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The Potency of Ethanolic Extract of *Mimosa pudica* L. Root and Stem from Indonesia As Antidiabetic and Hepatoprotector

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Abstract: *Mimosa pudica* L. was traditionally used to treat dysentery, leprosy, burning sensation, asthma, inflammations, leucoderma, fatigue and blood diseases. This research was conducted to evaluate antidiabetic and hepatoprotective effect of the 70% ethanolic extract of *Mimosa pudica* L. root and stem on male Wistar rats induced by alloxan. Twenty four male Wistar rats were divided into 4 groups. Group I was negative control (treated with distilled water), Group II was treated by metformin at dose of 500 mg/kg/day, Group III was treated with root extract at dose of 600mg/kg/day and group IV was treated by stem extract at dose of 600mg/kg/day. Before the treatment, their blood glucose, SGOT and SGPT levels were measured. After that, rats were injected by alloxan at dose of 150mg / kg intra-peritoneal and followed by extract/medication accords to each group treatment for 11 days. On 4th and 11th day, their blood glucose levels, SGOT and SGPT were re-measured. The results of this study are the 70% ethanolic extract of the roots and stems of *Mimosa pudica* L. were able to lower blood glucose levels in male Wistar rats induced by alloxan. The 70% ethanolic extract of the stem of *Mimosa pudica* L. may reduce blood levels of SGOT and SGPT in male rats of Wistar strain induced by alloxan.The 70% ethanolic extract of the roots and stems of *M.pudica* L has potency as antidiabetic agent while only the stems extract has potency as hepatoprotective agent.

Key words: *Mimosa pudica* L. · Antidiabetic · Hepatoprotective

INTRODUCTION

Mimosa pudica L. was commonly used to treat dysentery, leprosy, burning sensation, asthma, inflammations, leucoderma, fatigue and blood diseases in India [1]. Some researcher have proved that this plant has pharmacology activity. The results of those researchers show that: the methanolic extract of *M. pudica* L. root has good wound healing activity [2], the methanolic and aqueous extract of *M. pudica* L. stem have also wound healing activity [3-4]. This activity was suggested by phenolic in this extract [5-6]. The ethanolic extract of *M. pudica* L. leaves at dose 200mg/kgbw and 400mg/kgbw of have antiinflamation activity [7], anti antidiarrhea [8], antiplasmodial *Plasmodium berghei* [9]. The phenolic extract of *M. pudica* L. root has anti asthma activity [10]. The aqueous extract of *M. pudica* stem and methanolic extract of *M. pudica* L. leaves and seeds have antimicrobial activity [11-13]. The aqueous and alcoholic extract of *M. pudica* seed have anthelmintic activity [14]. The ethanolic extract of *M. pudica* L. seeds has anticancer activity (10). The aqueous extract of the leaves at dose 200 and 400mg/kg bw have antiulcer activity [15]. *In vitro*, the crude extract of aerial part of *M. pudica* L. has antioxidant with IC_{50} 296.92 µg/mL [16].

It is estimated that approximately 21.3 million people in Indonesia will suffer from diabetes by 2030 [17]. Previous study stated that *M. pudica* L. has antidiabetic activity [18]. The ethanolic extract of *M. pudica* L. leaves at dose of 600 mg/kg was able to lower blood glucose levels for 32.46% reduction. The ethanolic extract components of *M. pudica* L. leaves consist of alkaloids, tannins and flavonoids [18]). The study by Zhang *et al*. [19] in 2011 found that 70% ethanol extract of the *M. pudica* L. stem has anti-oxidant effect against free radicals by DPPH method. Flovanoid allegedly has a hepatoprotective effect because it has antioxidant activity [20]. This research was conducted to evaluate the antidiabetic and hepatoprotective effect of 70% ethanolic extract of *M. pudica* L. root and stem.

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MATERIAL AND METHODS

The animal test were male Wistar rats, 2-3 month old, weighing 175-225 g. The Rats were obtained from laboratory of Pharmacology of Faculty of Medicine of Universitas Muhammadiyah Surakarta. The *M. pudica* L. was found from Gonilan, Kartosuro, Sukaharjo, Jawa tengah, Indonesia. The plant was harvested on December 2015.

Extract Preparation: The *M. pudica* L. root and stem was dried under the sun and then blended to a powder form. 50 g powder was macerated by 70% ethanol with ratio 1:7 for 2 days. The filtrate was taken and put in glass (glass I). The residues were re-macerated with fresh solvent (ratio 1:4) for 2 days. The filtrate on the second process was mixed with first filtrate. This filtrate was dried in vacuum evaporator.

