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Effectivity Test Of Mahoni (Swietenia Mahagoni) Tree Extracts On Animals (Mus Musculus) As Diuretics

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Abstract

Hypertension is a condition where a person experiences an increase in blood pressure above normal with systolic pressure above 140mmHg and diastolic pressure above 90mmHg. Hypertensive disease is an important health problem throughout the world with a high and increasing prevalence. Treatment that can be done is by means of herbal medicine using mahogany fruit seeds which contain bioactive compounds including alkaloids, flavonoids tannins, and saponins. This study aims to determine whether mahogany fruit seeds can increase urine volume in mice and at what concentration mahogany fruit seed extract can provide pharmacological effects on mice. The type of research used is experimental with the population of mahogany fruit seeds (Swietenia mahagoni) obtained from the city of Palopo and the sample used mahogany fruit seed extract (Swietenia mahagoni). The data obtained were analyzed using one-way Anova. From the results of the study obtained diuretic activity of the extract with a dose of 100mg / kgBB as much as 2.5, extract dose of 200mg / kgBB as much as 4.6 and extract dose of 300mg / kgBB as much as 4.5 which means that the three doses have strong activity. In the statistical test results of the average urine volume obtained a significant value of p0.004 ($p < 0.05$). meaning that there are differences in urine volume in the five treatment groups tested proved to have a significant effect on the urine volume of mice.

Keywords: Diuretic; Mahogany Seed Extract

1. Introduction

Hypertension or high blood pressure is a constant blood pressure of systolic pressure over 140 mmHg and diastolic pressure over 90 mmHg (Black & Hawks, 2014). High blood pressure can occur because the heart is pumping blood more difficult to meet the body's need for oxygen and nutrients. High blood pressure is also often referred to as a silent killer because it does not show typical signs and symptoms (asymptomatic). When high blood pressure is not well controlled, disorders of the blood vessels appear (Nurarif & Kusuma, 2015).

Data from the World Health Organization (WHO) in 2015 showed that around 1.13 billion people in the world suffer from hypertension, which means that one in three people in the world suffer from hypertension. The number of people with hypertension continues to grow every year, it is estimated that by 2025 around 1.5 billion people will experience hypertension and every year 10.44 million people will die from hypertension and its complications. Data published by WHO (2018) shows that around 26.4% of the world's population suffers from hypertension, with a ratio of 26.6% in men and 26.1% in women. About 60% of people with hypertension are in developing countries, including Indonesia. According to the Ministry of Health, high blood pressure and other heart diseases are the cause of more than a third of deaths, while high blood pressure is the second cause of death after stroke.

Dalimartha (2010) states that non-pharmacological therapy can also be done by consuming herbal medicines such as garlic, bay leaves, celery leaves, mahogany seeds, cucumber, coriander, noni fruit, garlic, tomatoes, and pisang ambon. Herbal medicine is a treatment that uses medicinal plants. Indonesia is a country that is very rich in plant diversity. This situation is very beneficial

when people practice herbal medicine. Treatment with medicinal plants is very popular in today's society due to its low side effects, low cost, and easy access. One of the medicinal plants that can be used as herbal medicine for high blood pressure is the mahogany seed plant. Mahogany seeds are widely and commonly used for therapy as herbal medicine, especially to lower blood pressure. This is evidenced by the research of Alawiyah & Handayani (2015) which shows the effect of lowering blood pressure from mahogany seeds.

The benefits of mahogany seed plants are many, including lowering blood pressure in people with hypertension. Mahogany seeds contain saponins and flavonoids. Flavonoids are known to improve blood circulation, lower cholesterol, fat deposits in blood vessels reduce pain, bleeding and bruising, and act as antioxidants against free radicals (Hidayat, 2014). The chemical and pharmacological properties of the bitter taste of mahogany seeds are effective in lowering blood pressure, increasing appetite and lowering blood sugar. In addition to lowering blood pressure, it can also be used to treat diabetes and loss of appetite, rheumatism and fever. The seeds are used as part of the plant in connection with lowering blood pressure (Hidayat, 2014). Based on the results of research by Nikmah et al., (2022) on the results of phytochemical screening showed that extracts from mahogany fruit seeds positively contained alkaloid compounds, flavonoids tannins, and saponins.

