International Journal of Ecophysiology
Journal homepage: https://talenta.usu.ac.id/ijoep

Effect etanol extract of senduduk leaves (*melastoma malabathricum* L.) On SGPT and SGOT levels in white rats induced with Monosodium Glutamate

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ARTICLE INFO
Article history:
Received 19 February 2025
Revised 28 February 2025
Accepted 6 March 2025

E-ISSN: 2656-0674

How to cite:
Nurul Rahmadani, Husnarika Febriani, Melfa Aisyah Hutasuhut (2025), "Effect of etanol extract of senduduk leaves (*Melastoma malabathricum* L.) On sgpt and sgot conditions levels in male white rats (*rattus norvegicus* L.) induced with monosodium glutamate". *International Journal of Ecophysiology*, (7)1, 66-78.

Http://doi.org/10.32734/ijoep.v7i1.20217

ABSTRACT
The use of Monosodium Glutamate (MSG) has caused a lot of controversy because people think that overuse of MSG may have adverse effects on health. Prolonged consumption of MSG and excessive amounts can cause an imbalance between antioxidants that will disrupt liver function characterised by increased levels of Serum Glutamic Oxaloacetic Transaminase (SGOT) and Serum Glutamic Pyruvate Transaminase (SGPT) in the bloodstream. The negative effects of MSG can be prevented by reducing MSG consumption and utilising herbal plants such as senduduk leaves. This experiment wants to measure the effect of senduduk leaf extract on the number of SGPT and SGOT due to MSG. This study used experimental research for 14 days with 20 male white rats with 5 treatment groups. K- without treatment. K+ was given MSG 100 mg/kgBW (morning), P1, P2, and P3 were given MSG 100 mg/kgBW (morning) and senduduk leaf extract (P1 = 150, P2 = 200, P3 = 250 mg/kg BW) (afternoon). The stages in this study include phytochemical screening, observation of hepatic morphology and observation of SGPT and SGOT levels. Blood collection through the orbital sinus. Data analysis used one way anova and duncan's further test. The optimal dose to improve the amount of SGPT and SGOT due to MSG induction is group P3 with a dose of 250 mg/kg BW.
Keyword: Etanol Extract Of Senduduk Leaves, Monosodium Glutamate, SGOT, SGPT

ABSTRAK
Penggunaan Monosodium Glutamate (MSG) banyak menimbulkan kontroversi karena masyarakat menganggap penggunaan MSG yang berlebihan bisa menimbulkan efek negatif terhadap kesehatan. Konsumsi MSG dengan waktu lama dan jumlah berlebihan dapat terjadi ketidakseimbangan antara antioksidan yang akan mengganggu fungsi hati yang ditandai dengan meningkatnya kadar Serum Glutamat Oksaloasetat Transaminase (SGOT) dan Serum Glutamat Piruvat Transaminase (SGPT) pada aliran darah. Efek negatif dari MSG dapat dicegah dengan mengurangin konsumsi MSG dan memanfaatkan tumbuhan herbal seperti daun senduduk. Penelitian ini bertujuan untuk mengetahui pengaruh ekstrak daun senduduk terhadap jumlah SGPT dan SGOT akibat MSG. Penelitian ini menggunakan penelitian eksperimental selama 14 hari dengan 20 ekor tikus putih jantan dengan 5 kelompok perlakuan. K- tanpa perlakuan. K+ diberikan MSG 100 mg/kgBB (pagi). P1, P2, dan P3 diberikan MSG 100 mg/kgBB (pagi) dan ekstrak daun senduduk (P1=150, P2=200, P3=250 mg/kg BB) (sore). Tahapan dalam penelitian ini meliputi

skrining fitokimia, pengamatan morfologi hepar dan pengamatan jumlah SGPT dan SGOT. Pengambilan darah melalui Sinus orbital. Analisis data menggunakan one way anova dan uji lanjut duncan. Dosis optimal untuk memperbaiki jumlah SGPT dan SGOT akibat induksi MSG adalah kelompok P3 dengan dosis 250 mg/kg BB.
Kata kunci: *Ekstrak Etanol Daun Senduduk, Monosodium Glutamate, SGOT, SGPT*

1. Introduction

The delicious and savory taste of food mostly comes from monosodium glutamate (MSG) or flavoring added to the dishes or snacks. The use of MSG has caused a lot of controversy in the community, because most people think thet overuse of MSG may have adverse effects on human health [1]. In Indonesia, about 77,6% of the population consumes MSG more than once per day. Every year, Indonesia produces 254,900 tons of MSG annually, but consumption is rising by about 24.1 percent annually on average. [2].

One substance used to flavor food is MSG. Chemicals including 10% water, 12% salt, and 78% glutamate are present in MSG. MSG is widely consumed in India 0,4 gram/day, in Japan which reaches 1,6 gram/day, America 0,35 gram/day, Korea 2,3 gram/day, and in Taiwan 3 gram/day, while Indonesia consumes MSG as much as 0,6 gram/day [3]. Prolonged consumption of MSG and excessive amounts can cause an oxidative strain is due to an imbalance between antioxidants and reactive oxygen species (ROS). which has the effect of produces unstable and reactive lipid peroxides that result in fat degradation in the body. While the increased production of ROS will affect liver damage and lead to liver function disorders characterised through expanded tiers of transaminase enzymes that are specific to liver damage, namely *Serum Glutamic Oxaloacetic Transaminase* (SGOT) and Serum Glutamic Pyruvate Transaminase (SGPT) levels in the bloodstream [4].

