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# SURAT PENUGASAN TENAGA PENDIDIK

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| Bidang | Perincian Kegiatan | Tempat | Jam/ Minggu | Kredit (SKS) | Keterangan |
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| I PENDIDIKAN DAN PENGAJARAN | MENGAJAR DI KELAS (KULIAH/RESPONSI DAN LABORATORIUM) | | | | |
| | Farmakognosi 1 | Ruang HC-5 | | 1 | Jumat, 08:00-09:40 |
| | Fitofarmaka | Ruang HC-7 | | 1 | Selasa, 08:00-09:40 |
| | Fitokimia 2 | Ruang HC-8 | | 1 | Selasa, 08:00-09:40 |
| | Praktikum Fitokimia | Laboratorium | | 1 | Jumat, 08:00-11:00 |
| | Bimbingan Skripsi | | 3 Jam/Minggu | 1 | |
| | Menguji Tugas Akhir/ Komprehensip | | 3 Jam/Minggu | 1 | |
| | Penjaminan Mutu (KPMI) | | 12 Jam/Minggu | 4 | |
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| III PENGABDIAN DAN MASYARAKAT | Pelathan dan Penyuluhan | | 3 Jam/Minggu | 1 | |
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| IV UNSUR UNSUR PENUNJANG | Seminar | | 3 Jam/Minggu | 1 | |
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| | Jumlah Total | | | 13 | |

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# Maja Fruit (*Crescentia cujete* L.) Potential as a Laxative in Mice

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**ABSTRACT**

Constipation is a digestive disorder that anyone with symptoms of complex, uneven, and irregular bowel movements commonly experiences. This study aims to determine the laxative effect of maja extract (*Crescentia cujete* L.) on male white mice (*Mus musculus*) induced by loperamide. This fruit has been reported to be used as an analgesic, anti-inflammatory, and for digestive system disorders. The method used to test laxative activity is the intestinal transit method. Parameters observed included stool weight, defecation frequency, feces consistency, and not passage length in the intestine of mice. The extract was administered orally at a dose of 125 mg/kg BW, 250 mg/kg BW and 500 mg/kg BW; as a comparison, a negative control (CMC Na) and a positive control (docusate sodium) were used. Phytochemical screening of maja extract contains alkaloids, flavonoids, tannins, and saponins. The best results were obtained: maja fruit can provide a therapeutic laxative effect through the molecular mechanism of secondary metabolites in loperamide-induced test animals.

***Keywords*:** *Crescentia cujete;* Laxative; Constipation; In Vivo

## INTRODUCTION

Since the time of their ancestors, traditional medicinal plants have been used from generation to generation up until the present; some people are employing plants as medicine based on their willingness to try. According to estimates, there are still a significant number of plants that thrive in Indonesia but whose existence has yet to be made known to the general population in terms of knowledge about their composition and health advantages.[1]

Constipation is one of the diseases that individuals frequently experience, which can be treated with conventional treatment. Constipation occurs when the feces become firm, making it uncomfortable to pass and challenging to relieve in the rectum. Numerous factors, including insufficient fiber intake, dehydration, drug side effects, and disease-related as a result. Inadequate physical exercise can result in constipation.[2] Constipation can strike at any age and is typically defined by a reduction in stool frequency for three days without defecating bowel motions and heavy straining required).[3] Constipation sufferers may experience higher levels of stress as a result of the discomfort it causes.[4]

*Crescentia cujete* L. is one of the plants employed in conventional medicine. Maja fruit includes tannins, flavonoids, alkaloids, saponins, and phenols, which give it an astringent flavor when it is young.[5] Maja fruit (*Crescenia cujete* L.) has been shown to inhibit the growth of *Vibrio harveyi* when taken as a traditional medicine. This includes treating digestive system diseases (stomach aches, intestinal parasites) and respiratory disorders like colds, coughs, and asthma. Antibacterial, anti-inflammatory, and analgesic: *Crescentia cujete* L.[1,6,7,8,9,10]

Based on the above description, a study was conducted to ascertain the laxative activity of maja fruit extract with varying doses of constipated male white mice through loperamide induction and to ascertain the

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activity of secondary metabolites that can potentially provide molecular training as therapeutic agents. Maja fruit extract may be an alternative medicine for lacinia (constipation). Although it is well recognized that this issue will cause discomfort in the digestive tract, namely in the stomach, research on constipation is still infrequently conducted. The Maja fruit plant will aid future researchers regarding its pharmacological activity as a substitute laxative agent that can be employed for the development stage of new pharmaceuticals produced from Maja fruit that are no less successful than therapies derived from synthetic chemicals.

