

Hypoglycemic Activity of The Herbal Tea Combination of Bitter Melon (*Momordica charantia* L.) and *Lagerstroemia speciosa* Leaves in Alloxan-Induced Mice

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ABSTRACT

The aim of this study is to evaluate the hypoglycemic activity of the herbal tea combination of *Momordica charantia* L. and the leaves of *Lagerstroemia speciosa* in alloxan-induced diabetic mice. Hypoglycemic activity of the herbal tea (0.4 ml/20 g body weight) was tested in five groups of Balb/C mice with at least five animals each and the results were statistically compared with the results of CMC-Na 0.5% (negative control) and a known antidiabetic drug glibenclamide 0.013 mg/20 g body weight. Oral administration the herbal tea of *M.charantia* and its combination with *L.speciosa* leaves in ratio (2:1), (1:1), and (1:2) for 7 days exhibited significant reduction of blood glucose level in alloxan-induced diabetic mice.

Key words: Hypoglycemic activity, combination, *Momordica charantia* L., *Lagerstroemia speciosa*.

INTRODUCTIONS

Diabetes mellitus is a complex metabolism disorder characterized by increased blood glucose levels (hyperglycemia). It has something to do with the abnormal metabolism of carbohydrates, fats and proteins in the body. And it is resulting in many complications, including damage to micro vascular, macro vascular, and neuropathic (Triplitt *et al.*, 2008).

Indonesia ranked the ten highest in the world for the number of people with diabetes with the number of about 7.3 million people below China (90.0 million), India (61.3 million), the United States (23.7 million people), Russia (12.6 million), Brazil (12.4 million), Japan (10.7 million), Mexico (10.3 million), Bangladesh (8.4 million) and Egypt (7.3 million people). It is estimated that in 2030, people with diabetes mellitus in Indonesia reached 11.8 million people and will rank the nine highest in the world (Whiting *et al.*, 2011).

Oral Antidiabetic Drug (OAD) and insulin are the basic therapies for patients with diabetes mellitus (Kumar *et al.*, 2008). The main goal of therapy in patients with diabetes is to lower blood glucose levels (hypoglycemic) and also reduce the risk of complications. However, the use of modern medicine is still found dissatisfaction with the effectiveness of therapy in patients with diabetes mellitus.

In Indonesia, there are approximately 7000 species of plants traditionally known as a medicinal plant (Berawie, 2004). Medicinal plants can be used for treatment of various diseases, diabetes mellitus is no exception. Some traditional plant in Indonesia that has hypoglycemic activity (lower blood glucose levels) in patients with diabetes mellitus is *Syzygium cumini*, *Lagerstroemia speciosa*, *Momordica charantia*, *Tinospora crispa*, *Syzygium polyanthum*, *Morinda citrifolia* and *Andrographis paniculata* (Berawie, 2004; Handa *et al.*, 2006).

Momordica charantia L. and *Lagerstroemia speciosa*, two plants are the easiest and quietly

common. Both of these plants are empirically used in traditional medicine of diabetes in many countries. *Momordica charantia* L. fruit and *Lagerstroemia speciosa* leaves also proven to reduce blood glucose levels significantly in experimental streptozotocin induced diabetic rats (Kumar *et al.*, 2008; Saha *et al.*, 2009).

Thus, this research will be run to observe the hypoglycemic activity (decrease in blood glucose levels) of the herbal tea from these plants. Evaluation of its potential hypoglycemic activity assay performed with the alloxan induced diabetic mice.

MATERIAL AND METHODS

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

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

Plant material. The bitter melon fruits were collected from Pare, Kediri and the leaves of *Lagerstroemia speciosa* were collected from the local area of Surabaya in month of March. This materials were identified at Purwodadi Botanical Garden, Pasuruan, Indonesia.

Preparation of herbal tea. The fruits of bitter melon were sliced and leaves of *Lagerstroemia speciosa* were cut and then dried without sunlight. The dried materials is milled and then packed in tea bag. Each tea bag contained 10 g of dried milled material for single plant and the combinations with ratio (1:1); (1:2) and (2:1). The tea bag was poured by 100 ml of boiling water for 10 minutes then administered to the mice orally.

Experimental induction of diabetes. The mice were injected with alloxan monohydrate (Sigma[®]) dissolved in sterile normal saline at a dose of 150 mg/kg body weight intraperitoneally. Before the injection, all mice were fasted for 18 hours. After three

days, mice with blood glucose of 200-600 mg/dl were used for the experiment.

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

Group 1. Normal (Non-Diabetes) mice, Group 2. Diabetic mice administered with CMC-sodium 0.5%. Group 3. Diabetic mice administered orally with the suspension of glibenclamide in CMC-Na (0.013 mg/20 g BW). Group 4 (M). Diabetic mice administered with herbal tea of *M. charantia* fruit 0.4 ml/20g BW., Group 5 (M2L). Diabetic mice administered with herbal tea combination of *M. charantia* fruit and *L. speciosa* leaves (2:1) for 0.4 ml/20 g BW. Group 6 (M1L1). Diabetic mice administered with herbal tea combination of *M. charantia* fruit and *L. speciosa* leaves (1:1) for 0.4 ml/20 g BW., Group 7 (ML2). Diabetic mice administered with herbal tea combination of *M. charantia* fruit and *L. speciosa* leaves (1:2) for 0.4 ml/20 g BW., Group 8 (L). Diabetic mice administered with herbal tea of *L. speciosa* leaves 0.4 ml/20g BW.

The blood samples were collected through the tail vein puncturing with a needle.

Statistical analysis. The reductions of blood glucose level from each groups were analysed by anova one way followed by LSD test.