From increased levels of transaminase enzymes will cause liver necrosis with cell death occurring along with plasma membrane rupture. Initial changes in the form of a progressive increase in mitochondria with cristae damage, cytoplasmic swelling, destruction of organelles nuclei and rupture of the plasma membrane [1]. The liver is closely related to the food and beverages consumed by an individual. Because substances that enter the body will go through absorption, distribution, metabolism, and excretion, adjustments within the histological shape of the liver may result from the admission of specific amounts and kinds of compounds into the liver [5].

The negative effects of MSG can be prevented by living a healthy lifestyle and reducing MSG consumption. In addition, herbal plants can also be utilized for the treatment of various diseases caused by Monosodium Glutamate. One of the herbal plants that can be used is senduduk leaves. Senduduk plant (*Melastoma malabathricum* L.) is one of 22 species found in Southeast Asia. Senduduk plants are considered native to tropical, subtropical Asia and the Pacific Islands. The plant Senduduk is commonly found in bushes, rice fields and mountain slopes. This plant is believed to be an herbal medicine by the people of Indonesia [4].

Senduduk plant (*Melastoma malabathricum* L.) can be used pharmacologically, such as antiseptic, anti-inflammatory [6]. Some people utilize the senduduk plant (*Melastoma malabathricum* L.) traditionally, among others, by chewing the leaves, pounding them, and applying them to wounds or by finely chopping and squeezing them and then attaching them to the wound with the aim of stopping the wound and squeezed and then affixed to the wound with the aim of stopping bleeding [7].

Based on Simanjuntak and Kusumowati's research, the senduduk plant is used as a spasmolytic effect that inhibits cell growth by constricting cell membranes due to infection caused by bacteria, because of the disruption of cell growth, cell growth is inhibited because cells cannot carry out their life activities and even die. This reaction with the cell membrane and inactivation of the function of genetic material which is the effect of tannin chemical compounds contained in the plant senduduk plant [6].

Senduduk leaves involve steroids, alkaloids, saponins, tannins, flavonoids, triterpenoids [8]. Flavonoids are anti-inflammatory, antiallergic, prevent oxidation process, and antioxidant [9]. Antioxidants can minimize the effects of oxidative stress caused by exposure to MSG which can cause negative effects on the liver. Antioxidants can be found from chemical compounds from secondary metabolites of plants [10].

According to the description provided, the author is interested in the impact of administering an ethanol extract of senduduk leaves (*Melastoma malabathricum* L.) on rats' levels of serum monosodium glutamate-induced SGPT (*serum glutamate piruvat transaminase*) and SGOT (*serum glutamate oksaloasetat transaminase*). The results of these findings will also provide opportunities for other researchers to conduct further research to create standardized herbal medicines based on senduduk leaf extract, which will advance the field of pharmacology and herbal medicine.

2. Materials and Methods

2.1 Research Time and Place

This study was carried out in August and September of 2024, at the Biology Laboratory of the Faculty of Science and Technology UINSU in charge of care and treatment and blood cell collection of experimental animals, while the USU Pharmacy Laboratory will handle the ethanolic extract of senduduk leaves. Phytochemical tests were carried out at the Organic Chemistry Laboratory of the FMIPA USU. Blood cells were collected and monitored at the UINSU Biology Laboratory in Medan. With the support of professional analysts from the Integrated Laboratory Installation Hospital of the University of North Sumatra Medan, researchers observed the results of SGPT and SGOT levels.

2.2 Equipment and Materials

2.2.1 Equipment

The equipments used in this study were rat cages, sonde, drinking bottle, feed container, cutter knife, filter, beaker glass, spatula, syringe, blender, dark cloth, gloves, jar, filter paper, measuring cup, digital scale, rotary evaporator, hematocrit pipette, blood tube, centrifuge, scissors, and venoject tube.

2.2.2 Materials

The materials used in this research were 20 male white rats (*Rattus norvegicus* L.) weighing 150-200 gram and aged 2-3 months, senduduk leaves (*Melastoma malabathricum* L.), ethanol 96%, distilled water, MSG (*Monosodium glutamate*), animal feed, CMC Na 1%, chlorophyll, and Nacl.

2.3 Research Design

The research conducted was experimental research. This study was conducted for 14 days using 20 male rats (*Rattus norvegicus* L.) consisting of 5 treatment groups, 4 replicates, and using a completely randomized design (CRD). The following is the research design:

1. Negative control group (K-) rats were only fed and given water.
2. Positive control group (K+) consists of rats induced with MSG 100mg/kg BW (Body Weight)
3. The treatment group (P1) was given MSG 100 mg/kg BW in the morning and the application of senduduk leaf ethanol extract (*Melastoma malabathricum* L.) at a dose of 150 mg/kgBW in the afternoon for 14 days.
4. The treatment group (P2) was given MSG 100 mg/kg BW in the morning and the application of senduduk leaf ethanol extract (*Melastoma malabathricum* L.) at a dose of 200 mg/kg BW in the afternoon for 14 days.
5. The treatment group (P3) was given MSG 100 mg/kg BW in the morning and the application of senduduk leaf ethanol extract (*Melastoma malabathricum* L.) at a dose of 250 mg/kg BW in the afternoon for 14 days.