Based on the description above, it is necessary to conduct research on how the diuretic effectiveness of mahogany seed extract (Swietenia mahagoni) on mice (Mus musculus). Whether mahogany seeds can provide a diuretic effect from the bioactive compounds contained therein so that it can be utilized as a natural ingredient for alternative hypertension therapy tested in vivo.

2. Methodology

Type of Research

The research to be carried out is a laboratory experiment that is expected to see whether the administration of mahogany seed extract (Swietenia mahagoni) tested in mice (Mus musculus) can provide diuretic activity. The methods used are phytochemical screening, observation of physical properties of urine, calculation of diuretic activity.

Time and Place of Research

This research will be conducted in July-August 2023 in the pharmaceutical laboratory of Muhammadiyah University of Palopo, South Sulawesi.

Population and Sample

Population

The population of this study was mahogany fruit seeds (Swietenia mahagoni) obtained from the city of Palopo.

Samples

The sample used was mahogany fruit seed extract (Swietenia mahagoni).

Research Variables

The variables used in this study are independent variables (Independent) and dependent variables (Dependent). The independent variable in this study is mahogany fruit seed extract, while the dependent variable in this study is diuretic.This research was conducted from September to

October at the Microbiology Laboratory, Faculty of Health Sciences, University of Muhammadiyah Palopo.

2.1 Research Procedure

Sampling process

The collection of raw materials in the form of mahogany fruit seeds is taken when the fruit is large and if the fruit is old, the fruit will fall by itself from the tree stalk. The fallen fruit is what the seeds are taken from. Then do wet sorting, which is separating the seeds from the skin and other plant parts that are not needed.

How to make mahogany fruit seed extract (Swietenia mahagoni)

The dried mahogany fruit seeds are blended until smooth until the mahogany fruit seed simplisia powder is obtained, the mahogany powder is then macerated with 1000 mL of 70% ethanol. The reason for using 70% ethanol is a solvent that is more polar than 96% ethanol and more non-polar than 50% ethanol so that flavonoid compounds that are polar will tend to dissolve more in 70% ethanol (Riwanti et al., 2020). Maceration was carried out in a jar at room temperature for 5 days with occasional stirring. The solution was then filtered and the entire macerate was collected. The macerate was then evaporated to remove the solvent. Evaluation of Ethanol Extract of Mahogany Seed (Switenia mahagoni)

Organoleptical examination (Ministry of Health, 1979). Observations were made visually by observing shape, color and odor.

Determination of the yield of mahogany fruit seed extract (Switenia mahagoni). Samples of mahogany fruit seeds (Switenia mahagoni). weighed then the extraction results obtained were weighed again. The yield was calculated by the formula:

Yield (%) = (Weight of extract obtained)/(Weight of Wet Sample)×100%

Preparation of 1% Na CMC Suspension.

A total of 0.5 grams of Na CMC was weighed and then put into a mortar containing 10 ml. Warm aquadest, crushed until homogeneous. The Na CMC suspension was transferred into a 100 mL volumetric flask and the volume was filled with distilled water to 100 mL (Arliani et al, 2015).

Preparation of Furosemide Suspension

A total of one tablet containing 40 mg of furosemide was crushed, and weighed as much as 0.104 mg and then added 1% Na CMC suspension little by little while being crushed until homogeneous and diluted with a little water and then put into a 50 ml volumetric flask and the volume was sufficient with distilled water to 50 ml. Before treatment, the experimental animals were acclimatized to the research environment for 7 days and were fed for 8 hours before treatment but still given a drink (Rahayu, 2012). With the aim of adjusting the body condition of the test animals with environmental conditions that are considered by the test animals so that the test animals do not experience stress at the time of treatment that can affect the results of the study.

