# Neuroprotective Activity of Tassel Flower (Emila sonchifolia)

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# The Lipid Lowering Effect of Water Extract of *Andrographis paniculata*, Water Extract of *Syzigium polyanthum* and its Combination in Alloxan-Induced Diabetic Rats

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Background: Combination of water extract of *Andrographis paniculata* and water extract of *Syzygium polyanthum* (6:1) have been reported to reduce blood glucose in normal and alloxan rats. This combination also gave protection effects on kidney, liver and pancreas animals tested from alloxan toxicity

Methods : Eighty male white albino rats were divided into eight different groups including normal control, diabetic control, 4 treated groups with the water extract of *Andrographis paniculata*, water extract of *Syzygium polyanthum* and its combination, and also standard drugs (metformin, insulin) with 10 rats in each group. The extracts and the standard were given orally for 7 days. At day 7 blood sample was collected, serum separated and glycemic level, total cholesterol, LDL, HDL, triglyceride, and alkaline phosphatase were determined. The body weight was recorded on day 1 and day 7.

Results and discussion: The data obtained revealed that the water extract of *Andrographis paniculata* (WAP), water extract of *Syzygium polyanthum* (WSP) and its combination (1 WAP: 6 WSP; 6 WAP:1 WSP) reduced the glucose level. The treatment with these extracts also reduced the LDL and triglyceride level significantly and alkaline phospatase level as compared with normal and diabetic groups.

Conclusions: The water extract of *Andrographis paniculata*, water extract of *Syzygium polyanthum* and its combination possess significant antidiabetic activity along with antihypercholesterolemic activity.

**Key words:** *Andrographis paniculata*, *Syzygium polyanthum*, water extracts, antidiabetic, antihypercholesterolemic

## 1. Introduction

Diabetes mellitus is one of the common metabolic disorders with micro and macrovascular complications that results in significant morbidity and mortality. It is considered as one of the five leading causes of death in the world1-2. Hence, the global number of people with diabetes is estimated to rise up to 366 millions in 2030[3-4].

In modern medicine no satisfactory effective therapy is still available to cure diabetes mellitus5. There is increasing demand by patients to use natural products with antidiabetic activity due to side effects associated with the use of insulin and oral hypoglycemic agents[6-8].

World is endowed with a rich wealth of medicinal plants. These plants have made a good contribution to the development of ancient materia medica. More than 400 medicinal plants are present worldwide for the treatment of diabetes mellitus, while only few of them have been subjected to scientific authentication as anti-diabetic agents[9-10].

Andrographis paniculata (Acanthaceae), commonly called as king of bitter is a traditional medicinal plant common in South East Asia and found from India to Indo-China. According to the study conducted by Widjajakusuma et al.[11] pretreatment with Andrographis paniculata aqueous extract with dose 200 mg/Kg BW demonstrated significant antidiabetic activity in alloxan induced diabetic rats. Combination of water extract of Andrographis paniculata and water extract of Syzygium polyanthum (6:1) have been reported to reduce blood glucose in normal and alloxan rats. This combination also gave protection effects on kidney, liver and pancreas animals tested from alloxan toxicity[11].

In this study the prolonged effect (up to 7 day) of the water extract of Andrographis paniculata, water extract of Syzygium polyanthum and its combination in fasting blood glucose (FBG) and biochemical parameters such as serum total cholesterol (TC), LDL, HDL, triglyceride, and

alkaline phosphatase were studied in alloxan induced diabetic rats.

## 2. Materials and Methods

### *2.1. Plant Material*

The plant material of *Andrographis paniculata and Syzygium polyanthum* were taken from Natura Laboratoria Prima on dried powder form. Natura Laboratoria Prima is a nature-based health Products Company in Indonesia, which produce nature-based health products, one of them is quality dried extracts from plant materials.

### 2.2. Animals

Male wistar albino rats (8–10 weeks) were obtained from the animal house of Widya Mandala Catholic University. Before and during the experiment, rats were fed with standard diet. After randomization into various groups and before initiation of experiment, the rats were acclimatized for a period of 7 days under standard environmental conditions of temperature, relative humidity, and dark/light cycle. Animals described as fasting were deprived of food and water for 12 hours ad libitum.

### 2.3. Experimental Design

Eight groups of rats, ten in each received the following treatment schedule:

Group I: Normal control (CMC Na 0.5%).