The number of rats needed was determined using the Federer formula, as follows Equation **(1)** :

$$
\begin{aligned}
&(t-1)\,(n-1) \geq 15 \\
&(5-1)\,(n-1) \geq 15 \\
&4n-1 \geq 15 \\
&4n \geq 16 \\
&n = 4
\end{aligned}
\qquad \textbf{(1)}
$$

The Research Ethics Committee of the Faculty of Mathematics and Natural Sciences (AREC) of the University of North Sumatra has accepted and granted permission for this research on October 02, 2024, with number 0743/KEPH-FMIPA/2024.

2.4 Research Procedure

2.4.1 Preparation of Ethanol Extract of Senduduk Leaf *(Melastoma malabathricum* L.*)*

Blood were collected on the tenth day or after the rats had fasted for twelve hours. After being given Senduduk leaves were taken as much as 10 kg. Washed the sorted senduduk leaves with water to remove dirt or foreign objects. Then senduduk leaves were dried in the sun with a black cloth as a cover until completely dry to protect the secondary metabolite content of senduduk leaves from UV radiation. Next, the senduduk leaf samples were sorted into small pieces with scissors and blended to obtain simplisia powder. The simplisia powder that has been obtained is then subjected to a maceration process for 3 days. The maceration method using senduduk leaf simplisia powder and 96% ethanol is put into a jar with stirring 1 x 6 hours, soaked for 24 hours. the soak of simplisia powder and ethanol is then filtered with filter paper and accommodated in a container. then the filtered pulp is macerated again and the process is repeated 3 times with the same type of leaf and solvent. The rotary evavorator is used to collect and evaporate the entire macerate, after the ethanol did not drip in the solvent collection flask, the et hanol e xtract of senduduk leaves was obtained.

2.4.2 Preparation of Experimental Animals

White male rats (*Rattus novergicus* L.) weighing 150-200 grams aged 2-3 months as many as 20 rats were put into cages which were divided into 5 groups namely (K-), (K +), (P1), (P2), (P3) each group with 4 rats. White rats (*Rattus novergicus* L.) were acclimatized for one week to reduce the stress effect of being in a new environment and fed so that the metabolic processes of the rats were not disturbed. White rats (*Rattus novergicus* L.) used in the study must be in good health.

2.4.3 *Senduduk Leaf Extract and MSG Induction*

MSG was used as a source of induction in rats. The treatment was done orally through a sonde in the morning for 14 days at a dose o f 100 mg/k g BW in all treatment groups. While senduduk leaf extract (*Melastoma malabathricum* L.) was given orally through a sonde. The mice were given the extract in a predetermined dose of 150 mg/ kg B W, 200 mg/k g BW, and 250 m g/k g B W, For 14 days, the e xtract was administered in the afternoon.

2.4.4 *SGPT and SGOT Checking*

Serum was collected through the orbital sinus of the eye. The drawn blood was placed in a clean and dry venoject tube, then centrifuged at 3000 rpm for 15 minutes. The separated serum is taken and put in another clean and dry tube and closed. If the serum is not examined immediately, it should be stored in a refrigerator at a temperature of 2ºC- 8ºC.

2.4.5 Liver Morphology Observations

Macroscopic observations of the liver in rats included surface, color, and consistency. A healthy liver has a chewy texture, a smooth surface, and a brownish red color.
Normal criteria if not found:

a. Discoloration
b. Changes in surface structure
c. Change in consistency Degree of liver damage:
   + = No change
   ++ = If 1 of the above criteria is found
   +++ = If 2 of the above criteria are found
   ++++ = If there are 3 criteria above

2.4.6 Data Analysis

Data were analyzed using one-way ANOVA to determine the effect between the control group and the treatment group. If the ANOVA test results showed a difference in data ($P < 0.05$) in the number of SGPT and SGOT levels, then Duncan's further test was conducted to determine whether there was a difference between each treatment group.

