alloxan), positive control, (PGA 2% + alloxan + glibenclamide 0.45 mg / kg BW and four test groups (PGA 2% + alloxan + test 1 (50 mg/200g BW), PGA 2% + alloxan + test 2 (100 mg/200g BW, PGA 2% + alloxan + test 3 (150 mg / 200g BW), and PGA 2% + alloxan + test 4 (200 mg/200g BW). The results showed that test 3 had the best effect of antidiabetic activity on decreasing blood glucose levels in mice meaning the Fei bananas had the potential for antidiabetic treatment. It is recommended to determine the structured content to find out which compounds are efficacious for antidiabetic.

Keywords: Ranggap banana, *Musa Troglodytarum*, alloxan, antidiabetic, mice

INTRODUCTION

According to WHO (World Health Organization) data, diabetics in Indonesia ranks 4th largest in the world. Diabetes mellitus is one example of a degenerative disease which has recently become a hot topic of discussion among various groups and is no longer the consumption of doctors¹. Diabetes for all age groups around the world is estimated at 2.8% in 2000 and 4.4% in the year 2030. The number of diabetics is estimated to increase from 171 million in 2000 to 366 million in 2030. The number of people with diabetes in Indonesia according to WHO data in 2009 reached 8 million and is predicted to increase to more than 21 million by 2025. very high in men than women, but women have a higher risk of developing diabetes than men^{2,3}. Treatment of diabetes mellitus is a chronic and lifelong treatment. The use of synthetic drugs for the treatment of diabetes mellitus for a long time can cause undesirable side effects⁴.

One alternative is to do research on traditional medicine that has the effect of hypoglycemia. Traditionally and for generations, residents in the villages of the foot of Mt. Galunggung, Tasikmalaya, West Java, use ranggap (Sundanese) bananas to treat diabetes. and bananas are also believed by the community as a generator of passion for sluggish men. For diabetes, they treat it by eating ripe bananas every day at least 4.5 times and it can reduce blood sugar^{5,6}. anana that has a uniqueness because of the direction of the sign-up. So far the area of distribution is known to be from Maluku, Papua to the Pacific (Solomon, Samoa, Fiji etc.). Another unique feature of the banana sky stick is the higher content of carotene than other types of bananas. This can be marked by the color of orange flesh⁸. Based on this fact, the study of the antidiabetic activity of frei bananas ethanol extract was carried out in order to prove the trust of the community.

MATERIALS AND METHODS

Materials Plant

The materials used in the form of ripe ranggap bananas were obtained from smallholder plantations in the village of Linggajati, the Foot of Mt. Galunggung, Tasikmalaya, West Java

Chemical material

70% ethanol, toluene, Mayer reagent, Dragendorff reagent, Lieberman-Burchard reagent, chloroform, ammonia, 2N hydrochloric acid, 1% gelatin, iron (III) chloride, magnesium powder, amyl alcohol, ether, vanillin 10 % in concentrated sulfuric acid, and 5% potassium hydroxide solution, PGA, glucose, and glibenclamide tablets. All ingredients used were of analytical grade.

Equipment

Moisture analyzer, Rotary Evaporator (Buchi®), macerator, analytical balance, sonde oral, syringe, glucose meter

Animal Test

The animal test used was white mice (*Rattus novergicus*), Wistar strains, male, age 2-3 months, healthy and had normal activity, body weight between 150-250 g. Before being used for testing, all mice were adapted first for approximately one week and their health was observed. Ethical approval (No. 462/UN6. KEP/EC/2018) for testing with animals was applied to the Research Ethics Committee, Universitas Padjadjaran.

Methods

Ranggap bananas were collected and determined at the Plant Taxonomy Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Padjadjaran University, The Simplicia which was mashed was extracted by maceration using 70% ethanol solvent based on modifications of Mustarichie *et al.* method ⁹. The extracted parameter was tested based on standard methods ^{10, 11}. Farnsworth method ¹² was performed to detect secondary metabolites of alkaloids, polyphenols, tannins, flavonoids, quinones, saponins, monoterpenoids, sesquiterpenes, steroids and triterpenoids.

