Hypoglycemic Activity Herbal Tea Combination of *Andrographis paniculata* Herbs and *Swietenia mahagoni* Seeds

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ABSTRACT

Diabetes mellitus is a chronic metabolic disorder that continues to present a major world wide health problem. Numerous herbal drugs like *Andrographis paniculata* and *Swietenia mahagoni* have been used by people of various cultures to treat diabetes. The aim of this research was to measure the hypoglycemic activity herbal tea of *Andrographis paniculata* herbs and *Swietenia mahagoni* seeds and their combination in alloxan-induced diabetic mice. The tea was prepared by brewing 10 g herbal tea with 100 ml of boiling water for 10 minutes. The herbal tea of *Andrographis paniculata* herbs, *Swietenia mahagoni* seeds, combination with ratio 1:1, 1:2 and 2:1 (0.4 ml/20 g BW), was administered orally to groups I, II, III, IV and V respectively. The reference drug glibenclamide (0.013 mg/10 g BW) and CMC-Na were also administered orally to animals in positive and negative control group respectively.

Oral administration of herbal tea for seven days resulted in a slight reduction in blood glucose level. Statistically there is no groups that has significant difference with negative control groups ($P < 0.05$) except positive control. Therefore the herbal tea combination of *Andrographis paniculata* herbs and *Swietenia mahagoni* seeds with ratio 2:1, showed the biggest reduction in blood glucose level (88.20 ± 43.16 mg/dl).

Key words*: Andrographis paniculata, Swietenia mahagoni,* hypoglycemic activity, herbal tea

INTRODUCTION

Diabetes mellitus is chronic disease characterized by hyperglycemia, abnormal lipid and protein metabolisms, with long-term complications affecting the retina, kidney, and especially the nervous system (Debasis *et al*, 2011). Regarding its etiology the diabetes mellitus (DM) is classified into four types, namely type 1 that occurs due to the disruption of insulin production resulting from autoimmune disease or idiopathic disease; type 2 that occurs due to insulin resistance or impaired insulin secretion, *Gestational Diabetes Mellitus* (GDM) representing glucose intolerance that occurs during pregnancy and diabetes mellitus due to pancreatic or endocrine disease or due to use of other drugs (Suherman and Nafrialdi, 2011; Dipiro *et al*, 2008).

It is estimated that in 2030 the prevalence of diabetes mellitus (DM) in Indonesia will reach 21.3 million people. Many oral hypoglycemic drugs, such as sulfonylureas and biguanides are used in conjunction with insulin for treatment of diabetes mellitus, but these drugs have significant side effects (Debasis *et al*, 2011). Drugs derived from medicinal plants are often considered in terms of the safety and affordable costs. One of the medicinal plants in Indonesia known to have healing properties is Sambiloto *(Andrographis paniculata)* and mahogany *(Swietenia mahagoni)*. Sambiloto herbs contains andrographolide, while mahogany seeds contain swietenin in which both substances can produce hypoglycemic effects.

This study tried to test hypoglycemic activity of herbal teas of Sambiloto herbs (*Andrographis paniculata)* and mahogany seeds *(Swietenia mahagoni)* mixtures to determine the synergistic effects of the two mixtures.

MATERIALS AND METHODS

Animals. Adult male mice of body weights ranging from 20–40 g were obtained from Animal Laboratory, Department of Pharmacognosy and Phytocemistry, Airlangga University.

Chemicals. Alloxan monohydrate (Sigma®), Glibenclamide (Kimia Farma®), CMC-Sodium, Glucometer (EasyTouch® GCU Meter) and Blood Gluco-strip (EasyTouch® GCU Meter).

Plant material. The herbs of *Andrographis paniculata* and seeds of *Swietenia mahagoni* were collected from the local area of Surabaya in month of March and identified by Purwodadi Botanical Garden, Pasuruan, Indonesia.

Preparation of herbal tea combination. The herbs of *Andrographis paniculata* and seeds of *Swietenia mahagoni* were combined with ratio (1:1); (1:2) and (2:1). The tea was prepared by brewing 10 g herbal tea with 100 ml of boiling water for 10 minutes.

