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Effectiveness Testing of Mahogany Seed Ethanol Extract (*Swietenia mahogani* (L.) Jacq) as an Antidiarrheal Agent in Male Wistar Strain White Mice

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Abstract

Background: Increased bowel motions and a looser stool consistency than usual are signs of diarrhea. Alkaloids, which are present in traditional plants like mahogany seeds and can reduce intestinal motility and excess fluid secretion, are one of the secondary metabolites utilized as an antidiarrheal.
Aims: The purpose of this study was to determine the effectiveness of mahogany seed ethanol extract as an antidiarrheal agent in male Wistar strain white mice.
Methods: Using 96% ethanol as a solvent, extraction was carried out by maceration. 50 mg/kgBW, 100 mg/kgBW, and 200 mg/kgBW were the dosages utilized; loperamide was employed as a comparator. Six groups of twenty-four experimental animals were given 0.5 mL of oleum ricini to induce diarrhea. The intestinal transit method (measuring the length of the norit passage through the intestine) and the defecation method (frequency, consistency, and weight of feces) were then used to make observations. One-way ANOVA was used to evaluate the data, and Bonferroni's post hoc test was then used.
Result: The extract was most successful in producing antidiarrheal effects at a dose of 200 mg/kgBW, according to the results of the oleum ricini-induced antidiarrheal activity test. The diarrhea group did not differ significantly from the 50 mg/kgBW and 100 mg/kgBW dose groups in the initial parameters of diarrhea, but they did differ significantly from the loperamide and 200 mg/kgBW dose groups.
Conclusion: Ethanol extract of mahogany seeds (EEMB) exhibited antidiarrheal effects at doses of 50 mg/kgBW, 100 mg/kgBW, and 200 mg/kgBW in experiments on male white rats. Therefore, EEMB may be a potential antidiarrheal drug for further pharmacological development

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INTRODUCTION

Diarrhea is characterized by an increase in the frequency of defecation and watery stool consistency from normal conditions. This condition is caused by increased intestinal peristalsis due to bacterial infection, result from viral infections, parasites and toxins (Sukmawati et al., 2018). Diarrhea is a major health problem, especially in developing countries (Sharma et al., 2021). Indonesia is one of the countries with the highest rates of diarrhea (Dharmayanti & Tjandrarini, 2020).

The prevalence of child mortality worldwide among children under the age of 5, according to the WHO, is 8.5% in Southeast Asia and 7.7% in Africa. In Africa, an estimated 800,000 children die each year from diarrhea and dehydration (Dairo et al., 2017). Based on previous research in 2019 in Indonesia, 4,485,513 people were affected by diarrhea, 40% of whom were toddlers (Iryanto *et al.*, 2021). The results of the Basic Health Research according to doctor's diagnosis and symptoms experienced were around 9.27% in 2018 (Riskesdas, 2018). In Bukittinggi, based on the profile of the Tigo Baleh Community Health Center in 2021, there were 156 people diagnosed with diarrhea. One of the reasons it's important to focus on lifestyle and cleanliness in order to prevent diarrhea is the high prevalence of diarrhea in this population.

Indonesians have long used various types of traditional plants as medicinal ingredients, one of which is mahogany (*Swietenia mahogani* (L.) Jacq). Mahogany seeds are commonly used to treat several types of diseases, such as fever, diabetes mellitus, high blood pressure, fat loss, colds, colitis, diarrhea, wounds, and ulcers (Maryam et al., 2020). Alkaloids, which reduce intestinal motility and excess fluid secretion, are among the compounds in mahogany seeds thought to have antidiarrheal effects (Rahayuningsih et al., 2021). Dehydration results from the body losing a lot of water and salts, particularly sodium and potassium, due to diarrhea, which is sometimes accompanied by vomiting. Similar to diarrhea, dehydration causes blood vessels to tighten, which results in hypertension, a highly prevalent health issue (Andika et al., 2022).

Researchers are interested in testing the efficacy of an ethanol extract of mahogany seeds made from 96% ethanol solvent on male white mice of the Wistar strain since, as previously explained, there is still little study on the use of mahogany seeds as an antidiarrheal.

METHOD

Research Design

This study was quantitative and employed an experimental design, with data processing using one-way ANOVA. Twenty-four male white rats were used in this study, divided into six groups. The animal ethics committee's approval number is 268/KEPK/V/2022.