Testing Antidiabetic Activity

Male white mice were divided into 7 groups (each group consisted of 3 mice), namely the normal control group, negative control, positive control, and four test groups. All mice were measured for initial fasting blood glucose levels first, then injected with alloxan at a dose of 145 mg/kg BW in s.c (subcutaneous). Mice were left for three days while still being fed and drinking. Three days after alloxan induction, fasting blood glucose levels were measured before treatment. Then the antidiabetic effect was tested by dividing 7 male white mice, namely the normal control group (PGA 2%), negative control

(PGA 2% + alloxan), positive control, (PGA 2% + alloxan + glibenclamide 0.45 mg/kg BW and four test groups (PGA 2% + alloxan + test 1 (50 mg/200g BW.), PGA 2% + alloxan + test 2 (100 mg/200g BW, PGA 2% + alloxan + test 3 (150 mg/200g BW), and PGA 2% + alloxan + test 4 (200 mg/200g BW). Each of these preparations was given orally with the same volume of administration (1 ml/200 g BW). The treatment was carried out for 8 consecutive days, fasting blood glucose was measured on the day before alloxan induced, three days after alloxan induction and the 2nd, 4th, 6th, and 8th days during treatment. Blood was obtained by cutting the tail of the mouse under the light, then blood glucose levels were measured using a glucometer. All data were analyzed by statistical analysis of variance (ANOVA) followed by Duncan's test ¹³.

RESULTS

Plant determination

Determination of sample at the taxonomy laboratory of Biology Department, Faculty of Mathematics and Applied Sciences revealed that the sample used was *Musa Troglodytarum L*

Extractions: The yield of viscous extract was 10.20 % W/W.

Table 1: Phytochemical screening of ethanolic extract from *Musa troglodytarum L*

Secondary metabolites	Ethanol extract
Alkaloids	+
Flavonoids	+
Saponins	+
Polyphenolics	+
Tannins	+
Quinone	+
Monoterpenoids and Sesquiterpenoids	+
Steroids and Triterpenoids	+

Notes: (+): detected; (-): not detected

Table 2: The pharmacognostic parameters of *Musa troglodytarum L*

Parameters	Plants	Extract
	(%)	
Loss on drying	28.24	9.85
Ethanol soluble extractive	12.51	5.36
Water soluble extractive	12.61	8.63
Water content	23.58	9.19
Total ash content	23.27	32.70
Acid insoluble ash	3.04	0.86
Water soluble ash	7.24	9.85

Table 3: Average Blood Glucose Level (mg/dl) of *M. troglodytarum* ethanol extract

Time (day)	Normal control	Negative control	Positive control	Test 1	Test 2	Test 3	Test 4
0	60.00	66.00	80.00	61.00	61.00	72.00	65.00
1	58.07	458.00	425.67	394.00	397.67	342.00	328.67
2	81.65	496.67	389.54	407.67	447.67	390.33	272.00
4	59.33	489.33	357.33	239.33	355.00	401.33	377.67
6	75.33	363.67	279.33	193.67	323.33	264.33	286.33
8	54.60	326.07	213.57	171.38	201.42	252.40	299.57
10	55.70	85.77	44.78	189.87	132.23	213.39	199.45

Notes: Test 1 : PGA 2% + alloxan + extract 50 mg/200g BW; Test 2: PGA 2% + alloxan + extract 100 mg/200g BW; Test 3: PGA 2% + alloxan + extract 150 mg/200g BW; Test 4: PGA 2% + alloxan + extract 200 mg/200g BW

Table 4: Percentage of decreased antidiabetic activity *M. troglodytarum* ethanol extracts on male white mice

