



Provision of Gorocho Banana Flour Pie (*Musa Acuminata*, SP) to Control Blood Sugar Levels in Type 2 Diabetes Mellitus Patients in the East Ratahan Health Center Area

Daniel Robert, Vera T. Harikedua, Olfie Sahelangi, Ruqayah Junus, Phembriah S. Kereh, Nonce N. Legi, Owen N. Potalangi
Manado Ministry of Health Health Polytechnic
danielsamura30@gmail.com

Abstract. Proper treatment in people with diabetes mellitus is done by adjusting the diet to control blood glucose levels. Glycemic index value of gorocho banana has GI value of 46. White gorocho banana can be used as one of the alternative foods that are suitable for people with diabetes mellitus. The purpose of this study was to determine the effect of giving pie from pi-sang gorocho flour on controlling blood sugar levels of type 2 diabetes mellitus patients in the working area of the East Ratahan Health Center. The type of research is quasi-experimental with a one group pre-test-posttest design on 30 samples determined by purposive sampling. Data collection measuring fasting blood glucose levels. Data analysis using statistical test Paired Sample t-Test. Average fasting blood glucose before administration was known to be 230.5 mg / dL, after administration the average value was known to be 219.3 mg/dL. Almost all respondents experienced a decrease in glucose levels during the GDP examination even though it was not at normal values. Test Results t Samples there were differences in fasting blood sugar levels in respondents with type 2 diabetes mellitus before giving gorocho banana flour pie which was 230,500 and after giving gorocho banana flour pie amounting to 219,333, and showed a value of $p = 0.022$ greater than 0.05 with an average of 11.2 mg/dL. Therefore, it is recommended to be able to use gorocho banana flour in order to maintain a diet and avoid foods that easily increase blood glucose levels.

Keywords: Diabetes Mellitus, Gogorocho Banana, Blood Glucose Levels.

1 Introduction

Indonesia is one of the developing countries that has various health problems. The development of the world towards the era of globalization has caused various problems in the health sector, namely degenerative diseases. Degenerative diseases are influenced by changes in behavior, lifestyle, diet, and unbalanced activities. The increasing incidence of degenerative diseases makes some people aware of the importance of health. This has an impact on changing lifestyles and food consumption which is a

phenomenon in the consumptive life of today's people who prefer fast food or snacks that sometimes do not pay attention to the substances or ingredients contained in the food consumed [1].

Carbohydrates are known to be an important component of food, especially as the main source of energy for the human body. The International Diabetes Federation (IDF) explains that diabetes mellitus is a chronic condition that often occurs when the body does not produce insulin. IDF said Indonesia was ranked 7th with the number of diabetics as many as 8.5 million people[2]. In 2019, Indonesia was ranked the seventh highest (after China, India, USA, Pakistan, Brazil, and Mexico) in terms of the highest number of diabetes patients in the world. There are approximately 10.70 million people >65 years of age. In 2019, Indonesia was also the fifth-ranked country in the world, in terms of the number of adults (20–79 years) with undiagnosed diabetes. In 2013 the prevalence of diabetes mellitus in North Sulawesi according to the results of Riskesdas 2018 was 6.9% and in 2018 it increased to 8.5%, then in Southeast Minahasa the prevalence of diabetes mellitus was recorded at 1.66% so that appropriate treatment for people with diabetes mellitus (DM) was carried out by adjusting diet to control blood glucose levels to be controlled[3].

Low glucose levels in the blood are called hypoglycemia and high glucose levels in the blood are called hyperglycemia. In order to function optimally, the body must be able to maintain blood sugar concentrations (in the form of glucose) within certain limits, namely blood sugar levels or normal blood glucose that are recommended are 120-140 ml / dL at all times and 70-100 ml / dL. dL in a fasted state [4].

Controlled or controlled blood sugar levels do not only depend on the disappearance of diabetes symptoms, but must be checked by checking blood glucose levels. Checking blood glucose levels can be done in the laboratory, in the clinic during consultation or can be done alone by patients at home. Good glycemic control affects the reduction of diabetes complications, diabetes control and complication (DCCT) test results shows that good diabetes control can reduce chronic diabetes complications between 20-30%. In controlling blood sugar levels, we must provide food intake with a low glycemic index. Therefore, the glycemic index value of goroho bananas has a GI value of 46-51[5].