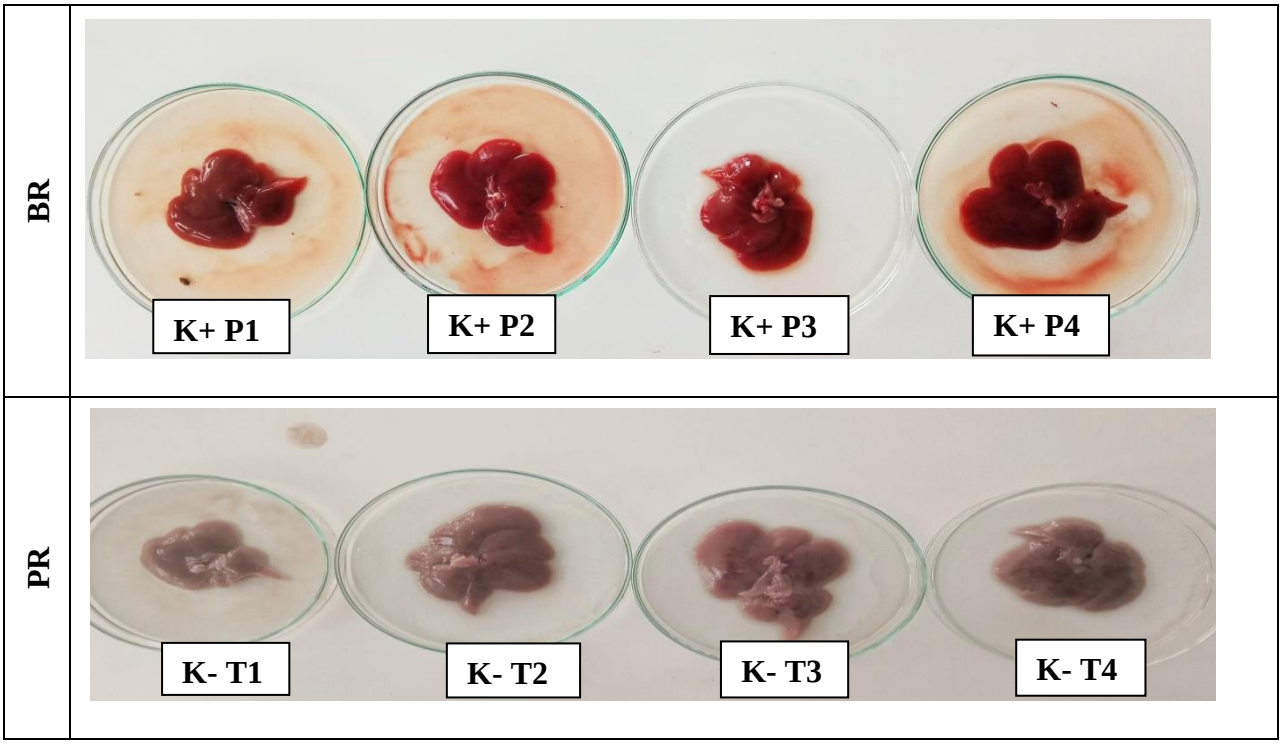
3. Result and discussion

3.1. Effect of Ethanol Extract of Senduduk Leaf on Liver Morphology of MSG-treated White Rats

The results of observations on the liver morphology of male rats (*Rattus norvegicus* L.) given ethanol extract of senduduk leaves and also MSG can be seen in the table 1. of the degree of damage and liver morphology figure 1. The observation of the degree of hepatic damage in the negative control group as much as 100% did not change color and had a brownish red liver color, did not have nodules, elasticity was still consistent, and had a smooth texture, positive control as much as 25% did not change color and 75% changed color given 100 mg / kg BW MSG induction and had a pale red liver color, did not have nodules, elasticity was still consistent, and had a smooth texture. This indicates that the administration of 100 mg/kg MSG can damage rat liver cells which is characterized by a change in color to pale red. This finding is in accordance with the research of Maulida et al. (2013) who found liver cell damage caused by MSG administration. Hepatic cells will undergo a number of morphological alterations if they are harmed by different causes. The abnormal liver is pink or pale due to the amount of administration of compounds that are toxic, causing the surface to be slightly rough and have spots [11].

Table 1. Degree of Damage to Liver Morphology

Group	Number of Sampel	Degree of Liver Damage			
		+	Value (%)	++	Value (%)
K-	4	4	100	0	0
K+	4	1	25	3	75
P1	4	4	100	0	0
P2	4	4	100	0	0
P3	4	4	100	0	0



