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Beneficial Effect of Grinting Grass (*Cynodon dactylon*) on the Streptozotocin Induced Diabetes Mellitus in the Mice

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¹Abstract

The aim of this study was to investigate antidiabetic activity of the non-polisacharide fraction of the aqueous extract of grinting grass (NPF-GG) in streptozotocin induced diabetes in mice. Thirty male BALB/C mice of two months age were divided into five groups: placebo control,

¹metformin control, NPF-GG treated groups (250 mg/kgBW, 500 mg/kgBW, and 1000 mg/kgBW, respectively). Hypoglycemic effect and histopathological features of the pancreatic islet showed that NPF-GG have high antidiabetic effect. It induced hypoglycemic effect and increased the cell quantity in Langerhans cells in the pancreas.

Keyword: antihyperglycemic activity, *Cynodon dactylon*, diabetes mellitus, pancreatic islet.

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Table I. Fasting Blood Glucose Level in Diabetic Mice

	Day 6			Day 14
	1h	3h	5h	
Placebo control	260.5 ^b ± 37.26	240.3 ^b ± 40.83	184.2 ^b ± 23.79	150.2 ^c ± 6,57
Metformin control	169.5 ^a ± 36.37	144.3 ^a ± 46.17	109.17 ^a ± 39.51	158 ^{bc} ± 34,37
NPF-GG 250 mg/kg	129.5 ^a ± 26.18	119.17 ^a ± 24.46	85 ^a ± 34,87	100 ^a ± 30,17
NPF-GG 500 mg/kg	116.3 ^a ± 7.71	94.5 ^a ± 19.26	91.5 ^a ± 20,11	115 ^{ab} ± 13,61
NPF-GG 1000 mg/kg	129.2 ^a ± 17.71	115.5 ^a ± 15.61	96.7 ^a ± 6,07	123 ^{ab} ± 16,47

Indonesia has a high level of biodiversity and has many natural potentials that can be utilized for the treatment of various diseases (Wahyuni *et al.*, 2017; Fadholly *et al.*, 2019). Grinting grass (*Cynodon dactylon*) is a stoloniferous grass widely distributed in the tropical and subtropical regions of the world. Currently, grinting grass is listed as invasive in many countries including Indonesia. Grinting grass traditionally used as medication in diabetes but there are not many study to demonstrate the antidiabetic activity of this grass. The aim of this study was to analyze the antidiabetic activity of the NPF-GG in streptozotocin induced diabetes in the mice.

Materials and Methods

This study was approved by the Committee of Animal Care and Use, Faculty of Veterinary Medicine, Universitas Airlangga, Surabaya, Indonesia. Dried powder of grinting grass was heated in the water (25g in 200mL) at 90 °C for 15 minutes. When it was filtrated and ethanol was added to induce precipitation, the sediments (polysaccharide fraction) was removed to obtain non-polysaccharide fraction (NPF) (Jarald *et al.*, 2008). The NPF was evaporated using rotary evaporator then dried using freeze dryer over night. The dried NPF-GG was suspended in 1% Tween 80 just before the administration to mice.

Thirty male BALB/C mice of two months age were used in this study. 40mg/kgBW of streptozotocin were administered intraperitoneally each day for five consecutive days. The mice were divided into five groups: placebo control, metformin control, NPF-GG treated groups (250 mg/kgBW, 500 mg/kgBW, and 1000 mg/kgBW, respectively). The test was conducted for 14 days. Hypoglycemic effect of NPF-GG was deter-

mined on day 6 at the 1st, 3rd, and 5th hours after NPF-GG administration and at day 14. At the end of the experiment, all mice were euthanized by cervical dislocation and the pancreas was collected by abdominal section for analysis of quantity cells in Langerhans islets in the pancreas. Langerhans islet cells were all normal cells in each pale form (Langerhans islets) in the pancreas. Normal cell was described as cell which has no sign of necrosis (pycnosis, karyorrhexis, and karyolysis) and also has no sign for cell degeneration. There were three histopathological sections of pancreas on a slide of each sample. The cells counted in all Langerhans islets and the total number of Langerhans islet cells was the average of the total cells in one Langerhans islet. The data were analyzed using one-way ANOVA and followed by Duncan post hoc test.

