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EFFECTIVENESS OF JAPANESE ANTS (*Ulomoides dermestoides*) AS ANTI-DIABETIC ON WHITE RATS (*Rattus norvegicus*)

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Abstract

Diabetes mellitus is a chronic disease characterized by hyperglycemia due to a disruption of carbohydrate, fat and protein metabolism, caused by inherited or acquired deficiency in production of insulin by the pancreas. This research was conducted to know the effectiveness anti-diabetic activity of Ulomoides dermestoides. Thirty-five rats were divided into 7 treatment groups with five in each group. Rats were made diabetic by single intraperitoneal alloxan. The result of experiment for 14 days showed that distribution of ½ and 1 part of larvae reduced blood glucose levels by 45.51 and 59.92%, respectively. While giving½and 1 part of imago reduced blood glucose level by 65.81 and 76.46%, respectively. This research showed that Ulomoides dermestoides has anti-diabetic potential in the diabetic rats.

Key words: *anti-diabetic activity, Ulomoides dermestoides, Rattus norvegicus.*

INTRODUCTION

Diabetes mellitus (DM) is a chronic disease characterized by hyperglycemia due to a disruption of carbohydrate, fat and protein metabolism which is associated with absolute or relative deficiencies of work or insulin secretion. (Suryono, 2007).

According to WHO in 2007 the number of DM patients in the world reached 246 million people. In Indonesia according statistics on DM patients in 2003 as many as 11.3 million people and is estimated to reach 21.3 million people in 2030. At present day, Indonesia has ranked fourth in the world after the United States, China and India. Awad et al. (2013), reported that in Manado city the patients of DM were more likely to be women than men and the highest age at 51-60 years.

Around the world many cultures use insect and their products as nutraceutical (Rumokoy et al., 2016; Toar et al., 20). *Ulomoides dermestoides* is eaten a live as an alternative therapy for branchial asthma, psoriasis, vitiligo, chronic skin deseaes, inflamation and diabetes mellitus (Costa-Neto, 2002; Flores et al., 2002). To determine the effectiveness of *Ulomoides dermestoides* in reducing blood sugar levels in DM disease, this study was conducted by using white rat *(Rattus norvegicus*) as animals experimental.

MATERIALS AND METHODS

This experiment used larvae and imago of *Ulomoides dermestoides*, making preparation by grinding until smooth, then dissolved with distilled water.

Thirty five white rats (*Rattus norvegicus*) with 150-300 g were used in this experiment. Animals were kept in cages 40 x 30 x 20 cm individually, and feeding and drinking water were carried out by *ad libitum*. Before initiation of experiment, the rats were acclimatized for 7 days period.

All the animals were randomly divided into 7 group with five in each group. Group I as control (P0), II (P1) diabetic (giving alloksan), III (P2) standard drug (glibenclamide 5 mg/kg BW), IV (P3) and V (P4) were treated with ½ and 1 part of larvae *U. dermestoides*, respectively. Group VI (P5) and VII (P6) were treated with ½ and 1 part of imago *U. dermestoides*, respectively. Treatment of glibenclamide, larvae and imago *U. dermestoides* are given daily for 14 day. The preparation by grinding until smooth mixed with distilled water 1,8 ml in each rat and given orally.

Rat were made diabetic by single intraperitoneal injection of alloxan monohydrate (TCL Tokyo Japan) 90 mg/kg body weight (BW) and solubilized with 0.2% saline before injection (Ahmed, *et.al*. 2005). Three days after alloxan injection, rat with plasma glucose level more

than 140 mg/dl, were included in experiment. Blood samples were collected from tip of tail and blood glucose levels were estimated using electronic glucometer (Accu-Check Performance). Treatment with glibenclamide and material *Ulomoides dermestoides* was started three days after alloksan injection. Blood sugar levels were measured on day 0, 7th and 14th.

RESULTS AND DISCUSSIONS

The value of blood glucose levels of white rats for 14 days of treatment are presented in Table 1.

In treatment (P1) it was seen on day 0 that blood glucose levels were 312.00 ± 168.22 mg/dl, then increased significantly on day 7 (417.00 ± 35.34 mg/dl) and on day 14 (446.00 ± 94.04 mg/dl).