Banana plants (*Musa sp.*) are a type of commodity that has a fairly high prospect. In this case because banana plants are a commodity that is quite preferred by most people in the world [6]. The characteristics and traits that exist in the morphology of banana plants are to have the most accurate determination process to be able to determine an agronomic trait in a classification in taxonomy in plants [7]. This banana is a typical banana of North Sulawesi, with a carbohydrate content of 75.18% with fiber 5.12% and a proportion of starch 70.78%, namely amylose 39.59% and amylopectin 31.19% [8].

Goroho bananas contain antioxidants that function to prevent damage to body cells, such as damage to cells β the pancreas which is a major factor in the occurrence of diabetes mellitus. The supply of antioxidants from white goroho bananas can also help prevent clinical complications in diabetes mellitus. From this combination, it can be said that white goroho bananas can be used as one of the suitable food alternatives for people with diabetes mellitus because it has a preventive function, namely That is to prevent the onset and development of diabetes mellitus [9].

Diversification of local food can add value to food products and can increase local food production and support food security. One of the efforts to support food security programs is the processing of local food sources of carbohydrates which are used as the main source of alternative food products, such as pie crusts or pie crusts [10]. Pie is a type of pastry consisting of a dough crust along with fillings and toppings. Pie crust dough is made from simple ingredients such as wheat flour, lipids, water and salt, while vla (filling) has a soft and thick texture, the texture of vla is influenced by the ingredients used. Therefore, it is necessary to develop the manufacture of food products such as pie dough using flour from local raw materials in the form of goroho banana composite flour [11].

2 Methods

The type of research used is quasi-experimental research which aims to determine cause-and-effect relationships, with a one group pre-test-posttest design, namely research carried out on one group only and measurements taken before being given treatment and after being given treatment. This research was carried out in May 2023 in the East Ratahan Community Health Center area. The sample in this study was people who had a history of type 2 diabetes mellitus, the sampling method was using a purposive sampling method and the sample size was 30 people.

3 Research Path/ Research Procedure

The research procedure started with the researcher obtaining permission to conduct research from the Nutrition Department of the Manado Ministry of Health Polytechnic addressed to the head of UPT Ratahan Timur who was given official permission to conduct research in the working area of the Ratahan Timur Health Center and for blood sampling assisted by health workers (Nurse/Health analyst). The steps in collecting research data include:

1. Arrange for a certificate of eligibility for research ethics to the Research Ethics Commission of the Manado Polytechnic of the Ministry of Health.
2. The researcher brought a research permit to the East Ratahan Health Center.
3. Determining research subjects with purposive sampling technique.
4. Describe the procedure for data collection.
5. Explain about product administration which will be given for 3 days and will be controlled for one week.
6. Checking blood sugar levels and conducting a 24-hour recall to determine the respondent's intake.
7. The data obtained is recorded in a previously prepared data collection format.
8. Furthermore, the collected data is processed data, data analysis and presentation of data in tabular form.

4 Processing and Analysis of Data

The data processing process is a way in which the resulting data can provide information that is useful and easy to accept. In this research, data processing begins with entering the data that has been collected and then editing the data again to prevent errors in the data before it is tabulated. The data that will be tabulated is in the form of blood sugar levels before and after administration, and the results of recall of carbohydrate intake before and after administration of Goroho banana flour pie. After the data has been tabulated, the data analysis process continues.

4.1 Univariate Analysis

Average blood sugar levels before and after treatment or intervention. Includes sample characteristics, namely age, gender, education level, occupation, duration of DM, using medication or not, height, weight, and distribution of pre-test and post-test blood sugar levels.

4.2 Bivariate Analysis

The bivariate analysis used was to test the differences between independent and dependent variables to determine the effect of giving Goroho Banana Flour Pie (*Musa Acuminata, Sp*) on controlling blood sugar levels in Type 2 diabetes mellitus sufferers in the East Ratahan Health Center Working Area with a significance level of $\alpha = 0.01$. To determine the difference between these two variables, a statistical test was carried out by looking at the difference in carbohydrate nutrient intake before and after the intervention, analyzed using the *Paired Sample t-Test*.

5 Results

5.1 Univariate analysis

Table 1 shows the results of univariate analysis on age characteristics of 30 respondents in the working area of the East Ratahan Health Center. Based on Table 1, it is described for people with a vulnerable age of 60-69 years with the most number of respondents being 11 people and followed by a vulnerable age of 50-59 years. Then for the sex of the most respondents, namely women with the number of respondents 21 people.