Tools and Materials

Tools: knife or scissors, measuring cup (*Iwaki*®), dropper, stirring rod, mortar and pestle, hot plate (*Ika*®), oral probe, filter paper, glass beaker (*Iwaki*®*),* test tube (*Iwaki*®), animal surgery tools, Erlenmeyer flasks (*Iwaki*®), dark maceration bottles, mouse cages, analytical scales (*Ohaus*®), animal scales, water baths, blenders (*Philips*®), animal surgery tables, funnels (*Herma*®), rotary evaporators (*Ika*®), and *stopwatches.*

Materials: male Wistar strain white mice, mahogany seeds (*Swietenia mahogani*), castor oil (Oleum ricini), 96% ethanol (*Merck*®), distilled water, iron (III) chloride/FeCl3 (*Merck*®), magnesium powder/Mg (*Merck*®), concentrated hydrochloric acid/HCl (*Merck*®), sodium carboxymethylcellulose/Na-CMC (*Merck*®), norit and loperamide (*Novadium*®).

Research Instruments

Test animals: A research animal distributor provided twenty-four male white Wistar rats, ages two to three months, and weighing between twenty and thirty grams. The animals were split up into six groups at random. According to the Federer formula, four experimental animals were utilized in each group. We purchased mahogany seeds (*Swietenia mahogani*, L. Jacq.) from street vendors who usually sell at Bukittinggi's Lereng Market. The Special Region of Yogyakarta on the island of Java is where the seeds come from. First, the seeds were sorted, meaning the shells were separated from the seeds. To eliminate undesirable contaminants, a 2 kilogram sample was obtained, diced, and then dry-sorted.

Procedure: The plant identification in the Andalas University herbarium laboratory under No. 130/K-ID/ANDA/III/2022 is the basis for the mahogany seeds utilized, which have the scientific name Swietenia mahogany. The extract was made by macerating 96% ethanol for three 24-hour periods. After that, 96% ethanol was added to a maceration container containing the pulverized mahogany seeds until the sample was completely submerged. After being sealed and kept out of direct sunlight, the container was left for a full day with sporadic shaking. The pulp was then re-soaked in 96% ethanol twice after the extract was filtered through filter paper to separate the pulp and filtrate. A thick extract was then obtained by evaporating the solvent at 50˚C using a rotary evaporator (Yuliyanti et al., 2019). After obtaining the mahogany seed ethanol extract (EEBM), organoleptic observations, yield determination, drying shrinkage.

Intervenstion In Dosage Adiministration

1. Mahogany Extract Administration

Ethanolic extract of mahogany seeds (EEBM) was administered at doses of 50 mg/kg BW for

group III, 100 mg/kg BW for group IV, and 200 mg/kg BW for group V to each set of test animals. The animal groupings were labeled to make dosing easier. A total of 10 milliliters of distilled water were used to dissolve 0.5% Na-CMC for each dose (Rambe et al., 2021).

2. **Administration of Loperamide HCl Suspension**
   Loperamide HCl suspension, which is derived from human dosage, is administered to tikus at a dose of 0.26 mg. A milliliter of 0.5% Na-CMC suspension is then added to a mortar containing loperamide (Rambe et al., 2021).

3. **Administration of Oleum ricini (Castor Oil)**
   The volume of oleum ricni administered in the study by Wahid et al (2018) for each mouse was 0.5 ml. Castor oil is produced by cold pressing the peeled seeds of Ricinus communis L. The castor seeds that have been separated from their shells are then wet sorted to remove any remaining outer skin, twigs, and pebbles. The clean castor seeds are cooked at 80°C under airtight conditions. After cooking, the seeds are dried at 100°C. The dried castor beans are blended and pressed using a hydraulic press with a force of 3-4 tons (Kolo et al., 2016).

4. **Preparation of Norit Suspension**
   Grind 5 grams of norit in a mortar and gradually add 10 mL of 0.5% Na-CMC suspension. Add distilled water up to 100 mL (Rambe *et al.*, 2021). The suspension must be shaken before use. Induce 0.2 mL of norit in mice.

5. **Preparation of 0.5% Na-CMC**
   The method for preparing 0.5% Na-CMC is as follows: sprinkle 500 mg of Na-CMC onto distilled water that has been placed in a hot pot, leave for 15 minutes, then grind until homogeneous and dilute to a volume of 100 mL (Rambe *et al.*, 2021).

