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Evaluation of Acute Dermal Toxicity of Hibiscus Leaves as Simplicial Ointment on Albino Rats

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Abstract

Hibiscus is a plant that has been shown to contain substances that may be used as sunscreen to protect the skin from UV radiation. In terms of their potential as sunscreens, flavonoids, tannins, and quinone chemicals are crucial because they are antioxidants that can reduce the negative effects of UV radiation and boost photoprotective activity. This study aimed to investigate the acute dermal toxicity potential of hibiscus leaves simplicial ointment 40% on female albino rats. The evaluation method refered to The OECD Guideline for Testing of Chemicals – No. Test: 402, Acute Dermal Toxicity-Fixed Doses Procedure. Based on the Globally Harmonized System compared to this study reported that acute dermal median lethal dose (LD50) was > 2000 mg/kg. It can be concluded that hibiscus leaves simplicial ointment 40% has safe to apply topically and doesn't produce acute skin toxicity.

Keywords: acute dermal toxicity, hibiscus, ointment

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INTRODUCTION

Hibiscus (*Hibiscus rosa sinensis L.*) is a plant that is known to have compounds that have the efficacy of sunscreen so that it can protect the skin from solar radiation (Al-Snafi, 2018). Flavonoid, tannin, and quinone compounds play an important role in terms of their potential as a sunscreen because they are antioxidants that can prevent the negative effects of ultraviolet radiation and increase photoprotective activity (Pratiwi and Husni, 2017; Petruk at al., 2018). Antioxidants can generally be obtained naturally from fruits and plants, or synthetically derived from the synthesis of a chemical reaction (Rahmi, 2017; Prasetya *et al*., 2020).

Providing antioxidants can be done topically or systemically (Soejanto, 2017). Topical ointments that are often used on the skin are semi-solid forms. Medically, the use of ointment or unguentum is local and is generally used for topical cases (Lazuardi, 2019). Producing ointments requires a base and active ingredients that dissolve in the ointment. One of the active ingredients that can be used is vegetable simplicial (Simaremare *et al*., 2015). Herbal simplicial is a natural material in the form of whole plants, parts of plants, or plant exudates used as medicine that has not undergone any processing and is a dried material (Endarini, 2016).

The use of herbal as medicine has been developing in several studies, but its use has not been well documented (Yassir and Asnah, 2018). According to Lestaridewi *et al* (2017), the number of people who use traditional medicine remains high even though Indonesia has developed modern health services. The prevalence of traditional medicine use is influenced by a person's level of knowledge. According to Adiyasa and Meiyanti (2021), limited knowledge and a lot of inappropriate information received by the public are new problems related to the consumption of traditional medicine. This condition is supported that traditional medicines are safer without side effects and are also easier

to obtain without a prescription (Sudira *et al*., 2019). In reality, plants used for traditional medicine still need to be evaluated preclinically and clinically, because medicinal plants still have the potential to be toxic at certain levels or doses (Mappasomba *et al*., 2019; Ridwan *et al*., 2020; Siregar *et al*., 2020).

Merdana *et al*. (2020b) declared in their study regarding the acute dermal toxicity of rajas oil in Wistar rats, that the acute dermal toxicity test was one of the tests carried out in the early stages of preclinical trials. The dermal acute toxicity test aims to determine the toxic power of a chemical substance through skin contact (Zulfiana, 2014). Toxicity testing is important to carry out because it will be used to consider determining dosage, administration time, and application as well as to determine the efficacy, safety, and potential toxicity of a drug (Merdana *et al*., 2020a; Sasmito *et al*., 2015). Basically, saponins and alkaloids are two active compounds contained in hibiscus that can trigger skin irritation (Brandenburg, 2018; Janjic, 2021).

Several studies suggest that hibiscus has the potential for oral toxicity. Nath and Yadav (2014) found that administering hibiscus leaf extract with dose of 800 mg/kg, there was an increase in the levels of the alanine aminotransferase (ALT) and aspartate aminotransferase (AST) enzymes as well as an increase in total bilirubin, urea, and creatine. In the meantime, Meena *et al*. (2014) assessed the hibiscus flower extract's toxicity on mice and discovered that it had hazardous potential, as evidenced by a 20% fatality rate at 1600 mg/kg. It is necessary to explore the potential for topical toxicity through an assessment of acute dermal toxicity.