Experimental induction of diabetes. The mice were injected with alloxan monohydrate (Sigma®)

dissolved in sterile normal saline at a dose of 150 mg/kg BW intraperitoneally. Before the injection, all mice were fasted for 18 hours. After three days, mice with blood glucose >200mg/dl were used for the experiment.

Experimental design. The mice were divided into eight groups after the induction of alloxan diabetes.

Normal control group. Non-Diabetic mice

Negative control group. Diabetic mice given with CMC-Sodium 0.5%.

Positive control group. Diabetic mice given with glibenclamide orally (0.013 mg/20 g BW).

Group 1. Diabetic mice given with herbal tea of *Andrographis paniculata* herbs (0.4 ml/20 g BW)., **Group 2.** Diabetic mice given with herbal tea of *Swietenia mahagoni* seeds (0.4 ml/20 g BW)., **Group 3.** Diabetic mice given with herbal tea combination of *A. paniculata* herbs and *S. mahagoni* seeds with ratio 1:1 (0.4 ml/20 g BW)., **Group 4.** Diabetic mice given with herbal tea combination of *A. paniculata* herbs and *S. mahagoni* seeds with ratio 1:2 (0.4 ml/20 g BW)., **Group 5.** Diabetic mice given with herbal tea combination of *A. paniculata* herbs and *S. mahagoni* seeds with ratio 2:1 (0.4 ml/20 g BW)., The blood samples were collected through the tail vein puncturing with a needle.

Statistical analysis. All values were expressed as the mean ± S.E.M obtained from a number of experiments (n). Data from all the tables of normal, diabetic control, reference drug treated and herbal tea treated animals were compared by ANOVA followed by Tukey test, $p<0.05$ was considered significant.

Table 1. Effect of a 7-day oral administration of herbal tea combination *Andrographis paniculata* herbs and *Swietenia mahagoni* seeds on the blood glucose level in alloxan-induced diabetic mice.

Group	Blood Glucose Level (mg/dl)					Blood Glucose Reduction
	0th Day	1st Day	3rd Day	5th Day	7th Day	
Normal (non-diabetic)	121.00 ± 14.32	112.33 ± 11.35	109.33 ± 11.70	123.33 ± 10.92	131.50 ± 6.77	
Negative control CMC-Na 0.5%	435.40 ± 87.62	419.20 ± 99.34	419.80 ± 105.14	421.60 ± 103.55	465.80 ± 76.52	
Positive control Glibenclamide (0.013 mg/20 g BW)	422.83 ± 58.83	403.33 ± 47.51	351.67 ± 55.13	431.83 ± 75.89	142.33 ± 37.45	280.50 ± 42.80
Herbal tea of *A.paniculata* herbs (0.4 ml/20 g BW)	425.33 ± 52.02	438.83 ± 28.08	452.67 ± 31.73	427.67 ± 50.41	385.50 ± 78.25	39.83 ± 60.08
Herbal tea of *S.mahagoni* seeds (0.4 ml/20 g BW)	430.17 ± 66.66	407.67 ± 80.06	345.67 ± 83.89	445.33 ± 80.99	401.33 ± 90.93	28.83 ± 52.46
Herbal tea combination of *A.paniculata* herbs and *S.mahagoni* seeds with ratio 1:1 (0.4 ml/20 g BW).	479.50 ± 26.98	519.00 ± 21.92	505.50 ± 25.69	472.17 ± 17.53	393.50 ± 59.38	86.00 ± 79.73
Herbal tea combination of *A.paniculata* herbs and *S.mahagoni* seeds with ratio 1:2 (0.4 ml/20 g BW).	418.50 ± 59.32	464.83 ± 47.37	418.83 ± 45.20	333.83 ± 64.96	364.83 ± 50.26	53.67 ± 22.21
Herbal tea combination of *A.paniculata* herbs and *S.mahagoni* seeds with ratio 2:1 (0.4 ml/20 g BW)	417.80 ± 76.60	364.00 ± 96.95	378.60 ± 91.79	375.60 ± 75.87	329.60 ± 71.44	88.20 ± 43.16

The values are expressed as mean + SEM. n = 6 animals in each group.

