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RESEARCH ARTICLE

Effect of Bee Pollen Kelulut Bees on HBA1C in Type 2 Diabetes Mellitus Patients

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Abstract Bee pollen has been used for generations to treat various diseases, including diabetes mellitus, because it inhibits alpha glucosidase enzyme. Two major problems suffered by patients with type 2 Diabetes Mellitus (DM) are linked to insulin resistance and impaired insulin secretion. They often occur in patients aged above 30 years and obese patients. High blood glucose and other complications, including increased HBA1C, are some of the risks faced by people with type 2 diabetes mellitus. This study aimed to reveal the efficacy of bee pollen in lowering the HBA1C levels of patients with type 2 DM. Subjects were gave bee pollen kelulut bees to the intervention group, twice a day in the morning during 4 weeks. This study was quasy experimental research. It involved 30 patients who were divided into the intervention group and the control group. Data were analysis determined the differences in the control and intervention groups using the Mann Whitney test. The result of pre- and post-group was p value=0.001(<0.05), meaning that there was a significant difference in median cholesterol levels, while the result difference of the two groups was p value=0.033 (<0.05), implying there was a significant difference in HBA1C levels of the two groups. Bee pollen has been shown to lower HBA1C and have a potential as a non-pharmacological treatment in patients with type 2 DM

Keywords: Type 2 Diabetes Mellitus, Antidiabetic Activity, Bee Pollen kelulut bees

Introduction

Diabetes mellitus is characterized by chronic hyperglycaemia and development of microvascular complication such as nephropathy, retinopathy, and neuropathy (Maqbool *et al*., 2018). As a result of its microvascular pathology, diabetes is a leading cause of nephropathy leading to end-stage renal disease (ESRD), which accounts for 35 % of all new cases requiring dialysis therapy in developed countries (Al-Saeed *et al*., 2016). Therefore, the importance of preventing the development and progression of diabetic nephropathy cannot be over-emphasized. Oxidative stress, mediated through hyperglycaemia, is known to play a crucial role in the development of diabetic complications such as nephropathy (Setyawan *et al*., 2020)

Although optimal control of blood glucose is effective in reducing microvascular complications of diabetes, even optimal control of blood glucose does not prevent oxidative stress-induced diabetic complications (Badrulhisham *et al*., 2020) . This suggests that alternative treatment strategies are required to prevent diabetic complications. Under physiological conditions, the body is fully protected from the adverse effects of free radicals by a network of the antioxidant defence system (Martinello & Mutinelli, 2021). This system becomes impaired in diabetes and it is further exacerbated due to persistent challenge by reactive oxygen species (ROS) generated by hyperglycaemia (Dendup *et al*., 2018).

This often leads to oxidative stress, which is an imbalance of oxidants/ antioxidants in favour of the

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former (Kocot *et al*., 2018). The efficiency of this defence mechanism is compromised in diabetes and therefore, the ineffective scavenging of free radicals leads to tissue and organ damage (Lavinas *et al*., 2019). Oxidative stress is linked to diabetic complications such as nephropathy, retinopathy, neuropathy, and atherosclerotic vascular disease. Antioxidants such as a-lipoic acid, and vitamins C and E have been considered as potential treatment for these complications (M C B Nascimento & E Luz Jr, 2018).

Bee products have long been used in medicine in the ancient world (Egypt, Greece, China). Currently, bee products (propolis, bee pollen, royal jelly, bee wax, bee pollen) are accepted for use as alternative drugs and their application refers to complementary and alternative medicine (CAM) (Denisow & Denisow-Pietrzyk, 2016). As the previous studies, flavonoids in bee pollen have an antioxidants activity and are thought to be the compound that is able to lower serum glucose level through the inhibition of oxidative stress. In addition, the antioxidants activity of bee pollen can improve insulin receptor signalling in insulin resistant conditions, therefore the insulin sensitivity can be increased (Syafrizal *et al*., 2020).

Accordingly, bee pollen used in the present study was from kelulut bees (Trigona sp). Kelulut bees are small bees which do not sting on their tails. Kelulut bees are found in the forests of East Kalimantan. The advantages of bee kelulut is produces more bee pollen than other type bee (Magdaleni, 2018). Hence, we aim to reveal the efficacy of bee pollen kelulut bees in lowering the HBA1C levels of patients with type 2 DM. HBA1C is remains the gold standard for assessment of glycaemic control in patients with diabetes.

Materials and Methods

This research is a quantitative study with a quasy experiment research design and a pretest-posttest control group design approach. The study was approved by the Human Ethical Committee at Faculty of Medicine Mulawarman University (No.06/KEPK-FK/II/2021). A multistage sampling was used to select type 2 diabetes mellitus patients for this study. First, patients were selected from Juanda Public Health centre Samarinda using purposive sampling technique. distributed using a flyer sent by the public health centre to health cadres in their working area. A total of 30 patients aged 30-65 years were initially identified for the study. The main inclusion criterion of patients for the study was patients aged 40 to 65 years living in the area of Juanda Public Health Centre, Samarinda, agreeing to participate in the study from beginning to end, and suffering from type 2 DM with HBA1C level 5,7-6,4% (prediabetes) and >6,5% (diabetes) meanwhile exclusion criterion for the study was patients who received insulin injection therapy and had severe disease complications such as kidney failure or heart disease. Based on inclusion and exclusion criteria

Results

1. Characteristics of Respondents

Table 1. Distribution of respondents and characteristics

Characteristics	Intervention group		Control Group	
	N	%	N	%
Gender				
Male	12	80.0	11	73.3
Female	3	20.0	4	26.7
Age				
40-55 Years	4	26.6	3	20.0
56-65 Years	11	73.3	12	80.0
Education				
Junior High School	5	33.3	2	13.3
Senior High School	7	46.7	11	73.3
Bachelor	3	20.0	2	13.3
Total	15	100	15	100

Source: Primary Data (2022)

Table 1 The analysis of the distribution of respondents based on their characteristics shows the dominant gender of the intervention group (12 people or 80,0%) were male and control group (11 people or 73,3%)

were male. Based on age of intervention group, 11 respondents (73,3%) was 40-55 years and control group, 12 respondents (80,0%) was 40-55 years. Based on education of intervention group, 7 respondents (46,7%) were senior high school and control group, 11 respondents (73,3%) were senior high school.