Time (day)	Decreasing Relative Glucose Level (%)				
	Positive control	Test 1	Test 2	Test 3	Test 4
1	22.61	8.98	6.50	32.15	23.19
2	35.39	11.61	3.87	27.50	43.66
4	39.51	45.97	24.56	24.59	18.88
6	37.30	39.50	6.81	31.35	14.92
8	42.88	39.92	36.42	26.70	2.64

Notes: Test 1 : PGA 2% + alloxan + extract 50 mg/200g BW; Test 2: PGA 2% + alloxan + extract 100 mg/200g BW; Test 3: PGA 2% + alloxan + extract 150 mg/200g BW; Test 4: PGA 2% + alloxan + extract 200 mg/200g BW

Fig 1: Graph of relative blood glucose level (%) *M. troglodytarum* ethanol extracts on male white mice

Notes: Test 1 : PGA 2% + alloxan + extract 50 mg/200g BW; Test 2: PGA 2% + alloxan + extract 100 mg/200g BW; Test 3: PGA 2% + alloxan + extract 150 mg/200g BW; Test 4: PGA 2% + alloxan + extract 200 mg/200g BW

Fig. 2: Graph of percentage reduction in antidiabetic activity *M. troglodytarum* ethanol extracts on male white mice

Notes: Test 1 : PGA 2% + alloxan + extract 50 mg/200g BW; Test 2: PGA 2% + alloxan + extract 100 mg/200g BW; Test 3: PGA 2% + alloxan + extract 150 mg/200g BW; Test 4: PGA 2% + alloxan + extract 200 mg/200g BW

Table 5: ANOVA Calculation Results Antidiabetic Activity of *M. troglodytarum* ethanol extracts on male white mice

Variation source	db	JK	KT	F _{cal}	F _{tab}
Treatment	6	861702.97	143617.20	10.72	2.44
Error	28	375070.78	13395.38		
Total	34	1236773.74			

DISCUSSION

Collecting and Plant Determination

The materials used in the form of ripe ranggap bananas were obtained from smallholder plantations in the village of Linggajati,

the foot of Mt. Galunggung, Tasikmalaya, West Java. Plant determination at Laboratory of Taxonomy, Biology Department, Faculty of Mathematics and Applied Sciences, Universitas Padjadjaran revealed that the sample used was the *Musa* genus and the *Musa troglodytarum*. Linn. species.

Extraction

Extraction of cold ways in the form of maceration with ethanol was chosen in this study, because the substances contained which were thought to be antidiabetic efficacy were unknown, whether the compounds were heat-resistant or not^{10, 11}. Ethanol was selected as a solvent in the extraction process because it had high solubility, most of the secondary metabolites were insoluble, not toxic, and were inert so they do not interfere with other components. The use of ethanol as a solvent could prevent the growth of molds and bacteria in the extract, so as to minimize the occurrence of contamination in the extract. The low ethanol boiling point facilitated the evaporation process in the process of extracting extracts and extract contact with less heat of¹⁴⁻¹⁶.

Phytochemical Screening

The results of the phytochemical screening test for ethanolic extract of *M. troglodytarum* showed the content of alkaloids, flavonoids, saponins, quinones, monoterpenoids, sesquiterpenoids, steroids and triterpenoids. The results of the phytochemical screening can be seen in Table 1. As shown the ethanolic extract from *M. troglodytarum* L. the metabolite was quite similar to the *Musa paradisiaca* reported by Onyenekwe *et al*¹⁷. Ogbonna Obiageli *et al*¹⁸, however, mentioned that some bananas in Nigeria did not contain tannin and alkaloids. This difference in the content of secondary metabolites was thought to be due to the origin of the plant and where the nutrient content of the soil would affect the chemical content of the plant.

Pharmacognostic Parameters

Pharmacognostic parameters referred to Indonesian Pharmacopoeia IV¹⁹ and Indonesian Materia Medika²⁰. Table 2 showed the results of pharmacognostic parameters from the banana fruit and its ethanol extract. The water content of the extract was 9.19% which met the requirements of the water content in extract¹⁰. The content of the extract was soluble in water and the extract obtained was quite large. According to ED-informatics²¹ bananas contain 74% water, 23% carbohydrates, 1% protein, 0.5% fat, and 2.6% fiber which each value varies depending on the cultivar, the level of maturity and growth conditions. Pharmacopoeia parameters of Pharmacopoeia IV and Materia Medika Indonesia slightly difference from the WHO guidelines²² mentioned above for the safety of herbal medicines.