Treatment of experimental animals

Treatment of Experimental Animals 25 male mice were divided into 5 groups, each group consisting of 5 mice. All mice were coded and weighed, Each mice was adapted in a metabolic cage for 3 days with food and water. Then all mice were given warm water as much as 1 ml/20gBB orally before 30 minutes of treatment, after which all groups were treated:

Group P-0 (Negative control group) was given 1% Na-CMC as much as 1 mL.

Group P-1 (Positive control group) was given furosemide 0.104 mg/20 g BB

Group P-2 (Test group) was given mahogany fruit seed extract with a concentration of 100 mg/kgBB

Group P-3 (Test group) was given mahogany fruit seed extract with a concentration of 200 mg / kgBB

Group P-4 (Test group) was given mahogany fruit seed extract with a concentration of 300 mgkg/BB.

Measurement of Urine Volume

Mice that have been treated are placed respectively in a metabolic cage that is available to collect urine excreted by mice. The amount of urine excreted by the mice was recorded every time for 6 hours. Then the percentage of diuretic power (potential) was calculated (Maulina et al., 2015).

Determination of Diuretic Effect

Determination of the diuretic effect is based on the results of urine volume measurements. Urine volume data is then used to calculate the percentage of urine excretion, diuretic work, and diuretic activity calculated according to Mamun et al, (2003) and Mahmod et al, (2004). As follows:

Urinary Excretion (%) =(Total urine produced (mL))/(Total fluid intake (mL))×100%

Diuretic action=(Urine excretion of test group)/(Urine excretion of Normal Control group)

Diuretic Activity = (Diuretic action of test group)/(Diuretic action of urine)

In addition, the diuretic activity data obtained was compared with the Gujral diuretic scale (Mahmood, 2004). The Gujral diuretic scale states, that diuretic activity with a value of less than 0.72 states that it has no diuretic activity; 0.72 to 1.0 states a diuretic with weak diuretic activity; 1.0 to 1.5 is a diuretic with moderate diuretic activity; and if more than 1.5 means it has strong diuretic activity.

Data Analysis

In this study, the average urine volume data obtained will be analyzed using one-way Anova.

3. Result and Discussion

This study aims to determine whether mahogany fruit seeds can increase urine volume in mice (Mus musculus) and at what concentration mahogany fruit seed extract can provide pharmacological effects on mice (Mus musculus). The samples used were mahogany fruit seeds

(Swietenia mahagoni) obtained from the city of Palopo.

Mahogany fruit seeds are extracted using 70% ethanol with the aim that flavonoid compounds that are polar will tend to dissolve more in 70% ethanol (Riwanti et al., 2020). Extraction was carried out using the maceration method, the reason for using this method is that the treatment is simpler because it does not require expensive equipment, the chemical content in the simplisia can avoid damage to the content of the compounds to be withdrawn because it does not require a heating process (Dewatisari, 2020) so that it can avoid damage to substances in mahogany fruit seed powder that cannot withstand heat. Maceration was carried out for 5x24 hours while occasionally stirring and then evaporated by aerating so that a thick ethanol extract of 55.5 grams was obtained.

The thick ethanol extract of mahogany fruit seeds was then subjected to a preliminary examination which included an organoleptic test using human sensory organs which showed the results of a thick form, brown color, distinctive odor and a very bitter taste. Ethanol extract of mahogany fruit seeds is also carried out quality characterization which includes the calculation of yield and determination of drying shrinkage. Yield is the ratio of the amount (quantity) of extract produced from plant extracts. The yield obtained in table 4.1. From ethanol extract of mahogany fruit seeds is 11.1%. In table 4.2, the drying shrinkage value is 8.77% where the standard value of drying shrinkage is not more than 10%. This means that the ethanol extract of mahogany fruit seeds produced has met the standard of drying shrinkage determination (Ministry of Health of the Republic of Indonesia, 2000).