Animal Test Group

Table 1. Test animals were randomly divided into six groups, each consisting of four mice, using oral absorption (1% VAO solution)

Group	Treatment
Negative Control (Na-CMC)	Rats were given 0.2 ml/20 g body weight of 0.5% Na-CMC suspension after being stimulated with 0.5 ml of oleum ricini.
Diarrhea Control (Oleum Ricini)	Rats were administered the test preparation 0.2 ml/20 g body weight of oleum ricini as a treatment intervention after being provoked with 0.5 ml of oleum ricini.
EEBM dose 50mg/kgBW	Rats were administered 0.2 ml/20 g body weight of EEBM suspension at a dose of 50 mg/kg body weight after being stimulated with 0.5 ml of oleum ricini.
EEBM dose 100 mg/kgBW	Rats were given 0.2 ml/20 g body weight of EEBM at a dose of 100 mg/kg body weight after being stimulated with 0.5 ml of oleum ricini.
EEBM dose 200 mg/kgBW	Rats were administered 0.2 ml/20 g body weight of EEBM suspension at a dose of 200 mg/kg body weight after being stimulated with 0.5 ml of oleum ricini.
Positive Control (Loperamide)	Rats were administered 0.2 ml/20 g body weight of a 0.26 mg Loperamide emulsion after being stimulated with 0.5 ml of oleum ricini.

1. Defecation Method

Before therapy, the test animals were given water but fasted for eighteen hours. Each group of rats received 0.5 ml of oleum ricini orally, and 30 minutes later, the therapy was administered according to their groups. The onset of diarrhea (first incidence of diarrhea), stool frequency, stool consistency (mucous, soft, or solid), stool weight, and duration of diarrhea were measured every 30 minutes for six hours using the defecation method (Rahayuningsih et al., 2021).

2. Intestinal Transit Method

Prior to treatment, test animals were kept in a food-free quarantine for eighteen hours. After an hour, each group of rats received treatment specific to their group after being gavaged with 0.5 ml of oleum ricini. All test animals received 0.2 ml of norit suspension 45 minutes later. The rats were killed by neck dislocation at minute 65, and their intestines were carefully removed. The intestines were placed flat on paper, and the intestines' connective tissue was cut with scissors. A ruler was used to measure the intestine's overall length as well as the intestine's journey distance. The entire length of the intestine was measured from the pylorus to the rectum, and the norit route length, or the length of the intestine traveled by the norit, was measured from the pylorus to the black end. Next, each test animal's usual ratio of the norit's travel distance to its total intestinal length was computed (Wahid et al., 2018).

The ratio of the norit passage measurement is calculated using the formula:

$$= \frac{length\ of\ intestine\ through\ by\ norit}{total\ length\ of\ intestine}\ x\ 100\%$$

Data Analysis

The data was processed using SPSS (Statistical Product and Service Solution) software. It was then analyzed using the Shapiro-Wilk method to determine normality. This was followed by a one-way ANOVA (Analysis of Variance) statistical method to determine the differences between groups. After obtaining the average differences, a *Bonferroni Post Hoc* test was used to determine the actual differences between groups.

RESULTS AND DISCUSSION

Results

Table 2. Mahogany seed ethanol exstract

Testing	Results
Weight	348.9 grams

Table 3. Characteristics of simplisia

Testing	Results
Organoleptic tests	Yellowish-brown color, is oily, has a bitter taste, and has a characteristic aroma
Loos on drying	5.59 %

Table 4. Phytochemical screening test

Testing	Reagents	Results	Ket (+/-)
Alkaloid	Extract + Wegner's reagent	Brown precipitate	(+)
Tannin	Extract + FeCl3	Green	(+)
Flavonoid	Extract + ethanol + Mg plate + HCl	Orange red	(+)

Description:

(+) : color change observed (-) : no color change

Antidiarrheal Effect Testing

A. Defecation Method

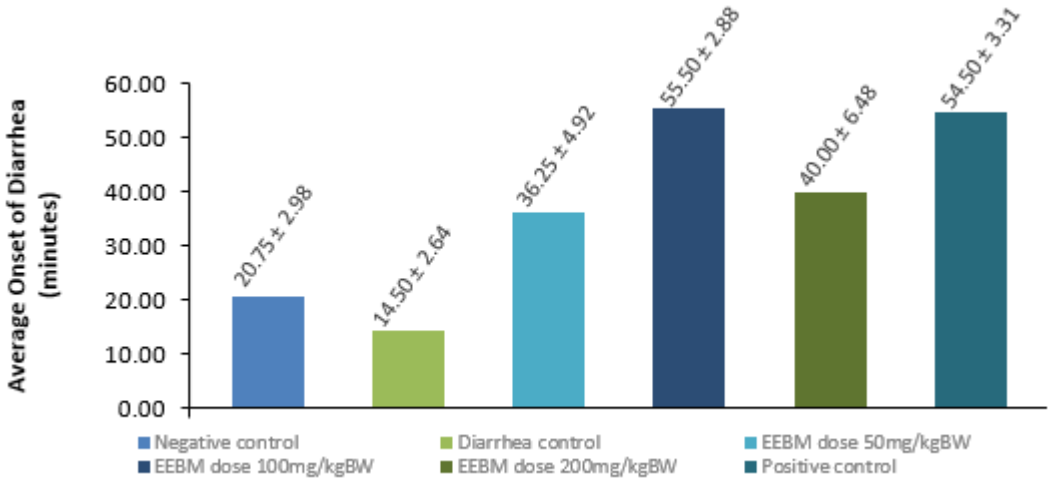

Figure 1. Onset Diarrhea (average onset of diarrhea)

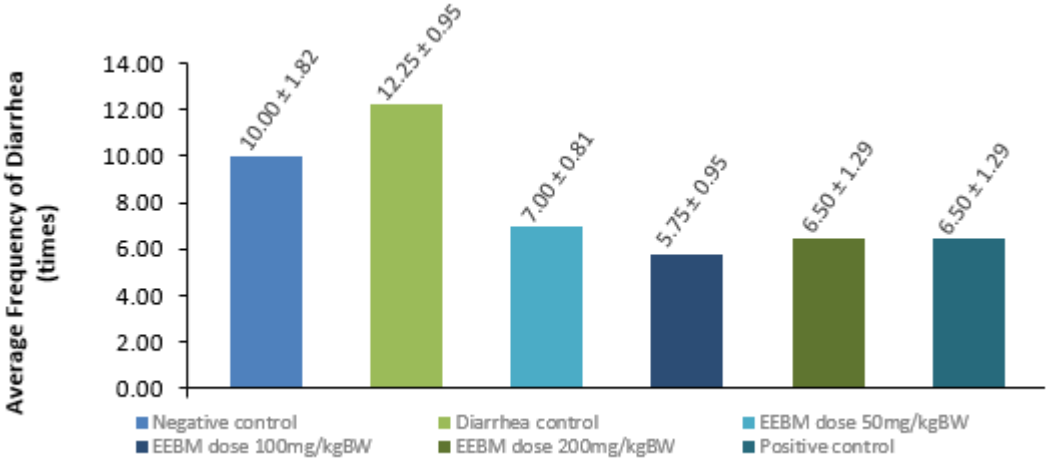

Figure 2. Fecal frequency (average frequency of diarrhea)

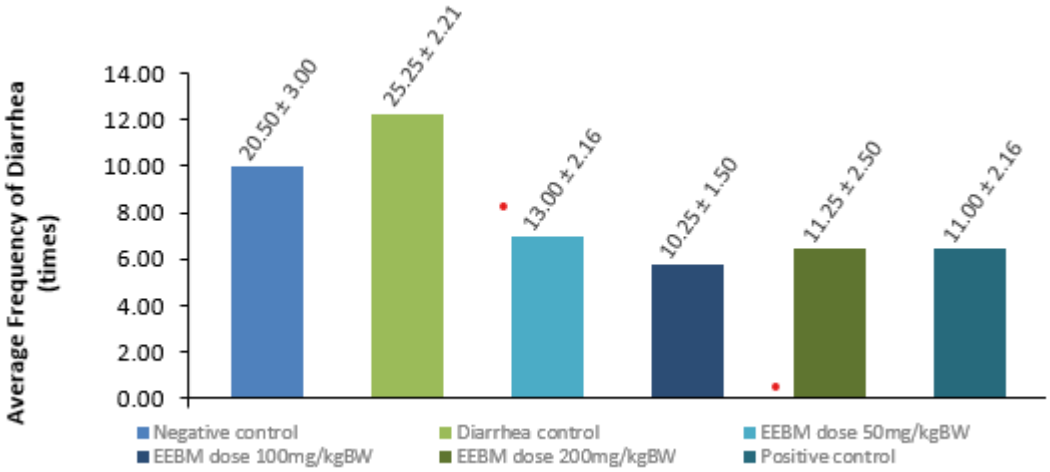

Figure 3. Fecal consistency (average fecal consistency score)