Results of Testing Antidiabetic Activity

Testing of the antidiabetic activity of the ethanol extract of banana fruit considered in male white mice obtained results of measurements of mice fasting blood glucose levels (mg/dL) are shown in Table 3. Then the relative fasting blood glucose levels were calculated by comparing fasting blood glucose levels of mice on the 1st, 2nd, 4th, 6th and 8th days of blood glucose levels on day 0 shown in Fig. 1. The percentage reduction in antidiabetic activity of banana extracts was considered in some test tests shown in Table 4 and clarified in graphical form as in Fig. 2.

Based on the graph of the average blood glucose level (mg/dL), relative blood glucose level (%), and the percentage decrease in antidiabetic activity of positive control group, test group 1, group test 2, test group 3, and test group 4 provided antidiabetic activity.

Actually, the traditional use of all parts of the Banana plant for medicinal uses has been known in any country has traditionally reviewed and reported²³. The flowers are used in treating bronchitis, dysentery, menorrhagia, and ulcers²⁴. Cooked flowers are used to treat diabetes. The astringent plant sap is given in cases of hysteria, epilepsy, leprosy, fevers, hemorrhages, dysentery and diarrhea, and it is applied to hemorrhoids, insect

and other stings and bites. Young leaves are placed as poultices on burns and other skin afflictions. The astringent ashes of the unripe peel and of the leaves are taken in dysentery and diarrhea and are also used for treating malignant ulcers. The roots are administered in digestive disorders, dysentery, and other ailments. It also has anthelmintic property. Banana seed mucilage is given in cases of catarrh and diarrhea in India. Antifungal and antibiotic properties are found in the peel and pulp of fully ripe Bananas. The plant is also used in inflammation, pain, and snakebite. Regarding the banana uses as antidiabetic activity was reported by Kumar *et al*²⁵ who studied the antidiabetic activities of methanolic extracts of the mature green fruit of *Musa paradisiaca*. Singh *et al*²⁶, reported the effect of *Musa paradisiaca* on blood glucose level (BGL) of normal & diabetic mice.

So far there is no scientific report mentioning the use of *Musa troglodytarum* L for antidiabetic treatment. However, there was a report of in vitro antioxidant and antidiabetic activity of *Musa balbisiana* Colla extracts, i.e., root extract²⁷. Fitriani *et al*²⁸ studied the effect on hyperglycemia, hyperlipidemia and augmented oxidative stress in diabetes mellitus of banana peel extract, Laksmi *et al*²⁹ mentioning that the ethanolic extracts and the hexane and chloroform fractions of leaves and fruit peels of *Musa paradisiaca* showed promising antidiabetic activity in STZ-s model. Nguyen *et al*³⁰ even mentioned that the stem juices from *Musa paradisiaca* to find out the real differences from each treatment group on the activity of decreasing blood glucose levels, the experimental data was tested using the variance analysis method (ANOVA) whose results can be seen in Table 5. Based on data from the analysis of the Duncan test with 95% confidence it was seen that the negative control group was in a different subset with the positive control group, test group 3, and test group 1. This showed that the test group 3 test and group 1 and groups positive control had a different effect on the decrease in mice blood glucose levels when compared to negative controls. Test group 2 and test group 4 were in two subsets namely a subset of negative control groups and a subset of positive control groups, test group 1, and test group 3. Test 3 showed the highest antidiabetic activity compared with negative controls, followed by test group 1, test 4, and test 2.