Antidiabetic and Hepatoprotective Test: This research protocol was approved by health research ethics committee of Faculty of Medicine Universitas Muhammadiyah Surakarta with no 007/A.1/KEPK/FK UMS/II/2015.

Animal Test Preparation: All rats were housed in standard environment condition for 1 week in laboratory of pharmacology of Universitas Muhammadiyah Surakarta and fed with standard diet for rodent with water *ad libitum*.

Experimental Design: Rats were divided into 4 groups. Each group consisted of 6 rats. Group I was the negative control (treated by distilled water), Group II was treated by metformin at dose of 500 mg/kg/day, Group III was treated root extract at dose 600mg/kg/day and group IV was treated by stem extract at dose 600mg/kg/day. Before treatment, the fasting blood glucose, SGPT (serum glutamic-pyruvic transaminase) and SGOT (serum glutamic-oxaloacetic transaminase) levels of the rats were measured and then injected by alloxan with dose of 150mg / kg intra peritoneal. The use of alloxan to induce diabetes refers to research by Shah *et al*., 2013 and Mbaka *et al*., 2008 [21, 22]. After that all rats were treated by extract/medication accords to each group treatment for 11 days. All rats are allowed to fed standard for rodent and drink 5% glucose *ad libitum* to prevent hypoglycemic effect. On 4^{th} and 11^{th} day, the fasting blood glucose levels, SGOT and SGPT of the rats were re-measured.

Data Analysis: All value (blood glucose, SGOT and SGPT) were expressed by Mean±SD. The difference value between group was tested by analysis of variants (ANOVA) followed by LSD test (P<0.05)

RESULTS AND DISCUSSION

In this research, rats blood glucose, SGOT and SGPT levels were measured on day 0, 4 and 11. The fasting blood glucose level can be seen in table 1.

Based data on table 1, there is increasing fasting blood glucose level after alloxan injection (day 4 versus day 0). The fasting blood glucose level on day 11 on the positive control; EERM and EEBM groups lower than negative control (83.67± 54.34; 84.83±15.82 and 94.50±20.93 vs 139.50 ±17.89 mg/dl respectively). From analyses of variants (ANOVA test), there are significant deference between group (P<0.05). The post hoc test (LSD) can be seen in table 2

Based on table 2, there are significant differences between positive control, EERM, EESM and negative control (P<0.05). From this analysis, it can be concluded that the 70% ethanolic extract of *M.pudica* L. root and stem can reduced blood glucose level in diabetic male wistar rats induced by alloxan.

The rats blood SGPT (serum glutamic-pyruvic transaminase) and SGOT(serum glutamic-oxaloacetic transaminase) levels can be seen on table 3 and table 4.

Table 1: Rats blood glucose levels ± SD (mg/dL)

	The mean blood glucose level ± SD (mg/dL)		
Groups	Day 0	Day 4	Day 11
Negative control	56.67 ± 18.07	253.50 ±109.87	139. 50 ±17.89
Positive control	70. 83 ± 55.09	241.67± 98.35	83.67± 54. 34
EERM	41.67 ± 21.73	227 ± 147.66	84.83 ± 15.82
EESM	36.83 ± 10.13	240.67 ± 119.21	94.50 ± 20.93

Notes: EERM: The 70% ethanolic extract of the root of *M. pudica* L., EESM: The 70% ethanolic extract of the stem of *M. pudica L.*

Table 2: The p value of blood glucose level (day 11) on LSD test

Groups	*P* value (vs negative control)
Positive control	0.006
EERM	0.007
EESM	0.022

Table 3: The mean of the rats blood SGPT level ± SD (U/L)

	The men of SGOT ± SD (U/L) on day		
Groups	0	4	11
Negative control	36.44 ± 9.50	46.33 ± 13.61	62.11 ± 21.04
EEEM	40.35 ± 18.15	77.44 ± 16.54	58.76 ± 8.02
EESM	37.88 ± 13.64	73.78 ± 28.62	44.67 ± 4.79

Table 4: The mean of the rats blood SGOT level ± SD (U/L)

	The men of SGOT ± SD (U/L) on day		
Groups	0	4	11
Negative control	40 ± 10.44	112.22 ± 30.04	124.33 ± 18.79
EEEM	60.89 ± 23.51	109 ± 20.89	98.44 ± 28.43
EESM	48.56 ± 17.84	97.67 ± 38.31	80.56 ± 32.20

Table 5: The *p* value of blood SGOT and SGPT level (day 11) on LSD test

	P value (vs negative control)	
Groups	SGOT	SGPT
EEEM	0.054	0.562
EESM	0.002	0.005

From table 3 and 4, the mean blood SGPT and SGOT level of EEEM on day 11 are 58.76 ± 8.02 and 98.44 ± 28.43 U/l. This results are lower than negative control. The mean blood SGPT and SGOT level of EESM on day 11 are 44.67 ± 4.79 and 80.56 ± 32.20 U/l. These results are lower than negative control too. The *p* value on post hoc (LSD test) can be seen on table 5.