In this study, the comparison group used was Furosemide. The administration of furosemide aims to see whether the test preparation has the same effect as the comparison preparation, Furosemide is a class of strong diuretic drugs, which act on the Henle arch. Furosemide can work rapidly, such as oral administration in 0.5-1 hour and last for 4-6 hours, furosemide's working period is 2-3 hours, for the half-life depends on the function of the organ in the form of kidneys (Guyton, 1997). And each treatment is carried out for 3 days to determine the average value of urine in mice.

In the results of the average volume of urine from day 1 to day 3, there was a difference in the negative control and positive control groups where the average value of the negative control was 1.80 mL, while the positive control given furosemide obtained an average urine value of 1.37 mL. Which means that the negative control obtained more average urine results compared to the positive control group.

There is a difference in results where at a dose of 100 mg / kgBB the average urine value is 1.66 mL, a dose of 200 mg / kgBB the average urine value is 3.03mL and at a dose of 300 mg / kgBB the average urine value is 2.93 mL.

This shows that there is a change in the results in each test treatment which indicates an increase in urine output in each treatment, this occurs because of the flavonoid content. Flavonoids can increase urination and excretion of electrolytes, which function like potassium, namely absorbing liquid electrolyte ions such as sodium that are in the intracellular blood to go extracellularly to enter the kidney tubules. A high glomerular filtration rate (GFR) due to flavonoid activity causes the kidneys to be unable to remove waste products from the body quickly (Kane et al., 2009)

Based on research conducted by Raja (2008), mahogany seeds contain flavonoid compounds, which are polyphenolic compounds that are found in abundance in nature. Flavonoids are a class of natural compounds made from phenolic compounds which are plant pigments. Flavonoids function to improve blood circulation by increasing nitric oxide levels through the secretion of endothelial nitric oxide synthase (eNOS). Endothelial nitric oxide synthase is an enzyme that functions to regulate vasodilation of blood vessels. Nitric oxide (NO) as a whole with the blood flow can cause smooth muscle relaxation so that it functions as a regulator of blood flow and pressure, preventing platelet aggregation and adhesion.

The mechanism of action of flavonoids as diuretics is to inhibit the reabsorption of Na+, K+, and Cl resulting in an increase in electrolytes. Apart from that, flavonoids can also inhibit the reabsorption of Na+ and Cl, causing an increase in Na+ and air in the tubules. Thus, there is an increase in the volume of urine in the tubule (Deswati et al., 2020). The type of flavonoid that works as a diuretic is a type of flavanol, the mechanism of action of flavonoids is a type of flavonol which is thought to be a diuretic mentioned by Khabibah (2011), namely by inhibiting the reabsorption of Na+, K+, and Cl- so that there is an increase in electrolytes in the tubules so that diuresis occurs. Increasing excretion will also increase air excretion and cause urine volume to increase (Nessa., 2013)

According to Siregar (2008), the main factor that influences the diuretic response is the site of action in the kidneys. Diuretics that work in areas where there is little sodium reabsorption will have a smaller effect when compared to diuretics that work in areas where there is a lot of sodium reabsorption. Second, the physiological status of the organ. For example, heart decompensation, liver cirrhosis, kidney failure. In this situation there will be a different response to diuretics. Third, the interaction between the drug and the receptor as diuretics are used to stimulate diuresis using diuretics.

4. Conclusion

Based on the research results, it can be concluded that administering mahogany seed extract (Swietenia mahagoni) has been proven to provide a diuretic effect in experimental mice (Mus musculus) with concentrations of 100mg/kgBB, 200mg/kgBB and 300mg/kgBB.

With concentrations of 100mg/kgBB, 200mg/kgBB and 300mg/kgBB, where a dose of 100 mg/kgBB has a diuretic activity of 2.5, a dose of 200 mg/kgBB has a diuretic activity of 4.6 and a dose of 300 mg/kgBB has a diuretic activity of 4.5. Based on the Gujral diuretic scale formula, diuretic activity with a value of more than 1.5 means it has strong diuretic activity.

5. Acknowledgement

It is hoped that future researchers will carry out further research with lower concentrations to see whether the results obtained are any different from the research conducted by the researcher.

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