Group II: Alloxan treated control (100 mg/kg.im).

Group III: Alloxan (100 mg/kg.im) + the water extract of Andrographis paniculata (200 mg/kg, p.o),

Group IV: Alloxan (100 mg/kg.im) + the water extract of Syzygium polyanthum (200mg/kg, p.o),

Group V: Alloxan (100 mg/kg.im) + Combination of water extract of Andrographis paniculata and water extract of Syzygium polyanthum (1:6; 200mg/kg, p.o),

Group VI: Alloxan (100 mg/kg.im) + Combination of water extract of Andrographis paniculata and water extract of Syzygium polyanthum (1:6; 200mg/kg, p.o),

Group VII: Alloxan (100 mg/kg.im) + Standard drug, Metformin (63 mg/kg, p.o)

Group VIII: Alloxan (100 mg/kg.im) + Standard drug, insulin (0.1 unit/Kg/day, subcutan)

The extracts, standard drug, and CMC Na 0.5% were administered with the help of feeding cannula. Group I serve as normal control, which received CMC Na 0.5% for 7 days. Group II to Group VIII are diabetic control rats. Group III to Group VIII (which previously received alloxan) are treatment groups given a fixed dose for 7 consecutive days.

### 2.4. Induction of Diabetes in Experimental Animals

Rats were made diabetic by a single intraperitoneal injection of alloxan monohydrate (100 mg/kgBW)[12]. Alloxan was first weighed individually for each animal according to the body weight and then solubilized with 0.2ml saline (154mM NaCl) just prior to injection. Two days after alloxan injection, rats with plasma glucose levels of >200 mg/dl were included in the study. Treatment with plant extracts was started 24 h after alloxan injection.

### 2.5. Collection of Blood Sample and Blood Glucose Determination

Blood samples were drawn from tail tip of rat. Fasting blood glucose estimation and body weight measurement were done on day 1 and 7 of the study. Blood glucose estimation can be done by one touch electronic glucometer using glucose test strips. On day 7, serum was separated and analyzed for serum cholesterol13, serum triglycerides by enzymatic DHBS colorimetric method[14] serum HDL[15], serum LDL[16], and serum alkaline phosphatase hydrolyzed phenol amino antipyrine method17.

### 2.6. Statistical Analysis.

All the values of body weight, fasting blood sugar, and biochemical estimations were expressed as mean ± standard error of mean (S.E.M.) and analyzed for ANOVA and post hoc Dunnet's t-test. Differences between groups were considered significant at $P < .01$ levels.

## 3. Results and Discussion

The results of antidiabetic activity of the water extract of Andrographis paniculata, the water extract of Syzygium polyanthum and its combination on fasting blood glucose, animal body weight and serum profile have been shown in Table 1-2. Vehicle control animals were found to be slightly decreased in their body weight but diabetic rats showed significant reduction in body weight during 7 days (Table 1). Alloxan caused body weight reduction, where the standard drugs and the treated groups cannot repair this condition.

Alloxan acts as a cytotoxin for beta-cells of the islet of langerhans, causes diabetes by inducing cell necrosis[18-19]. The Reactive Oxygen Species

mediates the cytotoxic action with the increase in cytosolic calcium concentration, leading to rapid beta-cells destruction20. This result into decreased insulin secretion and elevated blood glucose level21. This experimental study reveals that alloxan-treated rats received the water extract of Andrographis paniculata, water extract of Syzygium polyanthum and its combination showed lower blood glucose level as compared to the diabetic control group may be due to the possibility that few of beta cells are still surviving and stimulated by extract component (s), releasing insulin.

The extracts exhibited significant reduction of serum cholesterol level in alloxan-treated rats. The abnormal high concentration of serum lipids in the diabetic subject is mainly due to increase in the mobilization of free fatty acids from the peripheral fat depots, since insulin inhibits the hormone sensitive lipase whereas glucagon and epinephrine promote lipolysis. This diabetic dyslipidemia is, therefore, regarded as a consequence of the unregulated actions on LPL on fat depot[22]. The results indicate that secondary metabolites in both extracts may exert their role in maintenance the cholesterol profile, especially in LDL and HDL[23-25].