Table 1. Characteristics of respondents

Age	Average	
	n	%
30 – 40	1	3.3
41 – 49	2	10.0
50 – 59	10	43.3

60 – 69	11	80.0
70 – 79	6	100.0
Amount	30	100
Gender		
Man	9	30.0
Woman	21	70.0
Amount	30	100

Table 2. Blood Sugar Levels before giving Goroho Banana Flour Pie to Type 2 DM sufferers

Variable	Fasting blood glucose (mg/dl)	n	%
Blood sugar levels	≥ 126	30	100
	100 -125	0	0
	< 100	0	0
Amount		30	100

Table 3. Blood Sugar Levels after administration of Goroho Banana Flour Pie

Variable	Fasting blood glucose (mg/dL)	n	%
Blood Sugar	≥ 126	27	87.0
	100 -125	3	13.0
	< 100	0	0
Amount		30	100

Based on Table 2, it shows that all respondents had type 2 diabetes mellitus because at the time of examination all fasting blood sugar values were above 126 mg/dL. Based on Table 3, it shows that the results of the examination after giving the goroho banana flour pie were fasting blood sugar levels <126 mg/dL in 3 respondents and fasting blood sugar ≥ 126 mg/dL in 27 respondents. In the study of giving goroho banana flour pie, a decrease in blood sugar levels occurred, a decrease in blood sugar did not reach normal values. Based on Table 4 Carbohydrate intake before administration and after administration the average carbohydrate intake is categorized as less because it is <80% while for results > 80% before administration only 2 people and after administration only 1 person, because the intake of respondents consumed less than the recommended intake.

From the results of the normality test, it is known that the sig value for giving goroho banana flour pie to blood sugar levels is $0.120 > 0.05$, so it is concluded that the data is normally distributed.

Table 4. Carbohydrate intake before & after giving Banana Flour Pie Goroho

Carbohydrate intake	Categoryyy	n	%
Before	< 80%	28	93,3
	>80%	2	6,6
After	< 80%	29	96,6
	>80%	1	3,3

Table 5. Effect of Giving Goroho Banana Flour Pie on Blood Sugar

Variable	Average value	t	P
Blood Sugar	Before 230.500	2.192	0.022
Levels	After 219.333		

Based on Table 5 the results of statistical analysis using the paired sample t-test obtained an average score of blood sugar levels before giving Goroho banana flour pie, which was 230,500 and after giving Goroho banana flour pie, which was 219,333. In addition, based on the sig.(2-taled) value of 0.022 <0.05, it can be concluded that there is a significant difference between blood sugar levels in the data before and after the intervention of the effect of giving goroho banana flour pie to type 2 diabetes mellitus.

Table 6. Effect of KH Intake on Giving Goroho Banana Flour Pie

Variable	Average value	t	P
Intake Carbohydrate	Before 1271.233	1.757	0.089
	After 1097.567		

Based on Table 6, it shows that the results of the analysis using the paired sample t-test obtained an average score before administration of 1271,233 and after administration of 1097,567. Then based on the P value of 0.089 > 0.05, it can be said that there is no significant difference in carbohydrate intake before and after administration.

6 Discussion

During the study, the characteristics of respondents obtained were those who had a history of type 2 diabetes or a test score of >126 mg / dl. In this study, respondents aged 30-79 years amounted to 30 people and the highest number was 11 respondents aged 60-69 years (80%). This finding is in line with research [12], which shows that type 2 diabetes mainly occurs in women, which is 60.4%.

According to [13], carbohydrates from different plants have different glycemic responses. Different glycemic responses can also occur in carbohydrates from the same plant but different varieties; therefore, it is often impossible to know whether this effect is due to the amount of carbohydrate available, or due to the GI of the available carbohydrate, since GI is often confused with availability and biology. The second problem with the classical GI approach is that it does not really address the glycemic response caused by foods, which also depend on the CHO content in those foods [14].

6.1 Blood sugar levels before and after administration

In Indonesia, especially in North Sulawesi, local food has not been utilized optimally by the community because of its unattractive presentation, thus reducing the level of consumption. The lack of maximum utilization of local resources to be appointed as more quality and attractive food is caused by the inability of the community to master the processing technology Bananas as processed fruits can be fried, boiled or made into cakes.

The processed bananas that we most often encounter are fried, because the process is easy, many variations can be created and favored by many people as food friends drinking coffee or snacks[15]. Each individual has different blood sugar levels, due to whether there is a history of diabetes in the family environment and the performance part of the insulin hormone in the body[16].

Based on the results of examining blood sugar levels before giving Goroho Banana Flour Pie, it shows that there is a change in value where from the results of the examination there is a change with the results of 26 respondents experiencing a change in value with an average blood sugar level of 18,923 even though it is not yet at a normal value while 4 respondents experienced an increase because intake exceeds the recommended intake.