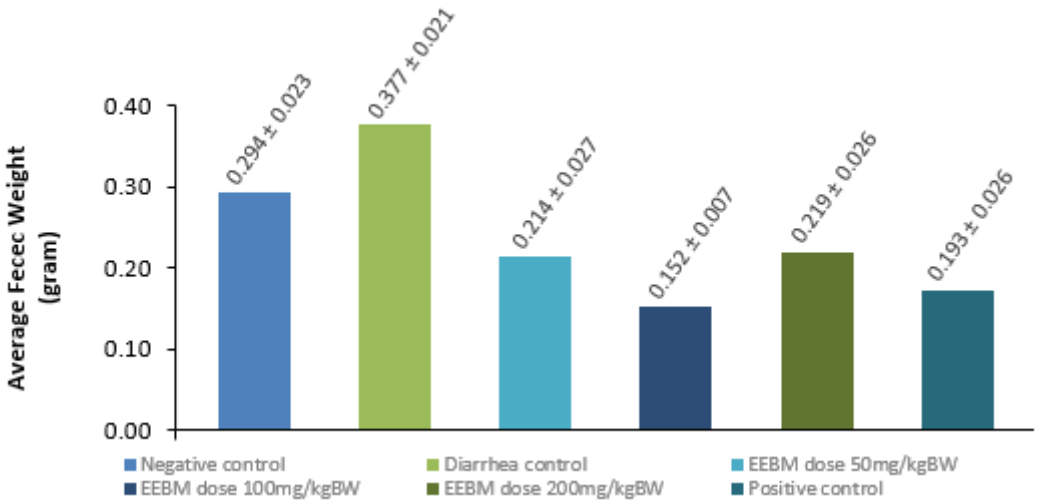

Figure 4. Fecal weight (average feces weight)

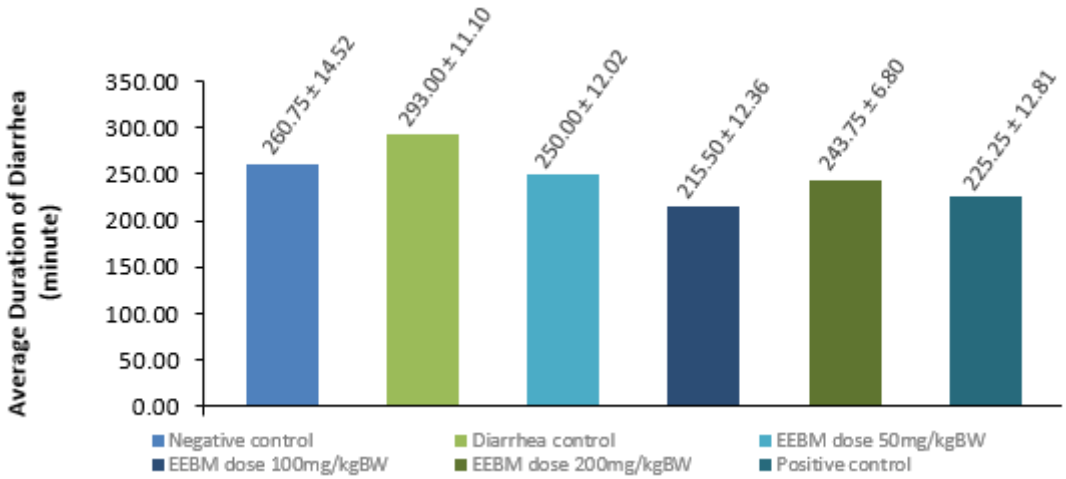

Figure 5. Duration of diarrhea (Average onset of diarrhea until stool returns to normal)

B. Observations Based on the Intestinal Transit Method

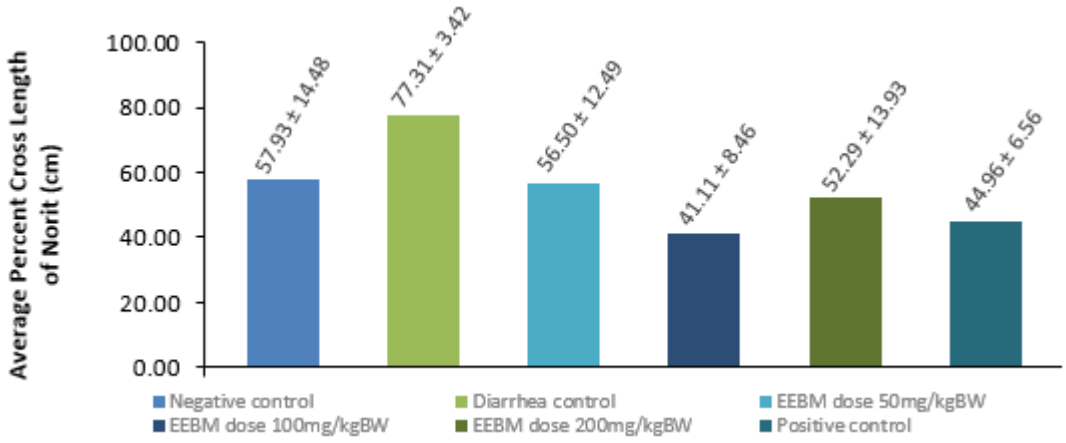

Figure 6. Average Percentage of Norit Run Length

Discussion

Mahogany Seed Ethanol Extract

After maceration, a thick mahogany seed extract weighing 348.2 grams was obtained with a yield of 17.41%. This yield meets the requirements based on the Indonesian Herbal Pharmacopeia (FHI) Edition II (Ministry of Health RI, 2017), which is not less than 16.0%.

