Comparison the Antihypertensive and Antioxidant Potential between Young Mahogany Seeds Extract with Mature Mahogany Seeds Extract in Rats with Hypertension

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Abstract

Mahogany seeds have been used in the community as an antihypertensive and antioxidant. Antihypertensive and antioxidant efficacy of mature mahogany seeds has been proven in hypertensive rats. The purpose of this study was to compare the antihypertensive and antioxidant effect of mature mahogany seeds extract with young mahogany seeds extract. This study is a laboratory experimental design with pre-test and post-test design control groups, with Wistar rats as samples. Thirty rats were divided into 5 groups, each group consist of 6 rats. The control group was given saline every day as a rat model of hypertension. 1-4 treatment groups were each given NaCl and water extract of young mahogany seeds for treatment 1, the ethanol extract of young mahogany seeds as treatment 2, water extract of mature mahogany seeds as treatment 3 and ethanol extract of mature mahogany seeds as treatments 4. Dosages of extract mahogany seeds is 100 mg / head / day for 4 weeks. Before treatment, evaluation of rat blood pressure with special sphygmomanometer was held, and examination of blood MDA as a pre-test data. Further evaluation of MDA and SOD blood pressure are at the end of the study. The data were tested by ANOVA to see the difference between the groups. The results showed a decrease in blood pressure and levels of MDA were significant in all treatments (p <0.05) compared with control as well as an increase in SOD were significantly (p <0.05). The ethanol extract of mature mahogany seeds showed the most excellent antihypertensive and antioxidant properties (p <0.05). From these results, it can be concluded that the ethanol extract of mature mahogany seeds is better than young mahogany seeds extract as an antihypertensive and antioxidant in hypertensive rats.

Keywords: Antioxidants, Hypertensive rats, Mature and young mahogany seeds.

Introduction

Research has shown that chronic hypertension causes oxidative stress due to the increased production of superoxide and hydrogen peroxide ions that accompanied by a decrease in superoxide dismutase (SOD) as endogenous antioxidant. Oxidative stress that occurs chronically will cause disruption of endothelial dysfunction resulting in various complications of hypertension. Good antihypertensive drugs are those that have antioxidant properties that can lower blood pressure and prevent complications of hypertension [1]. Treatment of hypertension with conventional drugs such as captopril and other similar drugs can overcome oxidative stress, but often cause side effects that led to failure of therapy, so need to look for alternative medicine from plants which...
have an antihypertensive and antioxidant properties.

Epidemiological studies have shown that foods with a high content of flavonoid can prevent and inhibit the occurrence of cardiovascular disease. Flavonoids can improve vascular endothelial function [2], through regulation of endothelial nitric oxide synthase (eons) expression and increase the production of NO (nitric oxide) [3-5]. Intake of fruits and vegetables that rich in flavonoids can lower blood pressure by decreasing free radicals [6].

 Provision of mahogany seeds extract that containing flavonoids has been proven as an antioxidant in vitro and to inhibit the angiotensin converting enzyme (ACE) [7]. Mahogany seeds have been used empirically in the community as an antihypertensive and as a drug that can improve the lipid profile in patients with diabetes mellitus [8, 9], as well as natural antioxidant [10], with the mild side effects and toxic effects [11].

 Research conducted in 2014 has proven that the water and ethanol extracts of mahogany seeds can lower blood pressure in hypertensive rats and may reduce oxidative stress. The study also shows the effect of mahogany seeds against oxidative stress and blood pressure in hypertensive rats was same with purple sweet potato extracts [12].

 Mahogany seeds that being investigated as antihypertensive and used empirically by the public, is a seed that has fallen from the tree (seeds that have been mature). The fact that happened is very difficult to get the fallen fruit from the tree, so we need studies that examined the fruit that has not fallen from the tree (young fruit).

 What are the effects of these two types of fruit are comparable to blood pressure and oxidative stress hypertensive rats? To answer these problems, research was held in a mouse model of hypertension, which is induced by a high dose of NaCl and given young mahogany seed extract and mature mahogany seed extract.

 Materials and Methods

 The population in this study were male rats that aged 3-4 months, weighing 175-225 g, were obtained from the Laboratory of Food Nutrition UGM. The sample size was 30 rats were determined by the Federer formula, in order to get 6 rats per group. Hypertensive rats group is a group of rat that were administered saline at a dose of 2% of body weight every day, as a control.

 The treatment group was treated rats with NaCl 2% of body weight each day and given the material test with a certain dose. Long of the treatment is for 4 weeks. Number of treatment was 4 types of treatments, treatment 1: water extract of young mahogany fruit seeds 100 mg / day and NaCl. Treatment 2: ethanol extract of young mahogany fruit seeds 100 mg / day. Treatment 3: water extract of mature mahogany fruit seeds 100 mg / day. Treatment 4: ethanol extract mature mahogany fruit seeds 100 mg / day. The use of animals in this study was approved by the Ethics Committee of the Faculty of Medicine, University of Udayana.