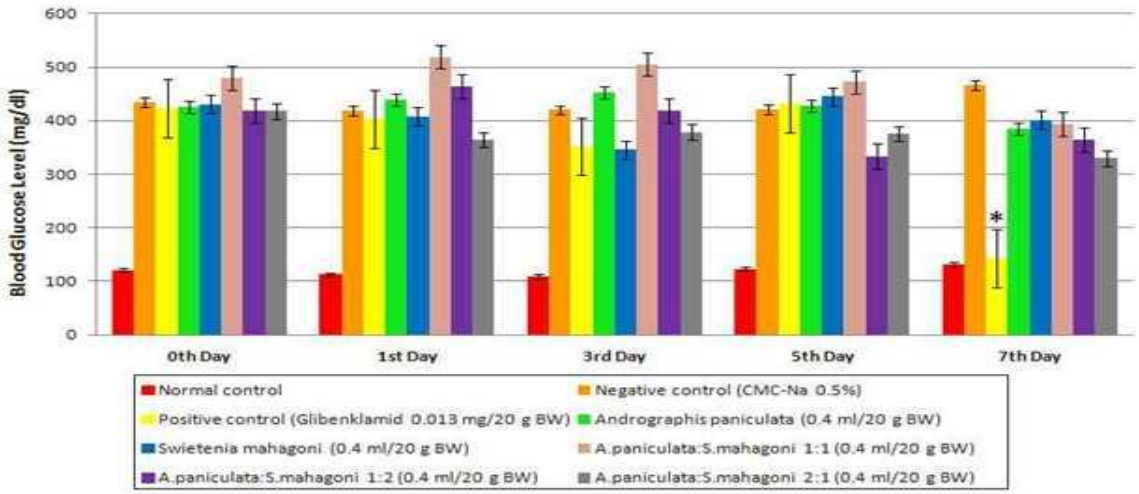

Figure 1. Effect of a 7-day oral administration of herbal tea combination *Andrographis paniculata* herbs and *Swietenia mahagoni* seeds on the blood glucose level in alloxan-induced diabetic mice.

RESULTS AND DISCUSSION

Results of the treatment for seven days showed profiles of blood glucose levels of mice related to the effects of herbal teas. Data were created in the form of means ± SEM. The herbal teas of sambiloto herbs and mahogany seeds mixture in the ratio (2:1) at a dose of 0.4 ml / 20g BW could reduce blood glucose levels in mice, ranging from day 0 (417.80 ± 76.60 mg / dL) to day 7 (329.60 ± 71.44 mg / dL) with an average reduction in blood glucose level of 88.20 mg/dL. The average reduction was also greater than herbal teas of sambiloto herbs, herbal teas of mahogany seeds, herbal teas of both mixtures with ratios of (1:1) and (1:2).

While the analytical results of *Post Hoc Test* with Tukey method, when compared to the negative control, only positive control showed significant differences ($p < 0.05$) in lowering blood glucose levels in alloxan-induced diabetic mice within seven days.

From the overall results, herbal teas of sambiloto herbs and mahogany seeds mixtures in the ratio (2:1) at a dose of 0.4 ml / 20g BW provided the largest reduction in blood glucose levels. However, this group was not showed to have significant differences compared with negative control group because p_{count} value = 0.724 ($p > 0.05$). Viewed from their compositions, sambiloto herbs is more dominant in the herbal teas of both mixtures, suggesting that in this mixture, the sambiloto herbs provided large contribution to the reduced blood glucose levels. The andrographolide acted by inhibiting the α-glucosidase and α-amylase enzymes to produce the hypoglycemic effects (Akbar, 2011). While the swietenin acted by increasing the absorption and use of peripheral glucose (Preedy *et al.*, 2011). If both plants are combined, it will generate synergistic effects in lowering blood glucose levels.

Conclusion

In statistical terms, only positive control generated significant differences ($p < 0.05$) when compared with the negative control but descriptively herbal teas of sambiloto *(Andrographis paniculata)* and herbal tea of mahogany seeds (*Swietenia mahagoni*) and the mixture of both have hypoglycemic effects on alloxan-induced diabetic mice within seven days. Herbal teas of sambiloto and mahogany seeds mixtures with ratio (2:1) at a dose of 0.4 ml/20g BW produced the largest hypoglycemic effects. When sambiloto herbs combined with mahogany seeds, they will produce synergistic effects in lowering blood glucose levels.

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