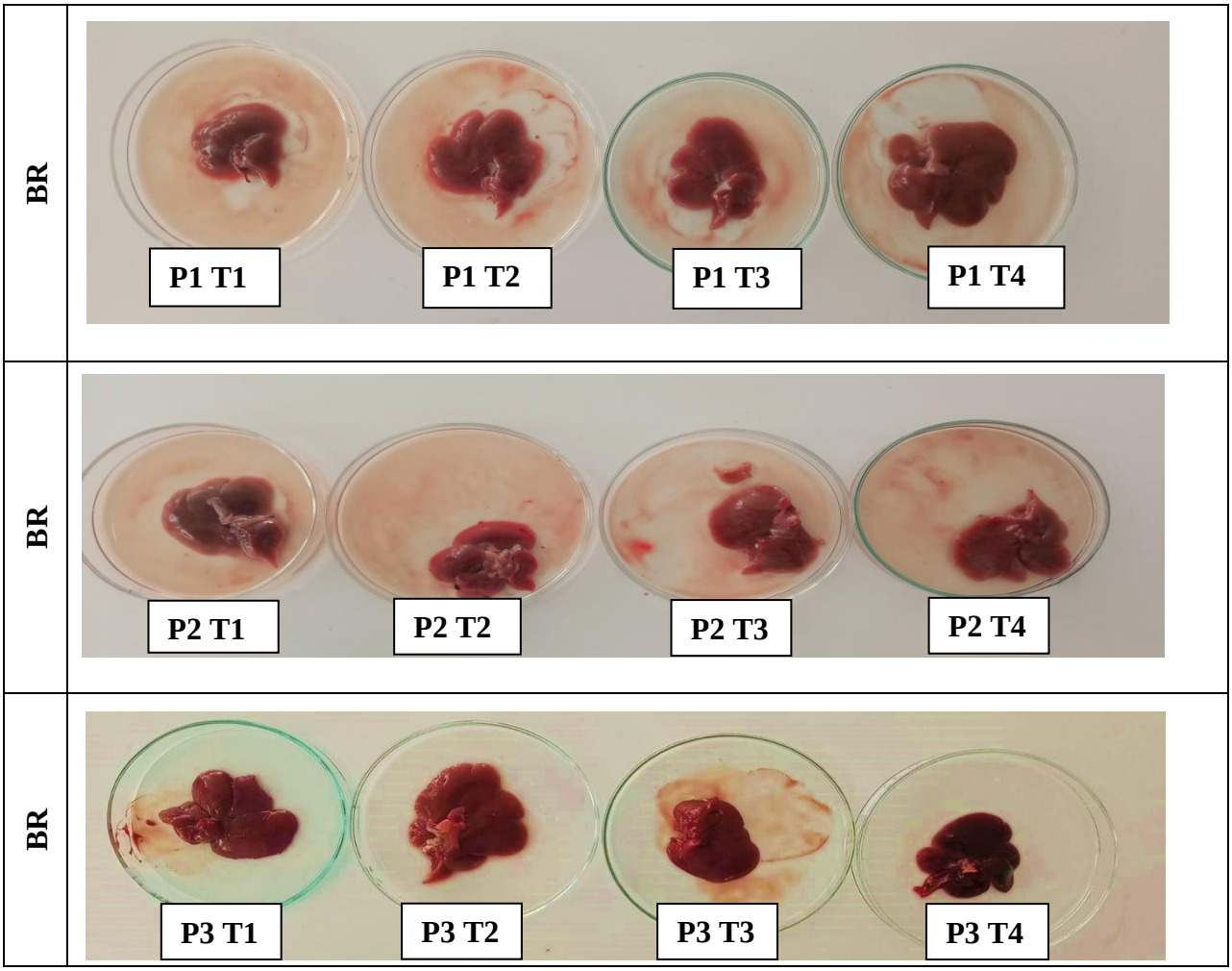


Figure 1. Observation of hepatic macroscopic after administration of MSG and sensesit leaf extract (*Melastoma malabathrium* L.) for 14 days: (K): only fed and drunk; (K+): MSG administration of 100 mg/kgBB; (P1): Administration of MSG 100 mg/kg BW + DS Extract 150 mg/kg BW; (P2): Administration of MSG 100 mg/kg BW + DS Extract 200 mg/kg BW; (P3): MSG 100 mg/kg BW + DS Extract 250 mg/kgBB. BR (Brownish Red), PR (Pale Red), T1 (Rat 1).

The pale liver is caused by free radical compounds in MSG which are toxic and cause fatty liver. Toxic compounds can enter the body through food, because the liver is 80% blood supply from the digestive tract it will disrupt blood flow to the liver resulting in a pale liver. The pale colored liver is caused by the rapid release of free fatty acids derived from visceral fat fat attached to organs in the enlarged body [12]. In all treatment groups there were no protrusions or nodules in the liver lobe, presumably there was no form of inflammatory reaction that occurred due to the entry of MSG into the liver through the blood vessels. The texture of the liver shows a smooth or spongy surface so that the condition of the liver is normal because it has a smooth and spongy texture and brownish red color. Damaged liver has a surface that is not smooth, uneven, mottled and discolored [13].

Considering the outcomes of the table 1. and figure 1. It was evident that the negative control group, group P1 with a dose of 150 mg/kg BW, group P2 with a dose of 200 mg / kg BW and group P3 with a dose of 250 mg / kg BW have a brownish red liver color, a smooth liver surface and a spongy consis tency and do not have nodules. This shows that the treatment of MSG after the administration of senduduk leaf extract shows an improvement in liver morphology and proves that the antioxidant content of senduduk leaves (*Melastoma malabathricum* L.) has strong category a ctivity IC_{50} 59.36 (Table 3. Page 8) so that it can repair the degree of damage and liver morphology due to toxic substances MSG entering the body.

Senduduk leaves contain flavonoids such as galangin, kaemferol, quercetin with excellent antioxidant effects. One of the steps to reduce and handle the adverse effects of free radicals from MSG is to consume antioxidants. The antioxidant content that is commonly known is flavonoids. By stabilizing free radicals by completing their missing electrons, preventing chain reactions, and preventing the production of free radicals that might result in oxidative stress and damage to liver cells, antioxidants can lessen the negative effects of free radicals in the body [14]. A normal liver has a brownish red color. This is due to the large amount of blood

flow facilitated by blood vessels. A normal liver will be brownish red in color because it contains a lot of blood including blood vessels consisting of the hepatic portal vein and hepatic artery with a smooth and unspotted liver surface [12].

3.2 Phytochemical Screening Results of Senduduk Leaf (*Melastoma malabathricum* L.)

The results of phytochemical screening to see secondary metabolite compounds from ethanol Senduduk leaf extract (*Melastoma malabathricum* L.) using various reagents, it can seen int table 2. Below: contains flavonoids, tannins, terpenoid, steroid, and saponins components, as shown in the table 2. below.