MATERIALS AND METHODS

Ethical Approval

All procedures for using experimental animals have received approval from the Animal Ethics Committee, Faculty of Veterinary Medicine, Udayana University, with Animal Ethics Approval Certificate Number: B/1/UN14.2.9/PT.01.04/2023. This study was carried out at the Veterinary Physiology, Pharmacy and Pharmacology Laboratory, Faculty of Veterinary Medicine, Udayana University with the support of the Bali-BRIN "Eka Karya" Botanical Garden Characterization Laboratory, Tabanan, and Medicinal Plant Post-Harvest Processing Center (P4TO), Tabanan and the Technology Laboratory, Faculty of Pharmacy, Mahasaraswati University Denpasar, Bali, Indonesia.

Experimental Design

This study was an experimental design using a qualitative descriptive analysis approach. The acute dermal toxicity test method used refers to The OECD Guideline for Testing of Chemicals – No. Test: 402, Acute Dermal Toxicity-Fixed Doses Procedure. The consideration for choosing this method was based on optimizing the study design by minimizing the number of experimental animals used and this method has been accepted and recognized internationally.

Plant Determination

Determination of the hibiscus leaf samples used in this research was carried out at the Bali-BRIN "Eka Karya" Botanical Garden Characterization Laboratory. The determination results showed that the leaf samples used were of the *Hibiscus rosa-sinensis L*.

Simplicial Production

Hibiscus leaves were air-dried at 25°C for 7–14 days (Davis *et al*., 2022; Simaremare *et al*., 2015) and kept from direct sunlight to avoid damage or loss of desired chemical content (Rivai *et al*., 2013). Dried simplicial was collected to obtain high antioxidant levels with lower water loss levels (Dharma *et al*., 2020). Drying generally functions to reduce water content which can inhibit the growth of bacteria and mold so that the material is more durable and easier to store, and also makes subsequent treatment easier (Handoyo and Pranoto, 2020). The leaves were then mashed and filtered using sieve number 100. The pollination process was carried out at the Medicinal Plant Post-Harvest Processing Center (P4TO), Tabanan. Simplicial powder was then

stored at a cool temperature in a clean and airtight container such as aluminum foil.

Ointment Production

The ointment was produced using a hydrocarbon base, i.e., vaseline album. The choice of ointment base was based on research by Davis *et al* (2022) and Trisnajayanti (2013), namely that the hydrocarbon base has good physical properties seen from the adhesion test and protection test, in addition to the hydrocarbon base having a longer contact time with the skin, so it was expected that penetration of the material more active into the skin layers (Mukhlishah *et al*., 2016). A total of 60 g vaseline album was mixed with 40 g of simplicial into the mortar, then grinded until homogeneous. The ointment formulation has produced a semisolid consistency, a deep green color, and a distinctive aroma of hibiscus leaves.

Experimental Animals

This study used adult and nulliparous female Wistar albino rats. Rats were healthy, 12–16 weeks old, weighing 200–300 g. Animals were acclimatized for a minimum of 5 days in the experimental room in individual cages, with a base area of 350 cm^2 and a height of 18 cm covered with husk with a wire cover. The room temperature was around 25°C, humidity 60–70%, and a 12-hour dark/light lighting cycle was provided. Animals were given laboratory standard commercial pellet feed of 20 g/day and provided with drinking water ad libitum, as well as a minimum stressful environment. All cages and test animals were numbered and randomized before treatment started. The above conditions meet the standard maintenance environmental parameters (Liu and Fan, 2018). The success of acclimatization of experimental animals can be seen by measuring normal physiological parameters such as changes in body weight, heart rate, body temperature, and behavior (Arts *et al*., 2014; Triana *et al*., 2020).

Preparation of Experimental Animals

The hair on the dorsal part was shaved 24-hour before treatment in an area of 6 x 8 cm^2 (at least 10% of the body surface area) for exposure to the test material. During the shaving process, the test animals were given ketamine-xylazine anesthesia at a dose of 50–100 mg/kg BW ketamine (Ket-A-100®, Agrovet Market Animal Health, Peru) and 5–12,5 mg/kg BW xylazine (Xyla®, Interchemie, Netherlands) (Krissanti *et al*., 2023) and carried out carefully so as not to cause injury to the dermis. Giving anesthesia aimed to reduce stress during the shaving process. Only animals with healthy, intact skin were used in this study.

Dermal Acute Toxicity Test Procedure

The acute dermal toxicity test stage was divided into two, i.e., the preliminary test (dose search), and then proceed to the main test stage. In stage 1, a preliminary test uses one experimental animal, the evaluation steps were performed as in Figure 1. If there was no information regarding the test material, it was recommended to start testing with a dose of 200 mg/kg BW, but if there was enough information, it could be started with a dose of 1000 mg/kg BW (OECD, 2017). In this study, an initial dose of 1000 mg/kg BW was used. The test material was applied to the specified skin, covered with sterile gauze, and wrapped with a non-irritating plaster to ensure the test material remained in contact with the skin for 24-hour and there was no chance of the test material being ingested by the test animal. At the end of the exposure period, the plaster was removed and the remaining test material was rinsed using distilled water or another neutral solvent. Then observations were carried out during the 0, 24, 48, and 72-hours after exposure to the test material, and continued until the 14-day. Observations include clinical assessment, weight loss, observation of skin anatomy pathology, and death. If the test animal experiences symptoms of severe toxicity or death, then evaluation continues using a lower dose with a new test animal. Evaluation was stopped if the lowest dose test showed death or symptoms of severe toxicity (Solikhah *et al*., 2022). The highest dose that does not cause death or does not show signs of severe toxicity will be used in the main evaluation phase (Puspitasari *et al*., 2021).