Characteristics of Simplisia

Based on the results of organoleptic tests, concentrated mahogany seed extract has a yellowish-brown color, is oily, has a bitter taste, and has a characteristic aroma. These results are in accordance with FHI Edition II (Ministry of Health of the Republic of Indonesia, 2017), which states that concentrated mahogany seed extract has a characteristic aroma, bitter taste, dark brown color, and is oily.

In the determination of drying loss content, 5.59% ethanol mahogany seed extract was obtained. Based on these results, the dry loss of ethanol mahogany seed extract meets the requirements in FHI Edition II (2017), which is not more than 10%. Next, a phytochemical screening test was conducted, and it was found that mahogany seeds positively contain secondary metabolite compounds, namely alkaloids, tannins, and flavonoids. 96% ethanol was chosen as a solvent because it is polar and effective for testing alkaloids, tannins, and flavonoids (Susanti et al., 2023).

The bioactive components of mahogany seed extract have antidiarrheal effects; flavonoid compounds inhibit intestinal motility, which can lower the secretion of bodily electrolytes, while tannin compounds have astringent qualities that can constrict the intestinal mucosa, thereby reducing the discharge of diarrheal fluid (Putri et al., 2016). According to Fadhil et al. (2017), flavonoid chemicals have a variety of impacts on organisms utilized in traditional medicine. As antibacterials with aromatic groups that can alter bacterial DNA and prevent bacterial growth, alkaloids offer antidiarrheal qualities that function by decreasing intestinal peristalsis (Sukmawati et al., 2018).

Antidiarrheal Effect Testing

In order for the test animals to adjust to their surroundings, the mice were acclimated for seven days. Oleum ricini was administered to the test animals as a stimulant to cause diarrhea in the small intestine throughout the therapy intervention. In the meantime, loperamide was used as an antidiarrheal medication to stop intestinal peristalsis and extend absorption time, which decreased the amount of diarrhea and stopped the body from losing salt and water (Putri et al., 2016).

A. Defecation Method

1. Onset of Diarrhea
   Using a timer, the time at which the rats first pass liquid or soft stool following Na-CMC treatment is used to determine the commencement of diarrhea (Manek et al., 2020). From the graph above, it can be seen that the group that experienced diarrhea the longest was the EEBM 100mg/kgBW dose variation group, while the group that experienced diarrhea the fastest was the diarrhea control group. This occurs because oleum ricini (castor oil) contains ricinoleic acid triglycerides, which stimulate the secretion of fluids and electrolytes and accelerate intestinal peristalsis, resulting in faster bowel emptying (Riskesdas, 2018). In this study, it was found that a dose of 200mg/kgBW did not produce an increased response, which is suspected because the 100mg/kgBW dose had already occupied all the receptors. Another reason is suspected to be that in herbal medicine, the active compound that acts as an antidiarrheal may be found alongside other compounds, causing the dose to have no antidiarrheal effect or even antagonize the antidiarrheal effect (Muthia et al., 2019). From the graph above, it can be seen that the group that experienced diarrhea the longest was the EEBM 100mg/kgBW dose variation group, while the group that experienced diarrhea the fastest was the diarrhea control group. This occurs because oleum ricini (castor oil) contains ricinoleic acid triglycerides, which stimulate the secretion of fluids and electrolytes and accelerate intestinal peristalsis, resulting in faster bowel emptying (Riskesdas, 2018). In this study, it was found that a dose of 200mg/kgBW did not

produce an increased response, which is suspected because the 100mg/kgBW dose had already occupied all the receptors.