2. Change in Mean HBA1C Levels

Table 2. Show the results of changes in mean HBA1C levels of both control group and intervention group in the pre and post treatment

HBA1C	n	Nilai	Pre Test	Post Test	P Value*
Intervention Group	15	Mean±SD	7.30±0.996	6.40±0.630	0.001
Control Group	15	Mean±SD	7.47±0.743	6.93±0.743	0.005

Source: Primary Data 2022
P<0.05 Wilxocon Test

Table 2 demonstrate the result of the wilxocon test, in which there was a significant difference in mean HBA1C levels of the intervention group with p value of 0.001 or less than the significance level (p<0.05).

Table 3 Difference between the change in HBA1C levels of control group and intervention group

HBA1C	n	Mean Rank	Sum of Ranks	P Value*
Intervention Group	15	12.37	185.50	0.033
Control Group	15	18.63	279.50	

Source: Data Primer 2022
*Mann Whitney Test

Table 3 shows the significant difference in the mean HBA1C levels between the intervention group and the control group as indicated by the results of Mann Whitney Test with a significance value of 0.033 (p<0.05). The significance value means that there was a significant difference in HBA1C level between the control group and the intervention group.

Discussion

The results of the present study of characteristics of respondents in Table 1 show the majority of the gender were female. The result of this study verified the theory that type 2 DM is more common in females than in males. Women have higher HBA1C levels compared to men (Punthakee *et al*., 2018). The increase in blood glucose levels of women was higher than than of men. The body fat ranges between 15-20% of body mass in men and 20-25% in women and hence, the risk for DM in women is 3-7 times, higher than in men (of 2-3 times) (Radzeviciene & Ostrauskas, 2018).

Furthermore, the majority of respondents were aged 55-64 years. It verified the risk for the development of type 2 DM that increases with age, particularly the age of 40 years and over. Patients with type 2 DM belong to the same age group, which is 40-65 years or middle adulthood period (Punthakee *et al*., 2018). The factor of age influences the health condition of an individual, since the working mechanism ability of the organs of one's body, including cholesterol that accompanies the activities of the body organs, are accumulated in the body (Al-Saeed *et al*., 2016).

The results of this study were obtained by consuming 1 teaspoon of dried bee pollen for four weeks in the intervention group and diabetes mellitus nutrition education in group II with results on HBA1C with p value 0.033 (<0.05), which means there is a significant difference between the two groups. the intervention and control groups.

The average levels of HBA1C, LDL and triglycerides experienced positive changes, both in the

intervention group and in the control group. DM patients have distinctive characteristics, namely increased blood glucose levels, cells cannot absorb glucose properly to be converted into energy (Prahastuti *et al*., 2020). Glucose will continue to circulate in the blood due to lack of insulin in the target tissue carbohydrate intake and physical activity can affect the results (Pillai Subramanian, 2018)

Previous study has indicated that bee pollen kelulut bees have antioxidant activity assay is based on a product's ability to inhibit oxidation, thereby reducing the production of free radicals that start a chain reaction that damages the cellular structure. Antioxidant activity has been linked to a number of healing properties, including anti-inflammatory, antimicrobial, anticancer, and anti-obesity properties (Badrulhisham *et al*., 2020).

As a matter of fact, another product generated from kelulut bees, such as bee pollen, also has antioxidant properties. In an in vitro study using 5-lipoxygen- ace (5-LOX) cell-free assays, the polar extract of bee pollen has shown the ability to suppress the catabolism of Lin- oleic acid, thus displaying a potent antioxidant effect that can prevent lipid peroxidation and protect the integrity of the cell membranes (Xi *et al*., 2018). In addition, it has been shown that the ethanol extract of bee pollen possesses antioxidant properties that reduce the number of ROS and protect human erythrocytes from lipid peroxidation in an anti- oxidant assay by using a human erythrocyte model (Ávila *et al*., 2018). This action is attributed to phenolic compounds, which are important antioxidant components that inhibit hemolysis in erythrocytes. The high antioxidant content in bee pollen kelulut bees may provoke interest in the application of this honey in antidiabetic research (Abd Jalil *et al*., 2017).

HbA1C has been widely used as an indicator of glycemic control, because it reflects the concentration of blood glucose, the advantage is that it is not affected by diet before blood collection. HbA1c is the bond between hemoglobin and glucose (Arung *et al*., 2021). Homological glycation occurs through a chemical reaction due to exposure of glucose circulating in the ground to red blood cells, the rate of HbA1c synthesis increases according to the concentration of glucose bound to erythrocytes during exposure (Sarihati *et al*., 2019). A direct relationship between HbA1c and average blood glucose occurs because erythrocytes are continuously glycated during their lifetime and the rate of glycohemoglobin formation is equivalent to the concentration of blood glucose (Cohen *et al*., 2018).

Conclusions

Bee pollen is proven to lower HBA1C. It is confirmed by the difference in the HBA1C levels between the control group and the intervention group, in which the intervention group had lower levels.

Conflicts of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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