In the main stage, the same procedure was carried out as shown in Figure 2. The evaluation was carried out with a predetermined dose with the addition of two new experimental animals for respective treatment and control groups. In this study, the treatment group was applied topically with hibiscus simplicial ointment, and the control group was given a placebo in the same amount as the treatment.

Clinical Observation

Observations were performed on both groups clinically immediately after the exposure period. Special attention to hourly checks is carried out in the first 6-hour and monitored for 24-hour, then continued once every day until the 14-day. Observations carried out included weighing the rat's body weight, visual clinical observations, and the death of test animals. All data including toxic signs, time to appearance, duration of toxicity and recovery time, changes in body weight, and time to death were recorded systematically, and compared with the control group. It was necessary to pay attention to the symptoms of tremors, seizures, drooling, diarrhea, lethargy, sleep, and coma. Observations should include changes in the skin, hair, eyes, mucous membranes, respiratory system, blood circulation, central and autonomic nervous systems, somatomotor activity, and changes in behavioral patterns. Observations were generally carried out once a day in the morning because mice will become aggressive during the day. Rats become aggressive during the day because rats are nocturnal animals that are active at night and sleep during the day (Al-Idrus *et al*., 2014). Body weight was measured before treatment, and then carried out every day until the end of the observation period. Animals found to be dying, showing severe pain, or signs of permanent physical injury should be sacrificed immediately.

Observation of Skin Anatomy Pathology

Anatomical pathology observations were carried out on the treated skin areas, carried out at 24, 48, and 72-hours after the exposure period for the appearance of irritation symptoms such as erythema and edema. Scoring uses an arbitrary scale (Krismayogi *et al*., 2018), i.e., (0) no erythema, (1) very little erythema (diameter < 25 mm), (2) clearly visible erythema (diameter 25–30 mm), (3) moderate erythema (diameter 30–35 mm), (4) severe erythema (diameter > 35 mm). (0) Lightly edema, (1) very light edema, (2) slight edema (clear edges and enlargement), (3) moderate edema (thickness ± 1 mm), (4) severe edema (thickness >1 mm). The data obtained were analyzed to obtain a primary irritation index (PII) using the PII formula: The sum of all erythema and edema values at the time of observation divided by the number of mice multiplied by the number of times observations (Kuncari *et al*., 2015). The level of irritation was assessed based on the Draize Test, i.e., (< 0,5) not irritating, (0,5–2,0) slightly irritating, (2,0–5,0) moderate irritation, (5,0–8,0) highly irritating (Baldisserotto *et al*., 2018).

Assessment of Acute Dermal Toxicity

Determination of the LD50 of test preparations was based on the Global Harmonized System of Classification and Labeling of Chemicals (Table 1). The LD50 value was calculated statistically using the Thompson-Weil method.

Data Analysis

Data from non-parametric observations will be presented descriptively. Overall data are expressed as mean (x ± SD). Statistical analysis of LD50 values was carried out using the Thompson-Weil test with a 95% confidence interval. Changes in body weight before and after treatment were analyzed using the paired t-test ($p < 0,05$ was declared significant). The primary irritation index was classified based on the Amended Draize Test. Conclusions were declared based on descriptive analysis of the analysis of results of the respective parameters.

RESULTS AND DISCUSSION

Preliminary Test

The test was performed with an initial dose of 1000 mg/kg BW because the compound of the test material was known, then continued with a

dose of 2000 mg/kg BW which reported no symptoms of toxicity or death in the main evaluation (Table 2).

In this study, a dose of 1000 mg/kg BW was used as the initial dose in the preliminary test because there was sufficient information regarding the chemistry of hibiscus leaves. The evaluation was performed on the respective dose. After observing and evaluating clinical signs, irritation, and changes in body weight, it was found that this dose was still safe for use as seen from the absence of signs of toxicity, weight loss, or death in terms of the OECD Guideline for The Chemical Testing of Chemicals No. 402 (2017) so that it is continued with a dose of 2000 mg/kg BW. The same results were also obtained in the evaluation with this dose, therefore a dose of 2000 mg/kg BW was used in the main acute dermal toxicity test. The results of this preliminary test are similar to the findings of Samirana *et al*. (2018) in their study regarding the preliminary test of the acute dermal toxicity of a 70% ethanol extract ointment preparation from binahong leaves which showed that a dose of 5000 mg/kg BW, was still safe to apply to the skin in the form of ointments or extracts.