2. Fecal Frequency
   The frequency of diarrhea is a method used to calculate how many times mice experience diarrhea every 30 minutes for 6 hours after administration of Oleum ricini and treatment of the test group. The more frequently diarrhea occurs, the less effective the antidiarrheal medication is, according to observations of bowel movement frequency. On the other hand, the antidiarrheal medication is more effective the less frequently diarrhea occurs (Ambari, 2018). The frequency of bowel motions in each therapy group demonstrates this. It can be concluded that the dose variation groups and the positive control group have good antidiarrheal effectiveness because the negative control group and the diarrhea control group experienced diarrhea more frequently than the dose variation groups and the positive control group. The diarrhea control group was significantly different ($p<0.05$) from the EEBM dosage variation groups of 50 mg/kgBW, 100 mg/kgBW, and 200 mg/kgBW as well as the positive control group, but not significantly different ($p<0.05$) from the negative control group, according to the statistical analysis's overall significance value = 0.001 and the Bonferroni test.

3. Fecal Consistency
   Observations were made on each group after treatment, observed for 6 hours every 30 minutes. Stool consistency was assessed visually and expressed as a score. This consistency was divided into 4 categories, namely no defecation or no stool production (-) = score of 0, solid or normal stool (+) = score of 1, soft or liquid stool (++) = score of 2, and slimy stool (+++) = score of 3 (Manek et al., 2020). The lower the consistency score, the better in improving stool consistency (Anggraeni et al., 2020). The results obtained from observing stool consistency showed that the diarrhea control group induced with oleum riciini had the highest average score compared to other groups because their stools contained more soft/liquid forms. This is due to the fact that the diarrhea control group was not given any drugs or active substances with antidiarrheal activity, so it took longer for their stools to return to normal compared to other groups. More liquid stool consistency indicates that the amount of fluid in the intestines that is not properly absorbed causes more fluid to be carried by the stool (Anggraeni et al., 2020). Based on the results of statistical analysis, the overall significance value obtained was sig.=0.001 ($p<0.05$), which means there is a difference in the average between groups. Further statistical tests, namely the Bonferroni test, were conducted to determine significant differences between treatments obtained for each stool consistency, namely between the diarrhea control group, which differed significantly ($p<0.05$) with EEBM 50mg/kgBW, 100mg/kgBW, 200mg/kgBW, and the positive control group, but no significant difference ($p<0.05$) was found with the negative control group.

4. Fecal Weight
   A test group is declared to have antidiarrheal efficacy if the feces produced weigh less than those in the negative group. The heavier the fecses, the weaker the effect of the antidiarrheal treatment (Fajar & Cahyo, 2020). The negative group had the highest fecal weight because the consistency of the feces produced contained more water or was softer than normal, resulting in heavier feces. Another factor is that the frequency of feces produced in the diarrhea control group was also higher than in the other groups. The statistical analysis yielded an overall value of sig.=0.001. The diarrhea control group was significantly different ($p<0.05$) from all treatment groups, including the EEBM dose variation groups of 50 mg/kgBW, 100 mg/kgBW, and 200 mg/kgBW, the positive control group, and the negative control group. Additional statistical tests using the Bonferroni test were performed to determine significant differences between treatments obtained for each stool weight. The 100 mg/kgBW dose demonstrated the greatest average reduction in stool

weight across the treatment groups, suggesting that it had the best antidiarrheal effect when compared to the other doses.

5. Duration of Diarrhea

The duration of diarrhea can be determined from the initial observation of the onset of diarrhea until the stool consistency returns to solid form. The duration of diarrhea is determined from the onset of diarrhea until the stool returns to normal (stool is not soft or liquid). This is done to determine how long diarrhea lasts after induction with oleum ricini and treatment of the group. The faster the time interval for the change from loose to solid stool consistency, the better the effect of the antidiarrheal treatment (Kartikasari et al., 2020). Because they were not given medication or active substances with antidiarrheal action, the diarrhea in the diarrhea control group and the negative control group persisted longer than in the other groups. As a result, changes in stool took longer to return to normal (Ambari, 2018). Long-term monitoring of diarrhea (duration of diarrhea) reveals that the stronger the diarrheal activity, the shorter the diarrheal duration, and the lower the antidiarrheal activity, the longer the diarrheal duration (Manek et al., 2020). Following a Bonferroni test between the negative control group and the EEBM dose variation groups of 50 mg/kgBW, 100 mg/kgBW, and 200 mg/kgBW as well as the positive control group, the overall significance value obtained from the statistical analysis was 0.001, indicating that there is a difference in the means between the groups, but not significantly different from the diarrhea control group. These findings indicate that the most effective antidiarrheal agent is EEBM 100 mg/kgBW.