CONCLUSION

The results of this study can be concluded that the extracted ethanol of Fei bananas provided diabetes activity. Test group 3 with 150 mg extract/200g BW followed by the test group 1 150 mg extract/200g BW showed the most effective antidiabetic activity. whereas the test group 4 with 200 mg extract /200g BW and test 2 with 100 mg extract/200g BW showed antidiabetic activity but the activity was not significant with negative control.

ACKNOWLEDGMENTS

We thank PDUPT – Kemristek Dikti to support this project.

REFERENCES

1. Badawi H. Fight and Prevent Diabetes. Yogyakarta: Araska. 2009.
2. Tarmizi T. 45 Types of Antidiabetic Plants, Medicinal Plants and Science, February 22, 2012 [cited 2018 Sept 10]. Available from: <http://tarmiziblog.blogspot.com/2012/02/45-jenis-tanaman-antidiabetes.html>.
3. Muhtadi A, Hendriani R, Mustarichie R, 2013. Pharmacological Screening of Various Indonesian Herbal Potentially Used As antidiabetic, Int. Res J Pharm. App Sci., 2013; 3: 90-5.
4. Chaudhury A, Duvoor C, Dendi VSR, Kraleti S, Chada A, Ravilla R, et.al. Clinical Review of Antidiabetic Drugs:

- Implications for Type 2 Diabetes Mellitus Management, Front Endocrinol (Lausanne). 2017; 8: 6
5. Solihin S. The village head of Linggajati, Personal communication, 2018.
 6. Rizal A. Ranggap banana can cure Diabetes & vitality becomes strong!, 2014 [cited 2018 Sept 24]. Available from http://www.kompasiana.com/aseprizal/pisang-ranggap-langka-bisa-sembuhkan-diabetes-vitalitas-jadi-greng_54f38553745513942b6c79db.
 7. Ploetz RC, Kepler AK, Daniells J, and Nelson SC. Banana and Plantain: An Overview with Emphasis on Pacific Island Cultivars. 2007 [cited 2018 Sept 5] Available from: https://www.ctahr.hawaii.edu/sustainag/extn_pub/.../Banana-plantain-overview.pdf.
 8. BALITBU. Tropical Fruit Research Institute in Tasikmalaya. 2017 [cited 2018 Sept 2]. Available from: <https://balitbu.litbang.pertanian.go.id/images/.../laptah2017.pdf>.
 9. Mustarichie R, Wicaksono IA, Gozali D. Anti-alopecia activity of dadap (*Erythrina variegata* L.) leaves ethanol extract. J Pharm Sci Res., 2017; 9:1849-54.
 10. Departemen Kesehatan RI. Farmakope Herbal Indonesia. 1st ed. Jakarta: Departemen Kesehatan RI; 2008: p. 157-78.
 11. BPOM RI. Monograph of Indonesian Medicinal Plant Extracts. (Indonesian: Monografi Ekstrak Tumbuhan Obat Indonesia). Vol. 1. Jakarta: BPOM RI; 2004: p. 83-4.
 12. Farnsworth NR. Biological and phytochemical screening of plants, J Pharm Sci., 1966; 55, 225-76.
 13. Stephanie S. Duncan's Multiple Range Test (MRT). 2017 [cited 2018 Sept 23]. Available from: <https://www.statisticshowto.datasciencecentral.com/duncans-multiple-range-test/>.
 14. Departemen Kesehatan RI. Farmakope Herbal Indonesia 1st Ed. 2008: p. 157-78.
 15. Sa'adah H and Nurhasnawati H. Comparison of Ethanol and Water Solvents in Making Tiwai Onion Bulbs Extract (*Eleutherine americana* Merr) Using the Maceration Method, Jurnal Ilmiah Manuntung, 2015; 1: 149-153.
 16. Susanti NMP, Budiman INA, Warditiani NK. Phytochemical screening of katuk (*Sauropus androgynus* L. leaves ethanol 90% extract, Jurnal Farmasi Udayana 2014; 3: 83-6.
 17. Onyenekwe PC, Okereke OE, and Owolewa SO. Phytochemical Screening and Effect of *Musa paradisiaca* Stem Extrude on Rat, Current Research Journal of Biological Sciences 2013; 5: 26-9.
 18. Ogbonna Obiageli A, Izundu AI, Helen ON, and Pauline IA. Phytochemical Compositions of Fruits of Three Musa Species at Three Stages of Development, IOSR Journal of Pharmacy and Biological Sciences, 2016; 11: 48 – 59.
 19. Departemen Kesehatan RI. Indonesian Pharmacopoeia (Indonesian: Farmakope Indonesia) IV Ed. Jakarta: Departemen Kesehatan Republik Indonesia 1995: p. 971, 1030.
 20. Departemen Kesehatan RI. Materia Medika Indonesia. Vol. VI. Jakarta: Departemen Kesehatan Republik Indonesia 1989: p. 155-60.
 21. ED-informatics. Banana. 2006 [cited 2018 Aug 11]. Available from http://www.edinformatics.com/culinaryarts/food_encyclopedia/banana.htm.
 22. Parthik P, Patel NM, Patel PM. WHO Guidelines on quality control of herbal medicines, IJRAP 2011; 2: 1148-54.
 23. Lavanya K, Abi Beaulah G, and Vani G. Musa paradisiaca - A Review on phytochemistry and pharmacology, World Journal of Pharmaceutical and Medical Research 2016; 2: 163-73.
 24. Ghani A. Chemical Constituents and Uses. Medicinal Plants of Bangladesh., 2nd Ed, 2003: p. 315
 25. Kumar S, Mishra CK, Ahuja A, Rani A, and Nema N. Phytoconstituents and Pharmacological activities of *Musa Paradisiaca* Linn, Asian Journal of Biochemical and Pharmaceutical Research 2012; 4: 204
 26. Singh SK, Kesari AN, Rai PK, Watal G. Assessment of the glycemic potential of *Musa paradisiaca* stem juice. Indian Journal of Clinical Biochemistry 2007; 22: 48-52.
 27. Kalita H, Boruah DC, Deori M, Hazarika A, Sarma R, Kumari S, et.al. Antidiabetic and Antilipidemic Effect of *Musa balbisiana* Root Extract: A Potent Agent for Glucose Homeostasis in Streptozotocin-Induced Diabetic Rat, Front Pharmacol. 2016; 7: 102.
 28. Fitriani A, Setyawati YD, Khalifah Z, Atiyah FU, Saputra FY. Antidiabetic Activity of Banana Peel Extract: Effect on Hyperglycemia, Hyperlipidemia and Augmented Oxidative Stress in Diabetes Mellitus, Journal of Health Medicine and Nursing 2015; Vol.17 Special Issue for International Conference of Medical and Health Sciences 2015
 29. Lakshmi V, Agarwal SK, Ansari JA, Abbas Mahdi AA, Srivastava AK. Antidiabetic potential of *Musa paradisiaca* in Streptozotocin-induced diabetic mice, The Journal of Phytopharmacology 2014; 3: 77-81.
 30. Nguyen D, Nováková A, Spurná K, Hříčko J, Phung H, 1, Viktorová J, et.al. Antidiabetic Compounds in Stem Juice from Banana, Czech J. Food Sci., 2017; 35: 407–13.

Cite this article as:

Dolih Gozali and Resmi Mustarichie. Anti diabetic activity of ethanol extract of Ranggap bananas (*Musa troglodytarum* L.). Int. Res. J. Pharm. 2018;9(10):80-84 <http://dx.doi.org/10.7897/2230-8407.0910230>

Source of support: PDUPT – Kemristek Dikti, Conflict of interest: None Declared

Disclaimer: IRJP is solely owned by Moksha Publishing House - A non-profit publishing house, dedicated to publish quality research, while every effort has been taken to verify the accuracy of the content published in our Journal. IRJP cannot accept any responsibility or liability for the site content and articles published. The views expressed in articles by our contributing authors are not necessarily those of IRJP editor or editorial board members.