Table 2. Phytochemical screening results of senduduk leaves

Group of Compounds	Reagents	Result
Flavonoid	$H_2SO_{4(p)}$	-
	$Mg_{(s)} + HCl_{(p)}$	-
	$FeCl_3$ 5%	+
Tanin	$FeCl_3$ 1%	+
Terpenoid	Salkowsky	-
	Liebermann Bourchard	+
Steroid	Salkowsky	-
	Liebermann Bourchard	+
Saponin	Aquadest+Alkohol 96%	+
Alkaloid	Bouchardart	-
	Maeyer	-

Description:
(-) No secondary metabolite compounds detected
(+) Secondary metabolite compounds detected

Phytochemical screening is a method used in phytochemical research to provide a broad overview of the chemical substances present in the plant being studied. Qualitative analysis is used to perform phytochemical tests. Using various solvents, the purpose of this experiment was to see if secondary metabolites were detected in Senduduk Leaf (*Melastoma malabathricum* L.) extract. According to table 2. findings, secondary metabolite components such flavonoids, tannins, terpenoids, steroids, and saponins are present in the ethanol extract of senduduk leaves as determined by phytochemical screening.

3.3 Observation of IC_{50} value of senduduk leaf

The antioxidant activity of a compound is decided using the IC_{50} parameter. IC_{50} is an inhibition concentration or concentration that can reduce or inhibit 50% of DPPH radicals. The smaller the IC_{50} value, the greater the antioxidant activity to inhibit free radicals from a compound, otherwise the greater the IC_{50} value, the smaller the free radical inhibition [15]. The IC_{50} value that has been obtained is then matched using the antioxidant classification according to Blois to determine the strength of antioxidant activity. The results of the observation of the number of IC_{50} values of antioxidants in senduduk leaf extract is displayed in Table 3.

Table 3. IC_{50} value of Senduduk Leaf Extract and Vitamin C

No.	Samples	Value IC_{50}	Classification

1.	Extract of Senduduk Leaf	59,36	Antioxidant activity is strong
2.	Vitamin C	58,98	Antioxidant activity is strong

Table 3 indicates that senduduk leaf extract is known to has an IC_{50} value of 59.36, while the IC_{50} value of vitamin C is 58.98. The findings of this research show that vitamin C has better antioxidants than senduduk leaf extract because the smaller the IC_{50} value (IC<50), the better the antioxidant activity. The classification of antioxidant activity shows that the samples of senduduk leaf extract (59.36) and vitamin C (58.98) have the potential to inhibit free radicals because the IC_{50} value which ranges between 50-100 has strong antioxidant activity. Fatmawati et al. (2023) explained that the classification of antioxidants according to Blois is divided into 5, namely: <50 (very strong), 50-100 (strong), 100-150 (medium), 150-200 (weak), and >200 means incredibly weak [16].

3.4 Effect of Ethanol Extract of Senduduk Leaf on Total SGPT of MSG-treated White Rats

The results showed that there were differences in the average number of SGPT levels for each treatment group. The number of SGPT levels in the treatment group decreased according to the dose of extract administration. The observation results of the number of SGPT levels can be seen in the table 4 below.

Table 4. Observation outcome of the number of SGPT levels

Groups	Levels of SGPT (mg/dL) ± SD	p=value
K-	93.25 ± 1.50^{b}	0.001
K+	130.00 ± 19.20^{c}	
P1	97.50 ± 19.46^{b}	
P2	87.00 ± 23.75^{ab}	
P3	66.00 ± 7.78^{a}	

Description: K- (eat and drink), K+ (given 100 mg MSG), P1 (dose 150 mg/kg BW, P2 (dose 200 mg/kg BW), P3 (dose 250 mg/kg BW).

The one-way anova test results on the observation of the number of SGPT levels showed a significant level of p=0.001 which indicates that MSG use and senduduk leaf extract gave a significant effect on the number of SGPT levels (p<0.05). The results of further analysis with Duncan's test with a 5% significance level on the observation of the number of SGPT levels showed that there was a significant difference between the negative control (93.25 mg/dl) and the positive group (130.00 mg/dl) (as in table 2.). The outcomes of the analysis on the mean number of SGPT levels of negative control with positive control prove that MSG a dose of 100 mg for 14 days can damage liver cell tissue with marked increases in SGPT levels in the bloodstream. This is in accordance with Delina's research (2018) which shows that giving 100 mg/kg of MSG can increase SGPT levels [1].

Increased SGPT can occur due to damage to liver cells from the ingestion of MSG. Excess toxic substances can enter the body and be metabolized into free radicals by cytochrome enzymes in the liver, which is the mechanism of increased SGPT enzymes. These free radicals then bind to hepatocyte cells in the liver so that the porousness of the liver layer changes (increases). Liver damage can occur due to oxidative stress processes due to increased production of ROS and reduced cell strengthening activities such as catalase. This provocative cycle causes an increase in SGPT levels [17]. MSG will activate NMDA receptors. The result of NMDA receptor activation is an increase in Ca 2+ ions resulting in several effects, including impaired ATP production, activation of NO synthase and protein kinases that can form free radicals [18]. The formation of free radicals will increase ROS which results in oxidative stress [19]. Oxidative stress can trigger lipid peroxidation, which causes harm to the liver cell membrane's structure. cell membrane, in addition to oxidative stress can cause a decrease in glutathione levels which results in the activation of the hepatic cell apoptosis process. When liver damage occurs, the transminase enzyme (SGPT) can be used as a parameter of liver damage because, when the liver is damaged, this enzyme will automatically leave the liver cells and its levels will increase in the blood [4].

