Hypoglycemic Activity of 96% Ethanolic Extract of *Andrographis paniculata* Nees. and *Swietenia mahagoni* Jacq. Combination.

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**ABSTRACT**

Diabetes mellitus is a heterogeneous group of syndromes characterized by an elevation of blood glucose caused by a relative or absolute deficiency of insulin. The incidence of diabetes is growing rapidly worldwide. Drug treatment for diabetes mellitus is expensive and carries risks for many adverse effects. Indonesia is one of rich emporium of medicinal plants useful in the treatment of diabetes. This research was performed to measure the hypoglycemic activity of ethanolic extract of *Andrographis paniculata* herbs and *Swietenia mahagoni* seeds and its combination in experimentally in alloxan-induced diabetic mice.

The 96% ethanolic extract of *Andrographis paniculata* herbs, *Swietenia mahagoni* seeds, and their combination with ratio 1:1, 1:2 and 2:1 (28 mg/20 g BW), was administered orally to groups I, II, III, IV and V for seven days. The reference drug glibenclamide (0.013 mg/10 g BW) and CMC-Na were also administered orally to mice as positive and negative control group respectively.

Administration of those extract produced significant reduce in the blood glucose level (BGL) compared to negative control group. The 96% ethanolic extract combination of *Andrographis paniculata* Nees. herbs and *Swietenia mahagoni* Jacq. seeds with ratio 2:1 showed the biggest reduction in BGL (250.80 mg/dl). The 96% ethanolic extract of *Andrographis paniculata* and *Swietenia mahagoni* showed BGL reduction of (232.00 mg/dl) and (28.00 mg/dl) respectively. The combination with ratio 1:1 and 1:2 has significant BGL of (213.60 mg/dl) and (237.60 mg/dl) respectively.

**Keywords:** *Andrographis paniculata* Nees., *Swietenia mahagoni* Jacq., hypoglycemic activity, ethanolic extract.

**INTRODUCTION**

Diabetes mellitus (DM) is a group of metabolic syndromes or metabolic disorders characterized by hyperglycemia. It is associated with abnormalities in the metabolism of carbohydrates, fats, and proteins (Triplitt et al., 2008). Modern therapy for NIDDM involves tiered treatments. It starts with diet modification before moving on to the oral anti-diabetic drugs and insulin. The use of oral anti-diabetic drugs such as sulfonylureas and biguanid is limited by their pharmacokinetic characteristics, secondary failure rate and the accompanying significant side effects (Tzoulaki et al., 2009). Treatment and health maintenance among people with DM have absorbed huge amounts of money each year. With a growing number of patent medicines for people with diabetes, medical treatment costs become even more expensive and not affordable, especially for people in the developing countries such as Indonesia (Widyaningrum, 2008). Currently more than 400 traditional medicinal plants have been reported to be used for complementary and alternative medicines for diabetes treatment, although only few traditional medicinal plants have been investigated scientifically (Widyaningrum, 2008).

Traditional medicines are generally made from natural materials of medicinal plants such as roots, tubers, rhizomes, wood, bark, seeds, leaves, fruits or sap of medicinal plant extracts. In Indonesia, there are some traditional medicinal plants that can be used to treat diabetes mellitus. They include sambiloto (*Andrographis paniculata* Nees.) and mahogany (*Swietenia mahagoni* Jacq.). Both plants are already widely used empirically for traditional treatment of diabetes in some countries such as China, India, and Indonesia. Both plants are scientifically proven to be capable of lowering blood sugar levels significantly in streptozotocin-induced diabetic animals (Debasis et al., 20 11; Hossain et al., 200 7). This study wanted to see the activity of sambiloto herbs and mahogany seeds combination in producing more potent hypoglycemic effects.

**MATERIALS AND METHODS**

**Animals.** Male mice of age 8 weeks and body weights ranging from 20–40 g were obtained from Animal Laboratory, Department of Pharmacognosy and Phytochemistry, Airlangga University.

**Chemicals.** Alloxan monohydrate (Sigma Aldrich® Chemical Co., US), Glibenclamide...
The herbs of *Andrographis paniculata* Nees, and *Swietenia mahagoni* Jacq. were collected and identified by Purwodadi Botanical Garden, Pasuruan, Indonesia.

