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The Effect of Forest Honey (Dorsata Sp.) and Trigona Honey (Trigona Sp.) on Changes in Blood Glucose Levels of Patients with Type 2 Diabetes Mellitus in Labibia Health Center, Kendari City, Indonesia

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Abstract

The National Basic Health Research Report noted that in Indonesia, the prevalence rate of Diabetes Mellitus in the ≥15 years age group continued to increase from 1.3% in 2013 to 2% in 2018 and in the Labibia Health Center showed an increasing prevalence rate from 0.5% in 2020 to 0.6% in 2022. This study aims to determine The Effect of Forest Honey and Trigona Honey on Changes in fasting blood sugar levels of patients with Type 2 Diabetes Mellitus. The type of research used is Quasi-Experimental with not randomized control group pretest posttest design. The sample size of 48 people consisting of 24 people in the forest honey group and 24 people in the trigona honey group with purposive sampling method. Data analysis using Wilcoxon test and Mann-Whitney test. The results of the study the average value of fasting blood sugar levels before being given forest honey was 196,41 mg/dl after 169,83 mg/dl with a value of p<0.05 (p=0.001}, in trigona honey before 204,45 mg/dl after 163,87 mg/dl, with a value of p<0.05 (p=0.000). The difference between forest honey and trigona honey obtained an average of 20,85 mg/dl and 28,14 mg/dl with a value of p>0.05 (0.071). Forest honey and trigona honey are good for consumption as an alternative therapy for people with Type 2 Diabetes Mellitus to control blood glucose.

Keywords: Blood Sugar Level, Forest Honey, Trigona Honey.

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1. Introduction

The International Diabetes Federation (IDF) in 2021 recorded 6.7 million deaths from diabetes or 1 person every 5 seconds. There are 537 million adults (aged 20 - 79 years) or 1 in 10 people living with diabetes worldwide. China has the largest number of adults with diabetes in the world at 140.87 million, followed by India with 74.19 million diabetics, Pakistan with 32.96 million and the United States with 32.22 million. Indonesia is fifth with 19.47 million with a prevalence of 10.6% [1]. The incidence and prevalence of Type 2 Diabetes Mellitus tends to increase from year to year. In Indonesia, the prevalence rate of Diabetes in the ≥15 years age group continues to increase from 1.3% in 2013 to 2% in 2018 [2]. Type 2 Diabetes Mellitus in Indonesia is predicted to continue to increase from 8.4 million in 2000 and will be around 21.3 million in 2030 [3].

Labibia Health Center is one of the health centers in Kendari City that experiences an increasing trend in the incidence of Diabetes every year. The Diabetes prevalence rate continues to increase from 0.5% in 2020 to 0.6% in 2022. In addition, in 2022, Labibia Health Center was one of the health centers with the lowest achievement or did not reach the target in terms of Diabetes patients who received health services according to standards, which was 69.3% [4]. Diabetes Mellitus is a group of metabolic diseases with elevated blood glucose levels or hyperglycaemia. Severe hyperglycemia causes classic symptoms such as polyuria, polydipsia, fatigue and decreased performance, unexplained weight loss through visual impairment and susceptibility to ketoacidosis infection or non-ketoacidosis hyperosmolar syndrome with risk of coma.

Chronic hyperglycaemia also leads to impaired insulin secretion and/or action and is associated with long-term damage and dysfunction of various tissues and organs (eyes, kidneys, nerves, heart and blood vessels) [5]. Type 2 Diabetes Mellitus is a chronic disease that can cause a series of complications that can lead to death. Therefore, preventing or delaying the occurrence of complications is the main goal of treating Type 2 Diabetes Mellitus, and the main concern for those with Diabetes is to maintain blood glucose levels within the normal range. Currently, the treatment of Type 2 Diabetes Mellitus mainly relies on lifestyle interventions such as nutritional therapy, physical activity, oral drugs, injectable drugs, surgical treatment, complementary and alternative medicine [6]. Many people have used herbal medicine from natural ingredients as one of the therapeutic options in healing diseases. The use of antidiabetic drugs that use natural ingredients to treat Diabetes is also an interesting thing. Many herbs or medicinal plants are used in the treatment of Diabetes [7]. Herbal plants mostly contain flavonoid compounds that function as antioxidants that can overcome free radicals, and prevent toxic compounds in the body. In addition, some plants have antidiabetic functions that can reduce glucose levels in the blood so that they can prevent and be used as therapy in Diabetes [8]. Honey is one of the herbs that can be used by diabetics. Honey is a food substance produced by honeybees. Efforts to treat or maintain health conditions in order to reduce blood glucose levels can be done by using herbs as a non-pharmacological option. Honey contains phenolic compounds consisting of various subclasses, namely flavonoids, phenolic acids, anthocyanins, stilbenes, lignans, tannins, and oxidized polyphenols [9]. The phenolic content in honey has been shown to have anti-inflammatory and antioxidant properties. Quercetin is one of the important components in honey used as an antidiabetic [10]. Quercetin is one of the compounds found in flavonoids [11].