Deamination of glutamate can produce excessive ammonium ions (NH4+) that can damage hepatocyte

mitochondria through activation of Ca+-independent intrinsic apoptotic pathways and increased free radicals. Oxidative stress, characterized by lipid peroxidation and increased glutathionestransferase activity, may be caused by the increase in free radicals. As a result, the accumulation of MSG can harm hepatocytes due to free radicals and cause a rise in SGPT values [20]. In the observation of the results of further analysis of Duncan's test on the group giving senduduk leaf extract (table 4.) shows that the positive control has a significant difference to the P1, P2 and P3 groups. The results of the real difference indicate that Senduduk leaf extract treatment can lower SGPT levels that rise due to induction of MSG. the lowest SGPT level was when using senduduk leaf extract is in the P3 group with a value of 66.00 mg/dl which proves that a dose of 250 mg is the most optimal dose to decrease SGPT levels that rise due to Monosodium Glutamate.

Oxidative damage or free radical damage in the body can basically be overcome by endogenous antioxidants, but if free radical compounds are present in excess in the body, then exogenous antioxidants are needed [21]. According to Febriani et al., (2024) explained that One of the several groups of molecules included in a vast array of natural products made by plants are flavonoids, a highly significant class of polyphenolic chemicals. Recent studies have focused on flavonoids, which has uncovered various aspects of their biology and pharmacology including such as antioxidant antibacterial, anti-inflammatory activities [22]. Senduduk leaves (*Melastoma malabathricum* L.) contain secondary metabolites such as flavonoids. Flavonoids contain quercetin which has a mechanism of action so that calcium ions that have already come out due to MSG can be reduced. Quercetin is also able to stimulate the release of endogenous antioxidants such as SOD (Superoxide Dismutase) and increase the production of IL-10 which is a hepatoprotector, so that liver damage due to hepatotoxic mediators can be repaired by quercetin [23] [24].

The DPPH method to determine the antioxidant activity of senduduk leaves obtained an IC_{50} value of 59.36 (Table 3. Page 8) which means that the antioxidant content in senduduk leaves (*Melastoma malabathricum* L.) has a strong category to reduce free radicals. According to Febriani et al., (2023) the category of strong antioxidant properties is in the range of IC_{50} values around 50 ppm-100 ppm. Flavonoid compounds are known to be strong antioxidants that can reduce free radicals. able to reduce free radicals [25]. Flavonoids can have potential as antioxidants because flavonoids have properties as a good acceptor of free radicals. Flavonoids will bind with free radicals to form new compounds that are not reactive so they are stable. Therefore, flavonoids can inhibit the oxidation process. By giving free radicals hydrogen protons from their hydroxyl groups, flavonoids will absorb them [26]. According to research, this (Gunawan et., al 2022) explaining that the flavonoid content acts as an antioxidant is by directly capturing free radicals called 'Direct scavenging' which can produce free radicals that are already stable and less reactive, causing the prevention of lipid peroxidation in vitro so that it can reduce the risk of various damages that can be caused by oxidative stress [27]. The mechanism of decreasing SGPT levels occurs due to antioxidant activity that binds free radicals carried by MSG. If antioxidants bind free radicals, free radicals cannot carry out their function in damaging liver tissue, so the mechanism of liver damage cannot run. When cells are not damaged, the levels of SGPT that escape into the bloodstream are reduced, because few cells are damaged and few SGPT levels flow out of the blood [28].

3.3 Effect of Ethanol Extract of Senduduk Leaf on Total SGOT of MSG-treated White Rats

The results showed there were differences in the average number of SGOT levels for each treatment group. The number of SGOT levels in the treatment group decreased according to the dose of extract given. The observation results of the number of SGOT levels can be seen in Table 5.

Table 5. Observation results of the number of SGOT levels

Groups	Levels of SGOT (mg/dL) ± SD	p=value
K-	144.00±14.306^{a}	0.001
K+	276.75±60.395^{c}	
P1	271.00±50.938^{c}	
P2	228.25±48.286^{bc}	
P3	174.00±15.853^{ab}	

Description: K- (eat and drink), K+ (given 100 mg MSG), P1 (dose 150 mg/kg BW, P2 (dose 200 mg/kg

BW), P3 (dose 250 mg/kg BW).

The one-way anova test results on the observation of the number of SGOT levels showed a significant level of p=0.001 which indicates that the use of MSG and senduduk leaf extract had a significant effect on the number of SGOT levels ($p<0.05$). The outcame of further analysis with the Duncan test with a 5% significance level on the observation of the number of SGOT levels showed that there was a significant difference between the negative control (144.00 mg/dl) and the positive group (276.75 mg/dl) (as in table 5). The results of the analysis on the number of average SGOT levels of negative control with positive control prove that MSG at a dose of 100 mg for 14 days can cause damage to the liver with marked increases in (SGOT) *serum glutamate oxaloacetate transaminase* levels in the bloodstream.

Hepatic cell injury may result in an increase in SGOT. The mechanism for the rise in SGOT enzymes is the introduction of excessively hazardous compounds into the body, which are then converted into free radicals by the liver's cytochrome enzymes. The hepatic membrane's permeability alters (increases) as a result of these free radicals' subsequent binding to hepatocyte cells in the hepatic organ. Reduced activity of antioxidants like catalase and increased generation of ROS cause hepatic damage. This inflammatory process results in an increase in SGOT levels [3].