**Preparation of extract.** The herbs of *Andrographis paniculata* Nees. and *Swietenia mahagoni* Jacq. were extracted with ethanol 96% by maceration process and evaporated to dryness. The extracts were mixed in three ratios (1:1); (1:2) and (2:1). The combination of extract was formulated into suspension form by using 0.5% CMC-Sodium.

**Experimental induction of diabetes.** The mice were injected with alloxan monohydrate (Sigma Aldrich Chemical Co., US) dissolved in sterile normal saline at a dose of 150 mg/kg body wt intraperitoneally. Before the injection, all mice were fasted for 18 hours. After three days, mice with blood glucose above 200 mg/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 96% ethanolic extract of *Andrographis paniculata* Nees. (28 mg/20 g bw), Group 2. Diabetic mice given with 96% ethanolic extract seeds of *S. mahagoni* Jacq. (28 mg/20 g bw), Group 3. Diabetic mice given with 96% ethanolic extract of *A. paniculata* Nees. and *S. mahagoni* Jacq. combination with ratio 1:1 (28 mg/20 g bw), Group 4. Diabetic mice given with 96% ethanolic extract of *A. paniculata* Nees. and *S. mahagoni* Jacq. combination with ratio 1:2 (28 mg/20 g body weight), Group 5. Diabetic mice given with 96% ethanolic extract of *A. paniculata* Nees. and *S. mahagoni* Jacq. combination with ratio 2:1 (28 mg/20 g body weight), The blood samples were collected through the tail vein puncturing with a needle. The largest hypoglycemic activities in this study occurred in the administration of 96% ethanol extracts of sambiloto herbs and mahogany seeds combination with ratio of (2:1). Within seven days, the mixture of both 96% ethanol extracts was capable of lowering blood glucose levels of mice on average of 250.80 mg/dL. A compound thought to have hypoglycemic activity of sambiloto (*Andrographis paniculata* Nees.) is diterpene lactone named andrographolide, which is also the main chemical constituent of sambiloto plants. Andrographolide compound produced hypoglycemic effects by inhibiting the α-glucosidase and α-amylase enzymes thereby statistically using SPSS program with Tukey method. From the statistical analysis, only mahogany fruit group did not give significant differences compared with the negative control group. Sambiloto extract and mahogany extract mixtures with ratio (2:1) provided the largest reduction in blood glucose levels with average reduction in blood glucose levels at 250.80 mg/dL. The sambiloto extract produced lower average reduction in blood glucose levels at 232.00 mg/dL. The sambiloto and mahogany extract mixtures produced a reduction in blood glucose levels at 213.60 mg/dL in ratio (1:1) and 237.60 mg/dL in ratio (1:2). In addition, the mahogany seed extract produced the lowest reduction in blood glucose levels at 28.00 mg/dL.
metabolism of disaccharides was inhibited significantly, but glucose metabolism increased. This causes blood glucose levels to decrease.

While compound thought to generate dominant hypoglycemic activity in mahogany plants (Swietenia mahagoni Jacq.) is swietenin. Swietenin refers to a class of tetranortriterpenoid compound representing natural agonist PPARγ (Peroxisome Proliferator Activated Receptor) with an action mechanism of activating the gen-responsive insulin which can stimulate insulin to form and translocate GLUT (glucose-transporter) to the cell membrane in peripheral organs so that the absorption and the use of peripheral glucose increased (Li et al, 2005; Hasan et al., 2011). Another function of this PPARγ activation is enhancing the metabolism of carbohydrates and fats and improving insulin sensitivity (Li et al., 2005).

From such description it can be seen that the hypoglycemic effects due to the administration of a mixture of 96% ethanol extracts of A. paniculata Nees. herbs and S. mahagoni Jacq. seeds are greater when compared with their single extract. This is likely due to differences in the action mechanism of each compound contained in sambiloto plants (andrographolide) and mahogany (swietenin) which can cause synergistic effects on the body in generating hypoglycemic effects.

**Conclusion**

The combination of 96% ethanol extracts of sambiloto herbs and mahogany seeds at dose of 28 mg/20g for seven days generated greater hypoglycemic activity compared with administration of 96% ethanol extract of both plants in singly manner. Mixture of 96% ethanol extract producing greatest hypoglycemic effect is administered at the ratio of (2:1).

**REFERENCES**