## METHODS

### Equipment and chemical materials

The types of equipment used analytical balance (Wiggen Hauser), mice cage, and rotary evaporator (Buchi). Maja fruit (*Crescentia cujete* L.) was obtained from the National Institute of Science and Technology, Srengseng Sawah, South Jakarta. Plant determination was carried out at PT. Palapa Muda Perkasa, Depok, West Java, which shows that the plant used is the maja plant (*Crescentia cujete* L.) originating from the Bignoniaceae tribe and has identified and authenticated the plant leaves 1080/IPH.1.01/If.07/XI/2020. The mice used in this study were obtained from PT. Palapa Muda Perkasa, Depok, West Java, showed that the mice used in this study were *Mus musculus*. Other Ingredients 70% ethanol, 25% Ammonia (Merck), Chloroform (Merck), Hydrochloric acid 15% (Merck), Mayer's reagent, Dregendorff's reagent, Bouchardat's reagent, 5% sodium nitrite (Merck), 10% aluminum chloride (Merck), Sodium hydroxide 1 N (Merck), Ferry (III) Chloride 1% (Merck), Hydrochloric acid 2 N (Merck), Acetic acid anhydride (Merck), Sulfuric acid P (Merck), Docusate sodium (Laxatab®), Loperamide HCl (Lopamid®), Norit.

### Preparation of extract

Up to 5 kg of maja fruit were brought to the National Institute of Science and Technology campus, sorted while wet, and dried at 60 °C. Drying lowers the moisture content, which can decrease quality or harm the simplicial.[11] 70% ethanol is used to macerate the dry powder. As much as 0.5 kg is then placed in a dark container and kept at room temperature; after 1x24 hours, filtering and maceration are done once. Utilizing a rotary evaporator, the ethanol filtrate was concentrated.[12] The formula % extract yield content was used to compute the yield% extract content.

$$\text{Yield} = \frac{\text{The obtained extract weight}}{\text{Extracted fruit powder weight}} \times 100\ \% \quad (1)$$

### Screening for phytochemicals

Alkaloids

The sample can be moistened with up to 2 g of 25% ammonia before being shaken. Incorporate 20 ml of chloroform, cover, and gently shake. The filtrate is filtered, boiled, and added 15% hydrochloric acid. Surprisingly, two layers then form; the transparent layer is removed. When Mayer's reagent is put to the first test tube, a white precipitate results; when Dragendorf's reagent is added to the second test tube, a red brick precipitate results; and when Bouchardat's reagent is added to the third test tube, a brown precipitate marks.

Flavonoids

After being mixed with distilled water, a 2 g sample was filtered. Up to 5 ml of the filtrate was used, adding 1 ml of 10% aluminum chloride, 1 ml of 5% sodium nitrite, and 2 ml of 1 N sodium hydroxide via the tube wall. If a red or yellow-orange hue develops, flavonoids are present.

Tannins

A hundred ml of hot water and 1 g of the material were combined, then filtered. If the filtrate tests positive for tannins, up to 5 ml is taken, and a few drops of 1% ferric (III) chloride solution are added. A green or black hue results.

Saponins

A hundred ml of hot water and 1 g of sample were combined, then the mixture was cooled and rapidly shaken for 10 seconds. If the test results for saponins are positive, foam is produced up to a height of 1 to 10 cm for at least 10 minutes, and then one drop of 2 N hydrochloric acid is added to prevent the foam from dissipating.

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**Determining dosage and research parameters: a Process**

The feces approach, which involves watching animals for 30 minutes to 4 hours, was used to acclimate mice for seven days before inducing them. Loperamide was administered orally to the mice for three days after receiving food and liquids. The mice were fasted for 18 hours and only given water before receiving the test preparation. There were five groups of mice. The test materials were administered to mice. Docusate sodium 100 mg/kg BW was administered to Group I as a positive control, and CMC Na 1% was given to Group II as a negative control. Maja extract was administered to Groups III, IV, and V at 125 mg/kg BW, 250 mg/kg BW, and 500 mg/kg BW, respectively. Oral medications were used for all treatments. The mice were given an oral suspension of norit as a marker 45 minutes later. The mice's displaced cervical vertebrae were dissected thirty minutes later, and their intestines were removed, stretched, and measured for the length of the norit route. Stool weight, frequency of feces, and consistency were all noted.[13,14,15].