B. Observations Based on the Intestinal Transit Method

The diarrhea control group caused by oleum ricini and the negative control group supplied Na-CMC had the largest ratio value, according to the observation results of the percentage of norit transit length. This happened in the negative control group because Na-CMC lacks antidiarrheal qualities, allowing norit as a marker to easily travel through the intestines and increasing intestinal contraction, which lengthens the norit transit. In contrast, the comparative group and the dose variation group showed lesser ratios. The antidiarrheal impact is better when the norit transit ratio is lower.

According to statistical analysis, the total result is sig.=0.003 ($p<0.05$), indicating that the group means differ. The diarrhea control group, the 100 mg/kgBW EEBM dose group, and the positive control group all had significantly different norit cross-section lengths according to the Bonferroni test; however, the 50 mg/kgBW dose group, the 200 mg/kgBW EEBM group, and the negative control group did not. Because the charcoal traveled a shorter distance in the EEBM 100 mg/kgBW group than in the negative control group and the diarrhea control group, the transit ratio of activated charcoal was lower. To put it another way, the inhibition of excessive electrolyte and water secretion increases with shorter charcoal transit, making it more difficult for the charcoal to pass through the intestines (Wahid et al., 2018). Charcoal functions by decreasing pore size and preventing fluid and electrolyte release. Intestinal peristaltic motions may be lessened as a result of this suppression of intestinal transit, which slows the interaction of food, liquids, and electrolytes (Riskesdas, 2018).

Implications

The results of this study show that in male white mice given oleum ricini, ethanol extract of mahogany seeds (EEMB) exhibits strong antidiarrheal efficacy. EEMB may be a promising natural source for the creation of herbal antidiarrheal drugs, as evidenced by the observed decrease in diarrhea frequency, stool consistency score, stool weight, duration of diarrhea, and intestinal transit. These findings offer a scientific foundation for the possible therapeutic use of mahogany seeds and validate their traditional use in gastrointestinal diseases.

Research Contribution

This research adds to the increasing amount of information about the pharmacological properties of mahogany seeds (*Swietenia mahogani* (L.) Jacq). In particular, it offers experimental data on the effectiveness of mahogany seed ethanol extract in preventing diarrhea during both intestinal transit and feces. Additionally, the study finds that 100 mg/kgBW is the most efficacious dose among the investigated concentrations, offering important information for dosage optimization and future preclinical research.

Limitations

When interpreting the study's findings, a number of limitations should be taken into account. First, only male experimental animals were used in the study, which may limit the findings' applicability to female animals. Second, the study's statistical power may have been diminished by the comparatively small sample size (n = 4 animals per group). Third, the study did not look into the precise molecular pathways behind the observed benefits; instead, it concentrated on evaluating antidiarrheal activity. Furthermore, the antidiarrheal activity's active ingredients were not separated and measured separately.

Suggestions

It is advised that future research look into the molecular processes of mahogany seed ethanol extract's antidiarrheal properties, particularly how it affects intestinal motility, electrolyte secretion, and inflammatory pathways. Larger sample sizes, both male and female animals, and toxicity assessments are all required for future research. Additionally, the creation of standardized herbal antidiarrheal formulations should be supported by the isolation and identification of the bioactive chemicals responsible for the antidiarrheal activity.

CONCLUSION

The following conclusions can be drawn from the mahogany seed ethanol extract (EEMB) test results:

1. At doses of 50 mg/kgBW, 100 mg/kgBW, and 200 mg/kgBW, mahogany seed ethanol extract (EEMB) had an antidiarrheal effect on male white mice.
2. The comparison group exhibits no significant difference with the EEMB dose of 100 mg/kgBW, but a significant difference with the EEMB doses of 50 mg/kgBW and 200 mg/kgBW, according to the early parameters of diarrhea occurrence. Meanwhile, there is no discernible difference between the doses of EEMB 50 mg/kgBW, 100 mg/kgBW, and 200 mg/kgBW and the reference group in terms of stool frequency, stool consistency, stool weight, duration of diarrhea, and % cross length of norit.
3. When compared to doses of 50 mg/kgBW and 200 mg/kgBW, a dose of 100 mg/kgBW yields the best outcomes.

It is hoped that further researchers can test the effects of ethanol extract of mahogany seeds (*Swietenia mahogani* (L.) Jacq) on other pharmacological effects, so that it can be used as an alternative treatment in the general population.

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AUTHOR CONTRIBUTION STATEMENT

NFRZ formulated and planned the research, performed the experiments, gathered and examined the data, and created the initial draft of the manuscript. MA. offered methodological direction,

oversaw the research process, and evaluated the manuscript. BHP. played a role in supervising the study, interpreting data, and critically reviewing the manuscript. All authors reviewed and accepted the final version of the manuscript.

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