 Samples

 The ethanol extract mahogany seeds made by the following procedure: A total of 300 grams of powdered mahogany seeds was macerated using 500 ml of ethanol 95% for 1 day. Then, macerate that obtained is filtered. The waste product is macerated back with two repetitions of 500 ml of 95% ethanol. Allowed to stand overnight and the solvent was evaporated with a rotary vacuum evaporator at a temperature of 50°C, followed by oven at a temperature of 40°C to obtain a thick extract. Extract thick stretcher test materials used by dissolving into the water at a dose of 100 mg and 200 mg / head.

 Water extract of mahogany seeds powder made by the following procedure: A total of 300 grams of powdered mahogany seeds was macerated using 500 ml of distilled water for 1 day. Macerate that obtained then the being filtered. The waste is macerated back with two repetitions of 500 ml of distilled water.

 The solvent is evaporated with aerated using a hair dryer, followed by oven with temperature at 40°C to obtain a thick extract.
Thick extract stretcher test materials used by dissolving into the water with a dose of 100 mg and 200 mg / head.

**Systolic Blood Pressure Measurement**

Systolic blood pressure was measured with a special instrument called tail-cuff plethysmography (sphygmomanometer S-2 Ser.N09208, Hugo Sachs Electronic, Germany). Before the study, the rats were adapted for 2 weeks. After 2 weeks of adaptation performed blood pressure measurement as a pre-test data. During treatment, blood pressure checked every 3 days.

**Blood examination**

After treatment, for 4 weeks, the rats blood was taken via retro orbital plexus at all rats. The blood sample used for examination of MDA and SOD. MDA examination (pre-and post-test) was conducted using the thiobarbituric acid reactive substances (TBARS) and SOD with randox total antioxidant status kit method.

**Results**

The results of examination of systolic blood pressure in all groups of rats showed the same results at the beginning of the study. The average systolic blood pressure in a row for the control group, the group of water extract of mature mahogany seeds, ethanol extract of mature mahogany seeds, water extract of young mahogany seeds and ethanol extract of young mahogany seeds: 84.5 mmHg, 84.5 mmHg, 86.16 mmHg, 87 mmHg and 85.6 mmHg (p> 0.05). The control group was given saline 2% only of body weight each day throughout the study.

The treatment group 1 to 4 each given NaCl 2% weight and water extract of mature mahogany seeds, ethanol extract of mature mahogany seeds, water extract of young mahogany seeds and ethanol extract of young mahogany seed: 84.5 mmHg, 84.5 mmHg, 86.16 mmHg, 87 mmHg and 85.6 mmHg (p> 0.05). The control group was given saline 2% only of body weight each day throughout the study.

There is an increase in blood pressure that significant in the control group which is reached 211 mmHg. In the treatment groups, there was an increase in systolic blood pressure that lower than other group, respectively 136 mmHg in the group of water extract of mature mahogany seeds, 104 mmHg in the group of ethanol extract of mature mahogany seeds, 154 mmHg in the group of water extract of young mahogany seeds and 111 mmHg in the group of ethanol extract of young mahogany seeds.

The statistical showed an increase in systolic blood pressure was significantly (p <0.05), but statistically significant increase in blood pressure in the treatment group was lower than the controls (p <0.05). When compared the effect of a decrease in systolic blood pressure between the water extract of mature mahogany seeds with water extract of young mahogany seeds, blood pressure reduction was more pronounced in the group seed extract mahogany ripe (p <0.05).

The group that given both ethanol extracts of mature and young mahogany seeds, efficacy in lowering blood pressure was significant (p <0.05). Comparison of systolic blood pressure in all groups of rats is presented in Fig. 1.

MDA examination results in early studies showed the average MDA is nearly equal between 1.14 mmol / l to 1.52 mmol / l, was not statistically different (p> 0.05). After treatment in the control group there was meaningful increases of MDA to 6.66 mmol / l, if compared to earlier studies, the increases are very significant (p <0.05). In the treatment group, there was an increase of MDA that lower than controls group (p <0.05).

The average levels of MDA in treatment group was 3.42 mmol / l, 1.95mmol / l, 4.15mmol / l and 2.83mmol / l respectively for treatment of mature mahogany seeds extract (water and ethanol) and young mahogany seeds extract (water and ethanol).

Among the group of young mahogany seeds extract with mature mahogany seeds extract, water and ethanol extract of mature mahogany seeds were better than young mahogany seeds extract (p <0.05). Comparison of MDA in all groups of rats were presented in Fig. 2.