**Procedure for observing laxative activity**

Twenty-five mice's defecation techniques were put into separate vessels. After treatment, each mouse's response was tracked every 30 minutes to 4 hours. Consistency, weight, and frequency of bowel motions are among the answers. The test animals were slaughtered by dislocating their neck bones 45 minutes after receiving the norit suspension. On the table, the intestines are removed and spread out. Stretch and cut the intestine's connective tissue to release it. The size of the entire intestine from the pylorus to the ileocecal sphincter was determined by the length of the intestine taken by the norit, and the length of the whole intestine using a ruler passed through the norit. The following formula evaluates norit path ratio:

$$\frac{\text{Length of intestine through which norit passes}}{\text{Enntire intestinal length}} \times 100\% \quad (2)$$

They were holding the mouse's tail and setting it down on a workable surface allowed for the dislocation. When mice push their bodies to stretch them, a holder, such as a pencil or metal rod carried in the left hand, is placed on the neck. The mice are killed when the right-hand hand pulls the tail firmly enough to fracture the mouse's neck.[16] Experiments were designed and conducted in accordance with ethical norms approved by the Ethics Committee University of Pembangunan Nasional "Veteran" Jakarta with number 35/I/2021/KEPK.

**Analysis of data**

Quantitative and qualitative data were acquired. Qualitative screening tests included phytochemicals and quantitative stool weight, frequency of defecation, consistency, and the ratio of marker distances. These data were statistically analyzed using the Kolmogorov-Smirnov test to determine whether or not they were usually distributed. If they were, the analysis was then continued with a homogeneity test (test Levene) to determine whether the variance of the data obtained was the same for all samples. Using the SPSS version 25 program, the normally distributed data was further tested using the ANOVA and Post Hoc tests to evaluate whether the mean differences between groups were statistically significant.

## RESULTS AND DISCUSSION

The results of testing secondary metabolites using phytochemical screening have been conducted to observe the color test reaction using color reagents. The extract includes alkaloids, flavonoids, tannins, and saponins based on the results of the resultant phytochemicals.[1,5,8,17]

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**Table 1.** Result for phytochemical constituents of maja fruit

| Constituents | | Reaction Results | Description |
|---|---|---|---|
| Alkaloid | *Mayer* | White deposits | (+) |
| | *Dragendorff* | Redbrick deposits | (+) |
| | *Wagner* | Brown deposits | (+) |
| Saponin | | Stable ± 1 cm froth | (+) |
| Tannin | | Greenish black color | (+) |
| Flavonoid | | Reddish orange color | (+) |

A preparatory test was carried out by acclimating the cage habitat for seven days before measuring laxative action. The research impact is anticipated by doing this, which attempts to keep the mice healthy and unstressed. Loperamide solution 4 mg/kg BW to mice once daily for three days to induce constipation in test animals. Based on earlier research, loperamide induction dosages were used in experiments.[18] As a result of the experimental findings showing a dose of 4 mg/kg body weight of mice administered for two days had an effective constipation effect, this dose was utilized as a benchmark for generating constipation or constipation in further study. The amount, frequency, and consistency of the feces all changed.[19]

Loperamide 4 mg/kg BW was administered for 3 days, and the induction was successful since there was a reduction in stool weight, frequency of feces, and consistency. To continue the laxative test, which involves administering maja fruit ethanol extract, positive control, and negative control at predetermined doses, there is a significant difference in the constipation parameter, indicating that the grouping of the constipation percentage data is homogeneous. To facilitate the determination of norit trajectories and the absorption of the test chemicals in the intestines, constipated mice fasted for 18 hours while still receiving fluids. Table 3 displays the results of calculating the typical percentage of the ratio of the length of the intestine that norit has traveled to the size of the total intestine in mice following treatment.