These results indicate that blood glucose levels in type 2 DM patients in the working area of the East Ratahan Health Center cannot be said to be controlled and have not met the target of controlling fasting blood glucose in Diabetes Mellitus patients, namely <100 mg/dL. Goroho bananas are good for consumption for people with diabetes mellitus because they have a low glycemic index, so they can be recommended as a substitute food for people with Diabetes Mellitus and contain fiber and antioxidants which prevent and relieve Diabetes Mellitus [17]

6.2 Differences in Blood Sugar Levels Against Giving Goroho Banana Flour Pie

Based on the results of the analysis of giving goroho banana flour pie to blood sugar, a p value = $0.022 < 0.05$ was obtained, meaning that there was a difference in the value of blood sugar levels before and after administration. The modification of goroho bananas into flour is then processed into the main ingredient in making cakes, goroho banana flour has a nutritional composition of carbohydrates 75.2%, protein 5.2%, fiber 5.1%, fat 1.0%, water content 11.3%, ash content (2.3%).

In addition to the above nutrients, gogoroho bananas also have a low glycemic index value so they are well consumed by people with diabetes mellitus [18]. The results of research conducted by [19], calculating the GI value obtained the result that the GI value of instant goroho banana pulp of 31.88 is included in the low category. Goroho banana flour also contains starch levels, through research conducted by [20], Analysis of water content using 80% goroho banana and 20% tapioca yielded 4.00% content. Starch acts as a food source that produces the main energy from easily absorbed carbohydrates. The starch content itself is one of the quality criteria for wheat flour, both as food and non-food ingredients with a starch content value of 72.86%.

The results of this study are also in line with research [21], which states that gogoroho bananas have the potential to reduce the formation of the Maillard reaction in the body. In this study, what appears in goroho bananas also contains compounds such as carbohydrates, dextrose, and levulose which are simple sugars.

Simple sugars contained in white Goroho bananas also supported increased levels of dicarbonyl compounds in the Maillard reaction inhibition test and total antioxidant extract. Goroho banana acetone is 1.83/100gm. So, from this relationship it can be said that goroho bananas can be used as one of the suitable food alternatives for people with diabetes mellitus because it has a preventive function, namely preventing the development and emergence of diabetes mellitus [22].

7 Conclusion

Based on the results of research conducted on the community about the effect of giving goroho banana flour pie on controlling blood sugar levels in type 2 diabetes mellitus patients, it can be concluded, as follows is based on the results of examining blood sugar levels before administration, it is known that the average sample value is 230.5 mg/dL. Where all respondents are in the value of GDP > 126 mg/dL. Based on the results of examining blood sugar levels after administration, it is known that the average sample value is 219.3 mg/dL. Where almost all respondents experienced a decrease when examining GDP even though it was not at a normal value. There is a difference in giving goroho banana flour pie to blood sugar levels in respondents who have type 2 diabetes mellitus by showing a significant value ($p = 0.022$ greater than a significant value of 0.05) with an average of 11.2 mg/dL.

8 References

- [1] S. Tinggi and I. K. Trinita, "Inhibition of Maillard Reaction from White Goroho Banana Fruit Extract (*Musa acuminata* Colla) as Diabetes Mellitus Prevention (2019)," *Fullerene Journ. Of Chem*, vol. 4, No. 1, pp. 16–20.
- [2] B. Zinman, "The International Diabetes Federation World Diabetes Congress (2015)," *Eur Endocrinol*, vol. 11, no. 2, p. 66, 2015, doi: 10.17925/EE.2015.11.02.66.
- [3] International Diabetes Federation, *IDF diabetes atlas*. International Diabetes Federation, (2015).