Results and Discussion

Streptozotocin enters the pancreatic beta cells through glucose transporter-2 (GLUT-2) and cause DNA alkylation. DNA alkylation or the entry of methyl groups from streptozotocin into the DNA molecules caused damage that lead to DNA fragmentation. Streptozotocin acts directly on the pancreatic beta cells by cytotoxic action mediated by reactive oxygen species (ROS). Nitric oxide (NO) donor binds to superoxide (O⁻) to produce peroxynitrite radicals that can be used as diabetes mellitus induction material (Szkudec, 2001). The diabetic mice were found to have fasting blood glucose level higher than 160 mg/dL on the day 5 after the last injection of streptozotocin.

In the diabetic mice after several hours evaluation we found that NPF-GG has antihyperglycemic effect at all dose levels 250 mg/

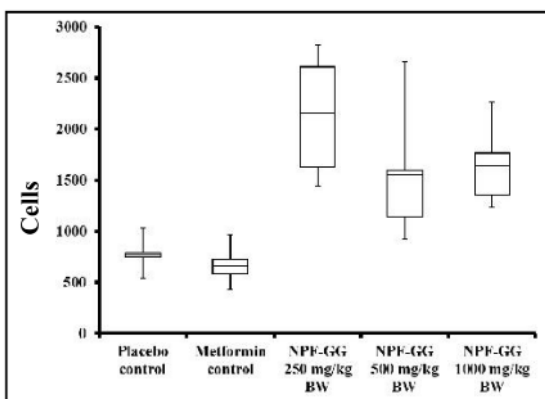


Fig 1. Total number of pancreatic islet cells in the diabetic mice

9 kg BW, 500 mg/kg BW, and 1000 mg/kg BW, respectively. It was found to be more effective than both placebo control group and metformin control group (Table I).

The data from Langerhans pancreatic islet in the Figure 1 and 2 showed that the cell quantity of each group is 776.17±156.68 cells for placebo control group and 671.17±184.34 cells for metformin control group. 2133.33±598.04 cells, 1551±622.63 cells, and 1643.33±377.59 cells for NPF-GG 250, 500, 1000 mg/kg BW, respectively. The results indicated that NPF-GG increased the total number of Langerhans pancreatic islets also.

NPF-GG contains several chemical constituents such as flavonoids, saponins, tannins, and glycosides. In the previous study, the isoliquiritigenin, protocatechualdehyde, and butein in flavonoid components are effective to preserve the integrity of the beta cells from streptozotocin exposure (Lukačínová *et al.*, 2008). Quercetin of flavonoid compounds acts as an antioxidant that prevent the cells in the pancreatic islet from oxidative stress. This theory might explain the protective activity of NPF-GG that inhibits the binding of streptozotocin NO donor to O. Quercetin might increase insulin secretion by the pancreas and might also increase the glucokinase activity causing increase in the uptake of glucose in a liver. Furthermore, quercetin was found to inhibit maltase enzyme that lowers glucose absorption in the intestines (Husen *et al.*, 2019). Other flavonoid compounds

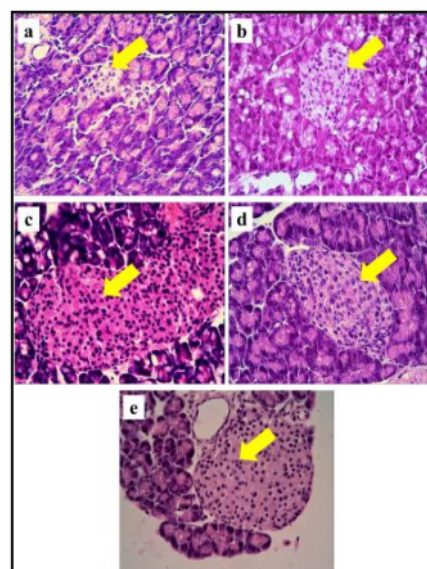


Fig 2. Histopathological features of pancreatic islets in the diabetic mice. a) A group of placebo control, b) A group of metformin control, c) A group of NPF-GG 250 mg/kg BW, d) A group of NPF-GG 500 mg/kg BW, and e) A group of NPF-GG 1000 mg/kg BW. Hematoxylin-eosin staining, 400× magnification

have an acarbose like-effect and inhibits the glucose absorption in the intestines (Giordani *et al.*, 2015).

Summary

The NPF-GG has high antidiabetic effect and hypoglycemic effect and increases the number of Langerhans pancreatic islet. NPF-GG was found to be more effective than metformin which is a standard antidiabetic drug.

6 Acknowledgment

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