**Table 2.** Average observation of constipation

| Treatment (mg/kg BW) | Before induction (g) | | | After induction (g) | | |
|---|---|---|---|---|---|---|
| | Faecal Weight | Defecation Frequency | Faecal Consistency | Faecal Weight | Defecation Frequency | Faecal Consistency |
| K+ | 1.16 ± 0.48 | 13.6 ± 5.98 | 1.68 ± 0.34 | 0.06 ± 0.08[a] | 0.80 ± 1.09[b] | 0.22 ± 0.43[c] |
| K- | 1.30 ± 0.41 | 14.8 ± 6.18 | 1.30 ± 0.40 | 0.20 ± 0.23[a] | 1.80 ± 1.30[b] | 0.20 ± 0.15[c] |
| EEBM 125 | 1.34 ± 0.15 | 18.6 ± 7.82 | 1.36 ± 0.28 | 0.14 ± 0.11[a] | 2.00 ± 1.58[b] | 0.24 ± 0.18[c] |
| EEBM 250 | 1.16 ± 0.42 | 14.4 ± 8.84 | 2.16 ± 0.53 | 0.06 ± 0.08[a] | 0.60 ± 0.89[b] | 0.12 ± 0.21[c] |
| EEBM 500 | 1.16 ± 0.42 | 14.4 ± 8.84 | 2.16 ± 0.53 | 0.06 ± 0.08[a] | 0.60 ± 0.89[b] | 0.12 ± 0.21[c] |

K+ = positive control of Docusate sodium; K- = CMC-NA 1%; EEBM 125=Maja fruit ethanol extract 125 mg/kg BW; EEBM 250=Maja fruit ethanol extract 250 mg/kg BW; EEBM: Maja fruit ethanol extract 500 mg/kg BW; (0.0 - 1)=Hard stools; (1.1 - 2) = normal stools; (2.1 - 3) = soft stools; (3.1 - 4)=Liquid stools; a = 0.358; b =0.300; c=0.597 which is significantly different (p>0.05).

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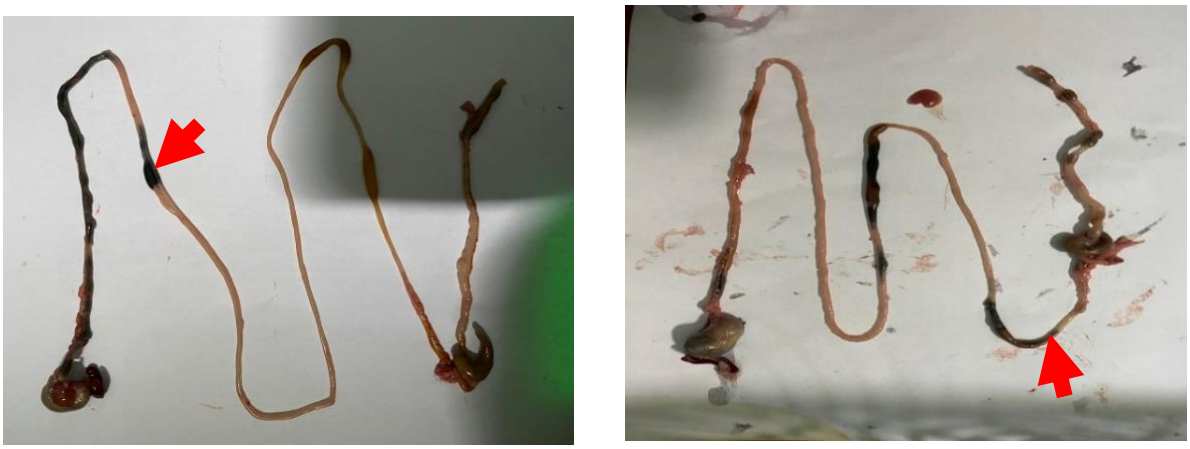
**Table 3.** Percentage of norit crossing in test animal intestines

| Treatment (mg/kg BW) | Average ± SD (cm) | *Levene Statistic* |
|---|---|---|
| K+ | 73.22 ± 6.54[b] | 0.222 > 0.05[c] |
| K- | 53.62 ± 2.18 | |
| EEBM 125 | 71.86 ± 2.36[b] | |
| EEBM 250 | 81.95 ± 1.52[a] | |
| EEBM 500 | 88.74 ± 5.68[a] | |

K+ = positive control of Docusate sodium; K- = CMC-NA 1%; EEBM 125=Maja fruit ethanol extract 125 mg/kg BW; EEBM 250=Maja fruit ethanol extract 250 mg/kg BW; EEBM: Maja fruit ethanol extract 500 mg/kg BW; a = significantly different (p-value <0.05); b = no significant difference (p-value > 0.05); c = normally distributed