- [4] W. Faswita, L. Suarni, and E. Elfira, "The Relationship Between Self-Care Activity And The Incidence Of Complications In Patients With Diabetes Mellitus At Puskesmas Binjai Kota," July, (2023).
- [5] A. Bin Arif, A. Budiyanto, and Hoerudin, Balai Besar Penelitian dan Pengembangan Pascapanen Pertanian Jalan Tentara Pelajar, , "The Glycemic Index Value Of Food Products And The Factors Affecting Them Glicemic Index of Foods and Its Affecting Factors," (2013).
- [6] R. A. Weihana *et al.*, "Identification Of Diversity Of Morphological Characters Of Banana Plants (*Musa* spp.) Land Area In Tanjung Jabung Timur Regency Identification Of Morphological Characters Of Banana Plant (*Musa* spp.) In Land Area Tanjung Jabung East District," (2020).
- [7] P. A. Ralston, K. (K. A. S.). Wickrama, C. C. Coccia, J. L. Lemacks, I. M. Young-Clark, and J. Z. Ilich, "Health for Hearts United Longitudinal Trial: Improving Dietary Behaviors in Older African Americans," *Am J Prev Med*, vol. 58, no. 3, pp. 361–369, Mar. (2020), doi: 10.1016/j.amepre.2019.09.024.
- [8] U. Sarker and S. Oba, "Protein, Dietary Fiber, Minerals, Antioxidant Pigments And Phytochemicals, And Antioxidant Activity In Selected Red Morph Amaranthus Leafy Vegetable," *PLoS One*, vol. 14, no. 12, Dec. (2019), doi: 10.1371/journal.pone.0222517.
- [9] H. S. Kaempe, E. Suryanto, and S. E. S. Kawengian, "Potency Of Phenolic Extract Of Goroho Banana Fruit (*Musa* spp.) Against The Blood Sugar Of White Rats (*Rattus norvegicus*)," (2013).
- [10] H. Anwar, P. Studi Keperawatan, Stik. Jayakarta, and J. Timur, "Utilization Of Kepok Banana Peel (*Musa paradisiaca* L.) As A Substitute For Wheat Flour In Biscuit Processing," vol. 4, (2021).
- [11] J. H. Mandei, B. Riset, D. Standarisasi, and I. Manado, "Pengaruh Penambahan Tepung Pisang Goroho Terhadap Mutu Snack Food Effect Of Addition Of Banana Goroho Flour On The Quality Of Snack Food," (2017).
- [12] A. K. Mamentu *et al.*, "Analysis of the sensory, physical and chemical qualities of toddler biscuits made from flour mixtures MOCAF (Modified Casavva Flour) and Carrots (*Daucus carota*) Analysis Quality Of Sensory Physical And Chemical Biscuits Toddlers Which Made From Mixture Of Flour Mocaf And Carrots."
- [13] J. Kasengke, Y. A. Assa, and M. E. Paruntu, "Description Of Instantaneous Sugar Levels In Young Adults Aged 20-30 Years With Body Mass Index (IMT) ≥ 23 kg/m²."(2015).
- [14] N. M. H. Osman, B. N. Mohd Yusof, and A. Ismail, "Glycaemic index and glycaemic load of foods and food products in Malaysia: a review," *Int Food Res J*, vol. 28, no. 2, pp. 217–229, Apr. (2021), doi: 10.47836/ifrj.28.2.01.
- [15] G. H. Putra, E. J. N. Nurali, T. Koapaha, and L. E. Luluhan, "Making Analog Rice Based On Goroho Banana Flour (*Musa Acuminate*) With Binders Carboxymethyl Celluloce (CMC)," *Jurnal Coco*, (2012).
- [16] P. Endokrinologi Indonesia "Guidelines For The Management And Prevention Of Adult Type 2 Diabetes Mellitus In Indonesia (2021) Perkeni, PB Publisher. Perkeni."

- [17] F. Rahmawati, J. Education, T. Boga, D. Clothing, K. Food, and D. D. Food, "Diversification Of Processed Cassava And Bananas."(2013).
- [18] F. Sayangbati *et al.*, "Physicochemical Characteristics Of Biscuits Made From Goroho Banana Flour (*Musa acuminata*,sp)."
- [19] E. Septianingrum, B. Kusbiantoro, Center for Rice Plant Research Jl Raya, T. Pos, C. Subang, and -West Java, "Review of Rice Glycemic Index: Influencing Factors and Their Relation to Body Health Rice Glycemic Index: The Factors Affecting and The Impact on Human Health.", *Journal Of Health*, ISSN 1979-7621, vol. 1, no. 1, june (2016): 1-9
- [20] R. A. Weihana *et al.*, "Identification Of Diversity Of Morphological Characters Of Banana Plants (*Musa spp.*) Land Area In Tanjung Jabung Timur Regency Identification Of Morphological Characters Of Banana Plant (*Musa spp.*) In Land Area Tanjung Jabung East District," (2020).
- [21] Y. A. Begum and S. C. Deka, "Stability of spray-dried microencapsulated anthocyanins extracted from culinary banana bract," *Int J Food Prop*, vol. 20, no. 12, pp. 3135–3148, Dec.(2017), doi: 10.1080/10942912.2016.1277739.
- [22] S. Rahayu and Stik. Jayakarta PKP DKI Jakarta, "The Relationship Between Age, Sex And Body Mass Index With Fasting Blood Sugar Levels In Type 2 Diabetes Mellitus Patients At Proclamation Outpatient Primary Clinic, Depok, West Java," (2020).

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