MSG can increase Ca2+ levels in leydig cells. The enzymes ATPase, phospholipase, endonuclease and protease will all be activated by the increase in Ca2+, which will also damage the mitochondria. Due to decreased ATP generation and cell membrane permeability, leydig cell death results. According to some studies related to MSG administration, there is a change in the cytotoxic effect on the liver, thus affecting the normal detoxification process and other liver functions. In addition, MSG causes an increase in AST (aspartate aminotransferase) enzyme activity indicating hepatocellular injury and liver cirrhosis [29]. According to Aliftiyo et al (2015), it is proven that consuming MSG increases SGOT levels. An increase in serum transmirase is a sign that the liver has been damaged by MSG administration. SGOT (*Serum Glutamic Oxaloacetate Transminase*) levels are a marker of liver disease. If liver cell necrosis or acute injury results in the release of intracellular enzymes into the blood, or, in other words, if liver cell damage occurs, SGOT levels will increase in the bloodstream [20]. In the observation of the results of Duncan's further test analysis of the administration of senduduk leaf extract (table 5.) shows that the positive control has no significant difference to the P1 and P2 groups but has a significant effect on the P3 group. The smallest level of SGOT in the treatment of senduduk leaf extract was found in group P3 with a value of 174.00 mg/dl. This proves that the 250 mg dose is the most optimal dose to reduce SGOT levels that rise due to Monosodiium Glutamate.

The decrease in SGOT levels in the group giving senduduk leaf extract (*Melastoma malabathricum* L.) is the work of flavonoids. Flavonoids work by suppressing the cytochrome enzyme system which will inhibit the formation of free radicals from MSG. The flavonoid content in senduduk leaf extract (Table 2. Page 7) has the ability as an antioxidant. Antioxidants from senduduk leaves are included in the strong category because the IC_{50} antioxidant value is 59.36 (Table 3. Page 8) which means that the antioxidant content in senduduk leaves (*Melastoma malabathricum* L.) has a strong category as normalizing SGOT levels and as an antioxidant. This is due to the influence of senduduk leaf extract which contains secondary metabolites such as flavonoids. Flavonoids can be antioxidants because they have phenolic hydroxy groups in their molecular structure that have free radical capture power. Flavonoids will release hydrogen radicals and generate new radicals that are relatively more stable and unreactive. Senduduk leaf extract can cause improvement in the amount of SGOT that increases due to MSG induction [3].

Flavonoids are substances with antioxidant properties. Flavonoids work as antioxidants by directly absorbing ROS, inhibiting their regeneration and indirectly boosting the antioxidant activity of cellular antioxidant enzymes. Flavonoids suppress the production of ROS in a number of ways, including by blocking the activity of the enzymes xanthine oxidase and nicotinamide adenine dinucleotide phosphate (NADPH) oxidase and by chelating metals (Fe2 + and Cu2 +) to stop redox processes that can result in the production of ROS. [30]. This research is in line with the research of Zahra et al. (2023) which states that flavonoids are one class of antioxidants that can inhibit the oxidation process due to free radicals. The antioxidant properties of flavonoids in addition to protecting the effects of ROS on cells can also play a role in inhibiting the formation of ROS and can reduce SGOT and SGPT levels [31].

4. Conclusion

Administration of senduduk leaf extract (*Melastoma malabathricum* L.) to male white rats (*Rattus norvegicus* L.) for 14 days effectively reduces SGPT levels that increase due to MSG induction, with an optimal dose of 250 mg/kg BW. Similarly, the administration of senduduk leaf

extract for 14 days also decreases SGOT (Serum Glutamic Oxaloacetic Transaminase) levels, which are elevated due to MSG induction, at the same optimal dose of 250 mg/kg BW.

5. Recommendation

Considering the findings of this study additional research is needed on the impact of providing senduduk leaf extract in the addition of research time and different doses to see different results on the number of SGPT and SGOT levels induced by Monosodium glutamate. Then further research is needed on the dose limit of senduduk leaf extract that will harm the situation, especially for SGPT and SGOT levels when the extract is given. In addition, human clinical trials are required to assess the safety and efficacy of this senduduk leaf extract as an herbal medicine. The development of herbal products based on ethanol extract of senduduk leaves can be a natural, environmentally friendly, and affordable treatment for liver disease.

6. Acknowledgements

We would like to express our deepest gratitude to Allah SWT, to the author's parents who the author respects and loves, Father Susiswanto and Mother Rabiah and all those who have supported and contributed to this research. We would like to thank the lecturers and staff of the Biology Laboratory of the Faculty of Science and Technology UINSU, the Pharmacy Laboratory of USU, the Organic Chemistry Laboratory of FMIPA USU, and the Integrated Laboratory Installation Hospital of the University of North Sumatra Medan for providing the necessary facilities and technical assistance. Our thanks also go to Mrs. Husnarika Febriani, S.Si, M.Pd and Mrs. Melfa Aisyah Hutasuhut, S.Pd., M.Si as supervisors for their valuable guidance and discussions during the research.

7. Conflict of Interest

Regarding this paper's publication, the authors state that they have no conflicts of interest. All of the studies were conducted free from any company or financial affiliations that would present a conflict of interest.

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