2. Materials and methods

This study was conducted at the Labibia Health Center, Kendari City. This study used a not randomised control group pretest posttest design to determine the effect of forest honey and trigona honey on changes in fasting blood sugar levels in patients with type 2 diabetes mellitus. The population in this study were all diabetes mellitus patients registered at the labibia health center. Diabetes mellitus data was collected from patient visit reports recorded in 2022. The total population was 104 people. The sample size was 48 people consisting of 24 people in the forest honey group and 24 people in the trigona honey group. This study used non-probability sampling with purposive sampling method and respondents were willing to be given forest honey and trigona honey for 4 weeks and respondents did not have stroke complications, a history of CHD, and kidney disorders. Samples were given forest honey (Dorsata bee species) and trigona honey (Trigona bee species) for 4 weeks totaling 40 ml and consumed twice a day, 20 ml in the morning and 20 ml at night. The examination carried out was fasting blood sugar levels. The instruments used in this study were Informed Consent, Standard Operating Procedure blood glucose levels, Standard Operating Procedure giving forest honey and trigona honey, Questionnaire Sheets, tools using a calibrated GCU and the materials used were measuring cups, aluminium foil sachet, forest honey and trigona honey. This study was approved by the Health Research Ethics Committee of Hasanuddin University with ethical approval recommendation number 4630/UN4.14.1/TP.01.02/2023. Informed consent was obtained from all research respondents, data confidentiality was maintained and privacy was guaranteed.

3. Results

In Table 1, the general characteristics of the research subjects show that the majority of research subjects are female, as many as 29 people (60.4%). Age group, most of the research subjects were in the 56-65-year age group totaling 27 people (56.2%). Level of education, most of the research subjects were in Elementary school totaling 26 people (54.1%). Most of the research subjects work as housewives (IRT) as many as 15 people (31.2%). Body mass index, most of the research subjects with obesity (≥25 kg/m^2) as many as 26 people (54.1%). In table 2, the characteristics of respondents mostly have a family history of diabetes as many as 31 people (64.5%). Long suffering, most of the research subjects suffered >5 years as many as 30 people (62.5%). Not doing physical activity as many as 29 people (60.4%). Smoking behavior, almost all respondents do not smoke as much as 46 people (95.8%). And consume vegetables and fruit as many as 45 people (93.7%). As shown in Figure 1, the average decrease in fasting blood glucose levels in the forest honey group and trigona honey group was greatest in trigona honey group, from 204.45 mg/dl before intervention to 163.87 mg/dl after trigona honey intervention. Meanwhile in the forest honey group, it decreased from 196.41 mg/dl to 169.83 mg/dl after forest honey intervention. Table 3 shows that the average fasting blood glucose score at the time of the pre-test was higher in the control group, 204.45 than in the intervention group, which was 196.41. The results of the statistical test at the time of the pre-test obtained $p>0.05$ ($p=0.622$), so statistically there was no significant difference in the mean fasting blood glucose score between the intervention and control groups. While the average score of fasting blood glucose at the time of the posttest in the control group was 16.,87 compared to the intervention group, which was 169.83. The results of the statistical test at the time of the posttest obtained $p>0.05$ ($p=0.713$), so statistically there was no significant difference in the mean blood glucose score between the intervention group (forest honey) and the control group (trigona honey). Table 4 shows the average difference in intervention values of fasting blood glucose between the intervention and control groups is 20.85 mg/dl in the intervention and control groups, which is 28.14 mg/dl. The results of the statistical test of the difference between the intervention group and control group obtained $p>0.05$ ($p=0.071$) which means that there is no significant difference between the intervention (forest honey) and control groups (trigona honey).

4. Discussion

4.1. Differences in blood glucose before and after intervention

The results of the Wilcoxon test analysis on forest honey showed that there was a difference in the average decrease in fasting blood glucose levels by 26.58 mg/dl with a $p<0.05$ ($p=0.001$).