Proteolysis, lipolysis and acute fluid loss during diabetes pave the way for weight loss26. The weight gain in extract treated groups reflects the correction of body metabolism. Results reveal that the water extract of Andrographis paniculata, water extract of Syzygium polyanthum and its combination exhibits the antidiabetic activity in a dose dependent manner. In conclusion, this study indicates that the water extract of Andrographis paniculata, water extract of Syzygium polyanthum and its combination possess significant antidiabetic activity along with antihypercholesterolemic activity. The active principle (s) in the extracts may have better performance if isolated and purified form. Therefore, further investigation is in necessary to determine the exact phytoconstituents (s) responsible for antidiabetic effect.

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Table 1 Effect of various groups of water extract of Andrographis paniculata, water extract of Syzygium polyanthum and its combination on fasting blood glucose and animal body weight in alloxan (100 mg/kg, i.m.) induced diabetic albino rats after 7 days of treatment.

| Groups | Animals Body Weight (gram) | | Fasting blood glucose (mg/dl) | |
|---|---|---|---|---|
| | Day 1 | Day 7 | Day 1 | Day 7 |
| Normal control | 253 | 242 | 88 | 74 |
| Diabetic control | 136 | 116 | 221 | 566 |
| Alloxan + water extracts of *Syzigium polyanthum* leaves | 169 | 142 | 390 | 75 |
| Alloxan + water extracts of *Andrographis paniculata* aerial parts | 188 | 146 | 367 | 62 |
| Alloxan + combination 1 : 6 (water extracts of *Syzigium polyanthum* leaves : water extracts of *Andrographis paniculata* aerial parts) | 196 | 151 | 343 | 98 |
| Alloxan + combination (6 : 1 (water extracts of *Syzigium polyanthum* leaves : water extracts of *Andrographis paniculata* aerial parts) | 178 | 143 | 488 | 75 |
| Alloxan + metformin | 172 | 134 | 485 | 59 |
| Alloxan + insulin | 228 | 181 | 323 | 134 |

Table 2 Effect of various groups of water extract of Andrographis paniculata, water extract of Syzygium polyanthum and its combination on serum profile in alloxan (100 mg/kg, i.m.) induced diabetic albino rats after 7

| Groups | Cholesterol (mg/dl) | HDL (mg/dl) | LDL (mg/dl) | Triglyceride (mg/dl) | Alkaline phospatase (mg/dl) |
|---|---|---|---|---|---|
| Normal control | 32.33 ± 2.51 | 59.67 ± 2.31 | 27.11 ± 0.58 | 30.22 ± 3.21 | 232.56 ± 6.36 |
| Diabetic control | 40 ± 1.41 | 82.75 ± 2.12 | 32.5 ± 0.71 | 38.50 ± 7.07 | 226.33 ± 10.61 |
| Alloxan + water extracts of *Syzigium polyanthum* leaves | 54.60* | 46.80* | 22.50* | 29.33* | 227 |
| Alloxan + water extracts of *Andrographis paniculata* aerial parts | 30.67 ± 1.41* | 34 ± 2.12* | 24 ± 0.71* | 28.57 ± 0.00* | 287.29 ± 1.41* |
| Alloxan + combination 1 : 6 (water extracts of *Syzigium polyanthum* leaves : water extracts of *Andrographis paniculata* aerial parts) | 43.25 ± 4.43* | 36.50 ± 1.00* | 23.33 ± 4.95* | 38 ± 5.68 | 261.50 ± 2.12* |
| Alloxan + combination (6 : 1 (water extracts of *Syzigium polyanthum* leaves : water extracts of *Andrographis paniculata* aerial parts) | 45.40 ± 7.79* | 28.20 ± 2.12* | 32.83 ± 0.70 | 28.17 ± 3.54* | 284.83 ± 2.12* |
| Alloxan + metformin | 39.17 ± 0.71 | 32.83 ± 2.12* | 22.17 ± 5.65* | 37.67 ± 3.46 | 211.83 ± 12.02* |
| Alloxan + insulin | 37.20 ± 1.41* | 51.80 ± 0.71 | 26.86 ± 0.71 | 30.29 ± 1.41* | 406.86 ± 1.41* |

Values are given as mean ± SEM for groups of ten animals each *$P < .01$ (Dunnet *t*-test). Diabetic control was compared with the vehicle control and extract treated groups were compared with the diabetic control.

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