Tabel 1. Analysis of blood glucose level in white rats for 14 days of treatment

Treatment	Blood Glucosa (mg/dl)		
	Day 0	Day7	Day14
Normal Control (PO)	89.33 ± 8.50	85.00 ± 9.53	86.33± 10.11
Negative Control (P1)	312.00± 168.22	417.00± 35.34	446.00± 94.04
Positive Control (P2)	466.60± 188.24	176.00± 85.28	188.60± 10.98
½ larva *U. dermestoides* (P3)	294.00± 181.04	213.60± 154.80	160.20± 115.16
1 larva *U. dermestoides* (P4)	428.60± 98.00	272.40± 142.66	171.80± 93.43
½ imago *U. dermestoides* (P5)	343.40± 179.75	336.80± 184.88	117.40± 38.14
1 imago *U dermestoides* (P6)	401.00 ± 144.51	263.60± 167.00	94.40± 447.99

Values are present in Mean and SEM

Treatment glibenclamide after administration of alloxan (P2) showed a decrease in blood glucosa level from 466.60 ± 188.24 mg/dl on day 0 to176.00 ± 85.28 mg/dl on day 7 and decreased again to 188.60 ± 100.98 mg/dl on day 14. In the treatment of ½ part larvae (P3), blood glucose level from 0 294.00 ± 181.04 mg/dl on day 0 to 213.60 ± 154.80 mg/dl on day 7 and decreased again to 160.20 ± 115.16 mg/dl on day 14. In the treatment of 1 part larvae (P4), blood glucose levels were showed a decrease from 428.60 ± 98.00 mg/dl on day 0 to 272.40 ± 142.66 mg/dl on day 7 and decreased again 117.40 ± 38.14 mg/dl on day 14. In the treatment of the ½ part imago (P5), blood glucose levels were showed a decrease from 343.40 ± 179.75 mg/dl on day 0 to 336.80 ± 184.88 mg/dl on day 7 and decreased again to 117.40 ± 38.14 mg/dl on day 14. In the treatment of one part imago (P6) it were showed that blood glucose levels from 401.00 ± 144.51 mg/dl on day 0 to 263.60 ± 167.00 on day 7 and decreased again 94.40 ± 47.99 mg/dl on day 14. The blood glucose levels in rats during treatment are presented in Figure 1.

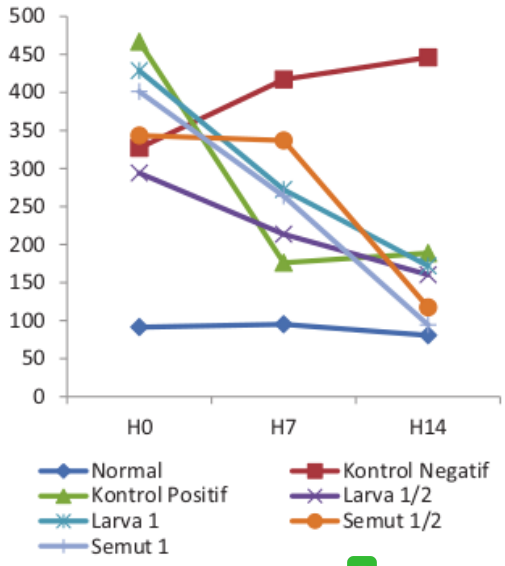

Figure 1. Graph of mean reduction in blood glucose levels in rats during treatment with *U. dermestoides*

The results of the initial experiment (0 or 3rd days after injection of alloxan) showed that the differences in rat blood glucose levels varied greatly. According to Suarsana et al. (2010), one of the causal factors for the existence of very large variations in blood glucose profiles of rate induced by alloxan was the resistance of individual rats to alloxan which caused the initial condition of diabetes to be uneven.

From Table 1, it can be seen that compared to control rat, giving alloxan was significantly able to increase blood glucose levels until the end of the experiment. This is because alloxan is one of the diabetogenic agents that is toxic, especially for pancreatic beta cells which, when given to test animals such as rat, will cause test animals to become diabetic (Prameswari and Widjanarko, 2014). Alloxan reacts by damaging essential substances in the pancreatic

beta cells, causing reduced insulin-bearing granules in pancreatic beta cells (Chandra, 2012).