RESULTS AND DISCUSSION

Hypoglycemic activity of the herbal tea combination of *M. charantia* and *L. speciosa* leaves in alloxan induced diabetic mice was evaluated for seven days. For seven days the mice treated with their respective groups. The observational data from the blood glucose levels of mice presented by mean $\pm$ SD. Within seven days, glibenclamide at dosage 0.013 mg/20 g BW reduced blood glucose levels by 280.5 mg/dl. Group M shown reduction of blood glucose levels by an average of 62.83 mg/dl. Group M2L shown reduction of blood glucose levels by an average of 66.17 mg/dl. Group M1L1 shown reduction of blood glucose levels by an average of 96.80 mg/dl. Group ML2 shown reduction of blood glucose levels by an average of 94.83 mg / dl. Group L shown reduction of blood glucose levels by an average of 15.83 mg/dl. All groups except negative control shown the reduction of blood glucose level. The blood glucose level of negative control group increased by 30.4 mg/dl during 7 days of treatment.

The reduction of blood glucose level were analysed by one way anova followed by LSD test. The result shown that the reduction of blood glucose level from all group except group L significantly different with negative control group. The blood glucose level is presented in table 1 and the result of LSD test is presented in Table 2.

From the data, it can be seen that group M1L1 gives the largest average reduction in blood glucose levels within 7 days.

Table 1. The blood glucose level of all groups

Group	Blood Glucose Level (mg/dl)			
	0 th Day	7 th Day	Reduction	% of reduction
Non-diabetic Group	121.00	131.00	-10.00	8.26
Negative Control	435.00	465.00	-30.00	6.89
Positif Control	422.00	142.00	280.00	66.35
Group M	364.83	302.00	62.83	17.22
Group M2L	386.00	319.83	66.17	17.14
Group M1L1	356.00	259.20	96.80	27.19
Group ML2	288.17	193.33	94.84	32.91
Group L	450.83	435.00	15.83	3.51

Table 2. The result of LSD test between groups

	Control 1 (+)	Control (-)	Group M	Group M2L	Group M1L1	Group ML2
Control (-)	0.000*					
Group M	0.000*	0.050*				
Group M2L	0.000*	0.043*	0.940			
Group M1L1	0.000*	0.012*	0.464	0.508		
Group ML2	0.000*	0.010*	0.469	0.516	0.966	
Group L	0.000*	0.320	0.290	0.257	0.086	0.080

*Groups are significantly different, $p < 0.05$.

Charantin, a substance that found in bitter melon has a potential antidiabetic activity (Krawinkel & Keding, 2006). This substance can increase the secretion of insulin, glucose uptake, glycogen synthesis, and lower the gluconeogenesis in liver (Yeh *et al.*, 2003).

The other substance which has antidiabetic activity is corosolic acid that found in *L. speciosa* leaves. The oral administration of corosolic acid can increase the number of glucose transporter 4 (GLUT-4) on the muscle cells of mice (Klein, 2007). On the muscle cells and adipocytes, GLUT-4 requires insulin and high concentration of glucose to uptake the glucose into the cells (Wilcox, 2005). So, with no insulin, GLUT-4 can't uptake the glucose into the cells. This is the suspect why group L didn't show the big reduction of blood glucose level during the treatment as the other groups did.

Conclusion

The oral administration of bitter melon herbal tea and its combination with *L. speciosa* leaves with ratio (2:1), (1:1), and (1:2) for 0.4 ml/20 g BW can reduce the blood glucose level in mice within 7 days of treatment.

REFERENCES

- Berawie, N., 2004. Inventory, Documentation and Status of Medicinal Plants Research in Indonesia. di dalam Batugal, Pons A, Jayashree K, Lee Sok Y dan Jeffrey T (ed.), *Medicinal Plants Research in Asia*. Malaysia: *International Plant Genetic Resources Institute*. p:56 – 68.
- Handa, S.S., Rakesh, D.D., Vasisht, K., 2006. *Compendium of Medicinal and Aromatic Plants Asia*. Italia: United Nations Industrial Development Organization and the International Centre.
- Klein, G., Kim, J., Himmeldirk, K., Cao, Y., and Chenxi, A., 2007. Antidiabetes and Anti-obesity Activity of *Lagerstroemia speciosa*. Advance Access Publication.
- Krawinkel, M.B. and Keding, G.B., 2006. Bitter Gourd (*Momordica charantia*): A Dietary Approach to Hyperglycemia. *International Life Sciences Institute*.
- Kumar, SR, Ashish, J., and Satish, N., 2011. *Momordica charantia* Linn.: A Mini Review. *International Journal of Biomedical Research*.
- Saha, B.K., Bhuiyan, N.H., Mazumder, K., Haque, K.M.F., 2009. Hypoglycemic activity of *Lagerstroemia speciosa* L. extract on streptozotocin-induced diabetic rat: Underlying mechanism of action. *Bangladesh Pharmacological Society (BDPS)*.
- Triplitt, C.L., Reasner, C.A., Isley, W.L., 2008. *Diabetes Mellitus*. Di dalam Dipiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM (ed). 2008. *Pharmacotherapy: A Pathophysiological Approach, 7th Edition*. New York: The McGraw-Hill Companies, Inc.
- Whiting, D.R., Guariguata, L., Weil, C., Shaw, J., 2011. IDF Diabetes Atlas: Global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Research and Clinical Practice* 94: 311 – 321.
- Wilcox, G., 2005. Insulin and Insulin Resistance. *The Clinical Biochemist Reviews* vol.26, p: 19-39.
- Yeh, G.Y., Eisenberg, D.M., Kaptchuck, T.J., Phillips, R.S., 2003. Systematic Review of Herbs and Dietary Supplements for Glycemic Control in Diabetes. *Diabetes Care* 26(4), p : 1227-1294.