This shows that, there are differences in fasting blood glucose levels before and after administration of forest honey in the intervention group. After giving forest honey, it can reduce fasting blood glucose levels 26.58 mg/dl and the effect is statistically significant. This study is in line with previous research that compared blood glucose levels in diabetic rats given wild honey (apis dorsata) with the drug metformin. The study resulted in a conclusion that showed a significant difference between groups, where wild honey at a dose of 2 g/kg BW/day reduced blood glucose levels by the largest percentage [12]. A study of 100 post-menopausal women given tualang honey (forest honey) 20 grams/hour for 12 months showed a significant reduction in fasting blood glucose levels with a $p<0.05$ ($p=0.021$) [13]. This may occur because wild honey reduces hyperglycaemia and ameliorates oxidative stress in the pancreas. The hypoglycemic effect of wild honey is due to its antioxidant effect on the pancreas, which is for the prevention of oxidative stress and free radical damage in diabetes [14]. The results of the Wilcoxon test analysis on trigona honey showed that there was a difference in the average decrease in fasting blood glucose levels by 40.58 mg/dl with a $p<0.05$ ($p=0.000$). This shows that there are differences in fasting blood glucose levels before and after administration of trigona honey in the control group. After giving trigona honey, it can reduce fasting blood glucose levels 40.58 mg/dl and the effect is statistically significant. This study is in line with research on type 2 Diabetes Mellitus patients with comorbidities given trigona honey 60 gr / hour for 7 days proving that there is a decrease in blood glucose levels temporarily the trigona honey group with a $p<0.05$ ($p=0.021$) [15]. Further research shows that trigona honey has better antidiabetic properties than other processed honeys, potentially through the inhibition of alpha amylase and alpha glucosidase enzymes, which are enzymes involved in the breakdown of carbohydrates [16].

4.2. Difference between pretest and posttest blood glucose between intervention and control groups

The results showed that the average score of fasting blood glucose at the time of the pretest was higher in the trigona honey group (control group) compared to the wild honey group (intervention group). In the forest honey group at 196.41 mg/dl and trigona honey at 204.45 mg/dl. The results of the statistical test at the time of the pretest obtained a $p>0.05$ ($p=0.622$), so statistically there was no significant difference in the mean fasting blood glucose score between the intervention group and the control group. The results showed that the average fasting blood glucose score at pretest showed the highest average value in the control group compared to the intervention group. The average score of fasting blood glucose at the time of the posttest in the control group was 163.87 compared to the intervention group, which was 169.83. The results of the statistical test at the time of the pre-test obtained a $p>0.05$ ($p=0.713$), so statistically there was no significant difference in the average fasting blood glucose score during the intervention group and the control group. This shows that the difference in fasting blood glucose at the time of the posttest shows the highest average value in the intervention group than in the control group. So, it can be said that the control group (trigona honey) is more effective and faster in reducing blood sugar in patients with diabetes mellitus, even though the intervention group (forest honey) and the control group (trigona honey) both contain flavonoids that can stimulate the work of the pancreas and increase insulin secretion. Trigona honey has better quality than other honeys, due to its nutritional content. The total phenolic content of trigona honey is higher with an average of 784.3 mg Gallic Acid Equivalent/kg compared to Apis spp. honey with an average of 590.5 mg Gallic Acid Equivalent/kg [17].