(a) (b)

**Figure 1.** Photo of Marker Distance; (a) negative Control; (b) 500 mg/kg BW Extract

The length of the intestine traveled by norit can be used as a marker. Beginning at the pylorus and moving toward the marker's tip, the length of the intestine through which the marker has traveled is calculated. The length of the intestine should then be measured from the pylorus to the rectum.[20] The maja fruit ethanol extract at doses of 125 mg/kg BW, 250 mg/kg BW, and 500 mg/kg BW are said to have a laxative action if the distance traveled by the marker is more significant compared to positive control. A parameter is the bowel length ratio.

Docusate sodium is utilized as a comparison group and as a positive control because it has a working surface activity (detergent) mechanism that makes it easier for water to enter the chymus and can soften feces. The ratio of the percentage of line markers is used to determine whether the maja extract has a laxative effect by comparing it to a negative control; if the balance is more outstanding than the negative control, the maja extract exhibits laxative activity. The findings demonstrated that docusate sodium, compared to maja extract, had a typical laxative effect, most likely due to the low dose. Docusate sodium is used in a 100 mg/kg human body weight ratio. Docusate sodium typically ranges from 50 to 360 mg for human use.[21] Docucinate sodium is a weak laxative that works solely through detergency qualities, making it ineffective for treating loperamide-related constipation.

The intestinal transit method, which has also been utilized to assess past laxative activity, was applied in this investigation.[13,22] The intestinal transit approach uses indicators to determine how medications affect the rate of intestinal passage. The test animals were dislocated in the neck bones,

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dissected, and the ratio of the norit courses was evaluated after the ethanol extract was administered. The parameter observed was the trajectory of the norit in the colon.

Phytochemical screening of maja extract contains alkaloids, flavonoids, tannins, saponins, and steroids/triterpenoids. The mechanism of saponins is that they have the same activity as docusate sodium, namely detergency. Detergents are anionic surfactants (fatty acid soaps) in which the alkyl part is attached to an anion. The mechanism of action allows the mixing of water and fatty materials to reduce the stool's surface tension, increasing the water's penetration. So that this process causes the stool to become soft and facilitates the process of defecation by smoothing the passage of feces.[23] Flavonoids are thought to have a laxative effect. The presence of these components can significantly stimulate intestinal peristalsis to facilitate digestion. Alkaloids can stimulate the intestines of test animals, causing a laxative effect and increasing intestinal motility through acetylcholine receptors.[24,25] Alkaloids, flavonoids, saponins, and tannins have compounds that cause fluid and electrolyte secretion in the intestinal lumen to increase, thereby stimulating intestinal peristalsis.[26]

Based In a previous study, it was reported that berenuk fruit extract (*Crescentia cujete* L) contains anthraquinone, which is used as a laxative at a dose of 23.53 mg and has a speed of 13.4 times faster for bowel movements to occur in less than 2 hours when compared to the group of postpartum women who are experiencing constipation and only given healthy food for more than 15 hours. *Crescentia cujete* L is effective at 6.72 mg/20 g BW because it contains anthraquinone as a laxative in rats constipated for 48 hours. In South Africa, Berenuk (*Crescentia cujete* L) has pharmacological activities, namely hypertension, diarrhea, respiratory diseases, stomach problems, and cancer.[27,28,29] Flavonoids, alkaloids, saponins, and tannins are the secondary metabolites found in maja fruit.[1,30] Anthraquinones, tannins, flavonoids, tannin derivatives, and cardiac glycosides. Due to crucial minerals and phytonutrients, *Crescentia cujete* has solid pharmacological activity.[31] The study's weakness is that the results of phytochemical identification were not carried out by isolating substances to discover substances that may have potential as laxatives in Maja plants and with a more extended research length to increase observation of patterns. Defecation with the inclusion of the marker discharge time parameter following extract administration.

## CONCLUSION

The intestinal transit method was used in this study to determine the pharmacological activity of Maja extract (*Crescentia cujete* L) as a medicinal laxative. The secondary metabolites in this extract, including alkaloids, flavonoids, tannins, and saponins, have been shown to have therapeutic effects in test animals given loperamide through their molecular pathways.

### Conflict of Interest

The authors declare no conflict of interest.

### Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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