The results of the examination of blood SOD after researching for one month, obtained
that there was decreases of blood SOD in the control group compared to the treatment group (p <0.05). Blood SOD in control group was 382.73 u / g. Blood SOD in group of water extract of mature mahogany seeds was 442.16 u / g, that number were higher than the water extract of young mahogany seeds which is about 341.98 u / g (p <0.05). Blood SOD of ethanol extract of mature mahogany seeds is 558.75 u / g, the number were higher than the levels of blood SOD in ethanol extracts of groups of young mahogany seeds which is 491.33 u / g (p <0.05). Comparison of blood SOD levels are presented in Fig. 3.
Discussion

Mahogany seeds have been used empirically in the community as an antihypertensive and as a drug that can improve the lipid profile in patients with diabetes mellitus [8,9], as well as natural antioxidant [10], with the mild side effects and toxic effects [11]. Research conducted in 2014 has proven that the water and ethanol extracts of mahogany seeds can lower blood pressure in hypertensive rats and may reduce oxidative stress.

In this study, has proved that the seeds extract of mature and young mahogany can prevent the increase in blood pressure in rats that given high doses of NaCl. Besides, the water and ethanol extract of mahogany seeds can prevent oxidative stress. The ethanol extract of mahogany seeds is more potent in preventing oxidative stress and increases in blood pressure in both of mature and young mahogany seeds.

Mahogany seeds extract has been investigated in several countries which is containing of alkaloids, flavonoids, saponins, tannins and terpenoids [7,13], has antioxidant properties in vitro were pretty good through the activity of neutralizing free radicals and as an inhibitor of xanthine oxidase which is an enzyme that can increase the superoxide ion [13]. Because of mahogany seeds extract that contains antioxidants that can lower blood pressure through increased levels of NO as vasodilation. Antihypertensive properties of mahogany seeds extract through its effect as an antioxidant as well as the barriers against angiotensin converting enzyme (ACE) [7]. In this study, reduction in blood pressure after being given seeds extract of mahogany allegedly caused by flavonoid, which is estimated by mechanism of increases of NO by flavonoids, so it can induce the relaxation of blood vessels through an increase of the NO.

Increased NO from application of flavonoids is a result of increased activity of eNOS by a variety of mechanisms. Flavonoids from various sources are also expected to increase the release of prostacyclin and inhibit the synthesis and decrease the effect of endothelin-1, causing relaxation of blood vessels [4].

Other antioxidant compounds that thought to play a role in antioxidant activity in mahogany seeds extract is saponin. Saponin has a cluster of sugar (hexoses) that soluble in water. These compounds can reduce free radicals so that it can function as an antioxidant. Saponins can be used as a generic drug to treat diabetes. These compounds can inhibit the absorption of glucose, so it can be useful as a therapeutic agent of diabetes mellitus [14].
In this study proved that the properties of mahogany seeds as antioxidants by effect of MDA and SOD, and antioxidant properties that better at the mature seeds were extracted with ethanol. Ethanol as a solvent in the extraction process was better because it is more selective, inhibiting the growth of fungi and bacteria, non-toxic, neutral, and can be mixed with water in any ratio. Ethanol can dissolve the alkaloids, glycosides, curcumin, coumarin, anthraquinone, flavonoids, steroids, resins and chlorophyll. Ethanol also can inhibit the dissolution of fat, tannins and saponins as distraction substance, thus the extract can produce better effects [15].

Ethanol extracts also proved that containing of phenolic groups was higher than the other extracts, so the ethanol extract had higher antioxidant properties. Research by DPPH proved that ethanol extract of mahogany seeds has antioxidant properties that nearly to 60% [16]. According to the study by Soheil et al, ethanol extract of mahogany seeds can boost levels of vitamins C and E in plasma and reduced glutathione in plasma, kidney and liver increased in rats treated with the extract [17]. The results of this study in which the mahogany seeds extract has antioxidant properties, according to research that conducted in diabetic rats which is after administration of mahogany seeds extract may prevent oxidative stress [9].

In this research, the technique of maceration was held to obtain ethanol and water extract of mahogany seeds as samples and it was found that the ethanol extract is more effective to maximize the antioxidant content of mahogany seeds, with the flavonoid suspected as main roles. Based on research by Aulia, ethanol extract by maceration method, produces an extract that has antioxidant activity better than the ethanol extract by reflux method. It is shows that there were antioxidant compounds that better extracted by ethanol, but its nature is not resistant to heating. Instead, the water extract by reflux method produces an extract that has antioxidant activity that better than the water extract by maceration method.

It is shows that there were antioxidant compounds that better extracted by water, but its nature is resistant to heating. One of antioxidant compound that better extracted by ethanol and its nature is not resistant to heating is flavonoid, while antioxidant compounds that better extracted by water and more resistant to heating is saponin [14].

**Conclusion**

The ethanol or water extract of mature and young mahogany seeds can lower systolic blood pressure of hypertensive rats that induced by NaCl. The ethanol or water extract of mature and young mahogany seeds can increase SOD and lower the blood MDA of hypertensive white rats that induced by NaCl. The ethanol extract of mature mahogany seeds is more potent than water extract of mahogany seeds in lowering blood pressure, improve blood SOD and lowering MDA in hypertensive rats that induced by NaCl.

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**References**