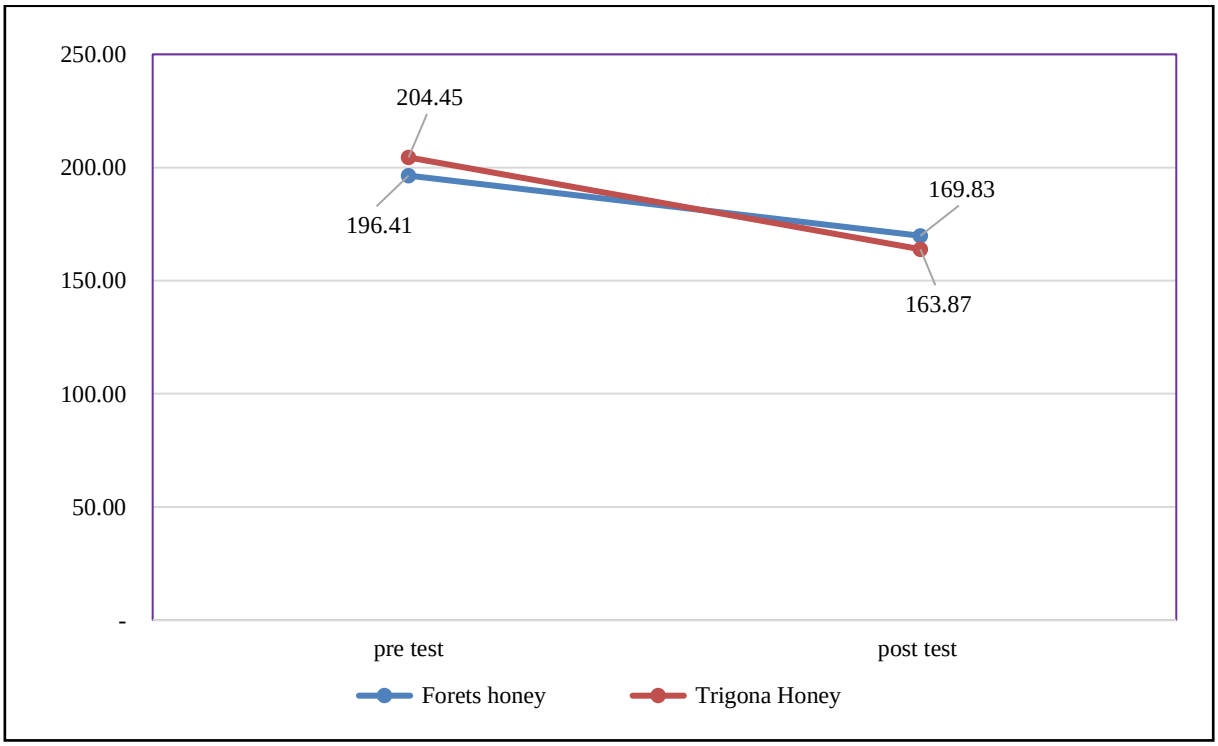

Figure 1: Average Blood Sugar Reduction in Both Groups.

Table 1: General Characteristics of Research Subjects.

Characteristics	N	%
Sex		
Man	19	39.5
Women	29	60.4
Age group, years		
≥46-55 years	21	43.5
≥56-65 years	27	56.2
Occupation		
Notworking	3	6.2
Housewife	15	31.2
Civil Servant	3	6.2
Private	4	8.3
Farmers	9	18.7
Merchant	8	16.6
Pensioner	6	25.5
Education		
Elementary school	26	54.1
Junior school	8	16.6
High school	11	22.9
Higher school (Diploma/S1/S2)	3	6.2
Body mass index		
Non-Obesity (<25 kg/m^2)	22	45.8
Obesity (≥25 kg/m^2)	26	54.1

Table 2: Respondent's Characteristics.

Characteristics	N	%
Family history		
Yes	31	65.5
No	17	35.4
Long suffering		
≤5 years	18	37.5
>5 years	30	62.5
Physical activity		
Already	19	39.5
Do not	29	60.4
Smoking Behaviour		
Already	2	4.1
Do not	46	95.8
Consumption of fruit vegetables		
Already	45	93.7
Do not	3	6.2

Table 3: Difference between pretest and posttest fasting blood glucose intervention group and control group.

Variable	Blood Sugar Group	Mean	SD	Mean Difference	*p* Value
Pretest	Intervention	196,41	49,00	-8,04	0,622
	Control	204,45	62,70		
Posttest	Intervention	169,83	49,22	5,96	0,713
	Control	163,87	61,67		

Table 4: Analysis of averages and margins of fasting blood glucose intervention group and control group.

Variable	Blood Sugar Group	Mean Rank	Mean Difference	*p* Value
Pre – Posttest	Intervention	20,85	-7,29	0,071

4.3. Analysis of averages and differences in the intervention and control group

The results of the Mann-Whitney test analysis showed no significant difference between the forest honey and trigona honey groups with a $p>0.05$ ($p=0.071$). The mean difference was 20.85 mg/dl in the forest honey group and 28.14 mg/dl in the trigona honey group. The results of this study are in line with previous research exploring the effects of different types of honey and their doses in lowering fasting blood glucose. Using 42 male Swiss Webster rats induced by alloxan to become hyperglycemic, the researchers found that all types of honey could lower fasting blood glucose, especially after three weeks. However, there was no significant difference between honey from different types of honeybees and the doses used in lowering fasting blood glucose [18].

4. Conclusions

The results showed that the average value of fasting blood glucose levels before being given forest honey was 196.41 mg/dl after 169.83 mg/dl with $p<0.05$ ($p=0.001$), in trigona honey before 204.45 mg/dl after 163.87 mg/dl with $p<0.05$ ($p=0.000$). This shows that there is a significant effect on fasting blood sugar levels in patients with Type 2 Diabetes Mellitus who are given forest honey and trigona honey.

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