Based on table 5, there are significant difference of SGPT and SGOT on EESM group with negative control ($P<0.05$). From this analysis, it can be concluded that 70% ethanolic extract of *M. pudica* L. stem can reduce blood SGPT and SGOT level in male Wistar rats induced by alloxan.

DISCUSSION

The data in this study show that the 70% ethanolic extract of the roots and stems of *M. pudica* L. are able to lower blood glucose levels in male Wistar rats induced by alloxan. The 70% ethanolic extract of the *M. pudica* L. stem is able to improve liver function due to induction by alloxan. This study was linear with previous studies, among others: The ethanolic extract of *M. pudica* L. leaves reduced blood glucose level significantly on hyperglycemic rat Wistar strain induced by alloxan [10,23]. Research by Sutar *et al.,* 2009 found that the ethanolic extract of the *M.pudica* leaves at dose of 600 mg / kg for 7 days can lowers blood glucose levels by 50.35% reduction, while metformin at dose of 500 mg / kg can lowers blood glucose levels by 62.44% reduction. Research by Bashir *et al*. [24], stated that root powder of *M. pudica* L. in 5mL suspension of gum tragacanth, dose 2, 4 and 6 mg / kg b ware able to lower blood glucose levels in albino rabbits.

Several studies explore the chemical compounds in *M. pudica* among others: The extract of *M. pudica* root contains steroids, alkaloids, glucosidal flavonoids and phenolic compounds [24], while in the stem there are flavonoids and phenolic [19].Chemical constituents in leaves are alkaloids, tannins, flavonoids [18].Steroid from plant is suspected to play an important role as an antidiabetic [25]. Alkaloids are a group of bioactive compounds that have antioxidant effects by reducing free radicals in pancreatic â cells and can increase glucose uptake in muscle cells and pancreatic â cells [26].

Glycosides Flavonoid can lower blood glucose by inhibiting the intestinal α- glucosidase [24]. Flavonoids are included in important group of phenolic compounds. Flavonoids are able to lower blood glucose by inhibiting the absorption of glucose and they also acts as an inhibitor of the enzyme α- glucosidase and pancreatic α-amylase [27]. The pancreatic α- amylase is an enzyme produced by pancreatic that converts polysaccharides into the disaccharide maltose, whereas α- glucosidase is an enzyme produced in the luminal brush border of intestinal that break disaccharides into monosaccharide [28]. *M. pudica* was suspected to contain flavonoids [24].

Phenolic compound are phytochemicals found in several plants including *M. pudica* [24]. These compounds are capable to lower blood glucose in several ways, among others: a). Serving as α- glucosidase enzyme inhibitors and pancreatic α- amylase which inhibits the absorption of glucose, b). Inhibiting glucose absorption in the gut by inhibiting the active transport of GLUT 2, c) Protecting pancreatic beta cells from glucotoxic, d) Increasing insulin secretion by increasing ATP intra-cells in the pancreas, e) Increasing glucose uptake in muscle cells and fat cells through the removal of GLUT 4 of the cell to the cell membrane and f). Inhibiting gluconegenesis process in the liver [27].

The leaf extract of *M. pudica* L. at dose of 300 mg/kg and a dose of 600 mg/kg have hepatorepair effect on male wistar rats induced by paracetamol [29]. Research by Karwani *et al*. [30] stated that the plant extract of *M. pudica* L. at dose of 200 mg / kg, 400 mg / kg, 800 mg/kg able to reduce levels of AST and ALT in rats induced by CCl4.

CONCLUSION

The 70% ethanolic extract of the roots and stems of *M. pudica* L. are able to lowers blood glucose levels in male Wistar rats induced by alloxan. The 70% ethanol extract of the stem of *M. pudica* L. are able to reduce blood levels of SGOT and SGPT in male Wistar strain rats induced by alloxan SGOT and SGPT level in male Wistar rats induced by alloxan. The 70% ethanolic extract of the roots and stems of *M. pudica* L. has potency as antidiabetic agent while *M. pudica* L. stems has potency as hepatoprotective agent.

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