Treatment with glibenclamide was able to reduce blood glucose levels by 59.58% of rat previously diabetogenic due to administration of alloxan. Glibenclamide is an oral hypoglycemic drug in the sulfonylurea group which has therapeutic effects to reduce blood glucose levels so that it is chosen as a comparative compound in research (Tanu, 2007). This is because glibenclamide works primarily in increasing insulin secretion (Bhowmik et al., 2009). The mechanism of action of glibenclamide is to stimulate the secretion of the hormone insulin from the granules of β cells of the islands of Langerhans pancreas. The interaction with ATP - sensitive K channel on the membrane of β cells causes membrane depolarization and this condition will open the Ca channel. After opening the Ca channel, the Ca2 + ion will enter the β cell and then stimulate the granule containing insulin and insulin secretion will occur (Suherman, 2007). The effective dose of glibenclamide in humans is 5 mg/kg body weight. This dose is then converted to dosage for test animals, namely white rat.In this experiment, all of the treatment both *U. dermestoides* larvae and imago were able to reduce blood glucose levels in diabetogenic rats. Treatment of ½ and 1 part larvae decreased blood glucose levels by 45.51% and 59.92%, respectively. While giving ½ and 1 parts of imago in the body reduced blood glucose levels by 65.81% and 76.46%, respectively. This shows the potential of *U. dermestoides* imago in reducing blood glucose levels in diabetogenic rats are greater than those of larvae. The same thing with the given dose seen both larvae and imago 1 part showed a greater decrease compared to only ½ part.

The results of the previous study showed that *U. dermestoides* containing various amino acids, saturated fatty acids and unsaturated fatty acids (Tables 2 and 3). Arginine is associated with wound healing, especially in people with diabetes mellitus. The mechanism of the influence of arginine in wound healing that arginine is one of the nitric oxide (NO) forming materials that will help the synthesis of collagen in the injured area (Abumrad and Barbul, 2005). Other studies reported that NO synthesized from arginine will regulate glucose metabolism, fatty acids and amino acids, so consumption of arginine will reduce fat mass in obese and diabetic mice (Shi et al., 2006). Nitric oxide also increases glucose transport, decreases the synthesis of glucose and glycogen and stimulates insulin release.

Table 2. Amino acid content - *U. dermestoides*

No	Amino acid element	Larva (%)	Imago (%)
1	Aspartic acid	2.42	1.86
2	Glutamic acid	3.26	2.91
3	Serin	0.51	0.42
4	Glycine	0.70	0.31
5	Histidine	0.53	0.54
6	Arginine	0.65	0.42
7	Treonine	0.38	0.63
8	Alanine	0.76	0.60
9	Proline	0.54	0.62
10	Tyrosine	0.26	0.31
11	Valine	0.50	0.46
12	Methionine	0.38	0.40
13	Cysteine	0.54	0.59
14	Isoleusi	0.31	0.30
15	Leusin	0.84	0.54
16	Phenyl-alanine	0.28	0.75
17	Lysine	0.63	0.48

Table 3. The content of saturated fatty acids and unsaturated fatty acids - *U. dermestoides*

No	Tipe Analysis	Larva (%)	Imago (%)
1	Kaprat	Undetected	Undetected
2	Laurat	Undetected	Undetected
3	Miristat	0.72	0.37
4	Palmitat	33.02	32.79
5	Stearic	0.67	0.49
Saturated fatty acid		34.11	33.65
6	Oleat	49.39	47.51
7	Linoleat	15.94	16.03
8	Linolenat	0.33	0.30
Unsaturated fatty acid		65.66	63.84

Hypoglycemic power is caused by the inhibition of the enzyme α glucosidasein the intestine so that it will slow down the breakdown of carbohydrates into a simple form and consequently the release of glucose and its absorption will be slowed in the intestinal brush border.

Besides amino acids, *U. dermestoide*s contain saturated fatty acids and unsaturated fatty acids. *U.* dermestoides extracts contain secondary metabolites which have antioxidant activity

(Mendoza et al., 2013) and antioxidant enzymes such as superoxide dismutase (Long et al., 2009). Antioxidants are known to have a function in counteracting free radicals that cause cell or tissue damage and can cause degenerative diseases.

Glutamic acid has an important role in sugar and fat metabolism. Fatty acids in animals and plants can be used as a treatment ingredient in treating epilepsy, mental retardation, muscular dystrophy, hypoglycemic ulcers and coma and side effects of insulin drugs for diabetes.

CONCLUSIONS

Base on the results and on the discussion we concluded that *U. dermestoides* were significantly reduced blood glucose levels in diabetic rats. Potential of *U. dermestoides* imago in reducing blood glucose levels in diabetogenic rats are greater than those of larvae.

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