Clinical Observation

The mortality rate is presented in Table 3 and clinical observations of the toxicity symptoms of hibiscus leaf simplicial ointment are shown in Table 4. The results of clinical observations in the main evaluation reported that the experimental animals at the beginning of the exposure period experienced decreased activity, and looked stressed, lethargic, and immobility. Then it returned to showing normal activity 24-hour after exposure until the 14-day. Experimental animals did not show any symptoms of toxicity such as deviations from normal activities, tremors, seizures, and diarrhea. The eyes and mucous membranes as well as the respiratory system appear normal, with no abnormalities. The mortality rate was obtained at 0% because there were no deaths in the treatment and control groups. The skin changes appeared reddish like erythema on the 0-hour to the 3-day of observation and disappeared on the 4-day as measured by the degree of irritation based on the Draize test. The variability of hair growth in test animals began to appear on the 2-day of observation in all test animals. On the 14-day, hair growth looked like before treatment, but there were several points that were still shorter.

The results of this study were similar to the findings of Zahi *et al*. (2015) in testing the acute dermal toxicity of noni fruit extract which showed that when administered doses of 2000 mg/kg BW and 5000 mg/kg BW there were no visible symptoms of toxicity and a mortality rate. A study by Merdana *et al*. (2020b) regarding the potential for acute dermal toxicity of Rajas Oil also showed that there was no death and the reversibility of hair growth in experimental animals began to appear on the 3 and 14-day it looked like before treatment but the size was still shorter than the initial condition.

The changes in behavior that occurred at the beginning of the exposure period in this study were thought to be due to the influence of bandaging during treatment so the animals felt less comfortable due to changes in lifestyle habits. Various factors can influence stress in animals, such as drastic changes in habits such as eating and drinking, transportation, moving cages, the presence of predators, rough handling, treatment, and climate change (Efendy, 2018). The findings of Zulfiana (2014) in testing the acute toxicity of dermal biolarvicide also showed similar results, namely the absence of deaths and changes in behavior up to the first 2-hour of the exposure period. Sari *et al*. (2016) in their study also found behavior changes in the first 2 hours of the exposure period up to 30 minutes after the exposure period is over. The difference in the duration of changes in behavior is thought to be caused by differences in the size of the administration dose.

Observation of Skin Anatomy Pathology

The results of observation and evaluation of skin anatomy pathology showed that both groups showed mild irritation (Figure 3) and the classification is presented in Table 5. Based on anatomical skin pathology observations, it was found that there were indications of erythema at

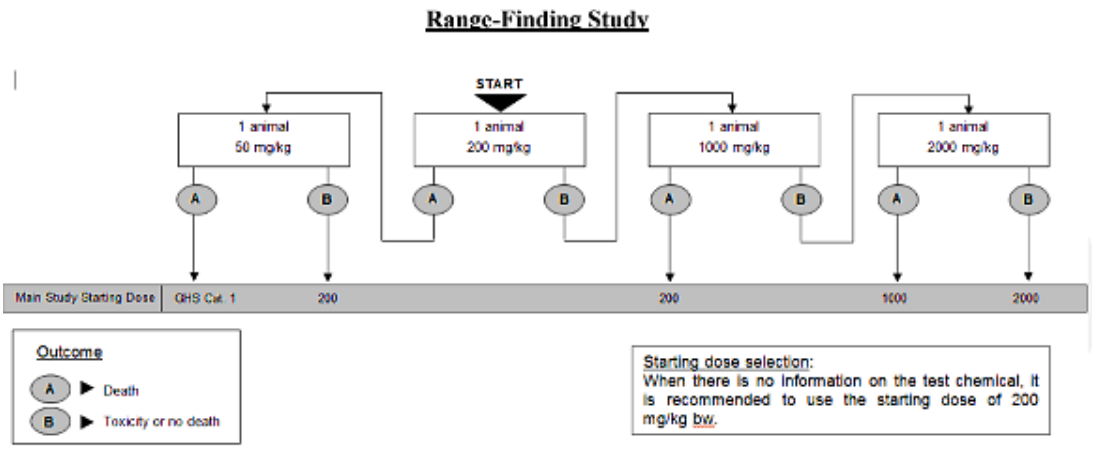

Figure 1. Preliminary evaluation stages (OECD, 2017).

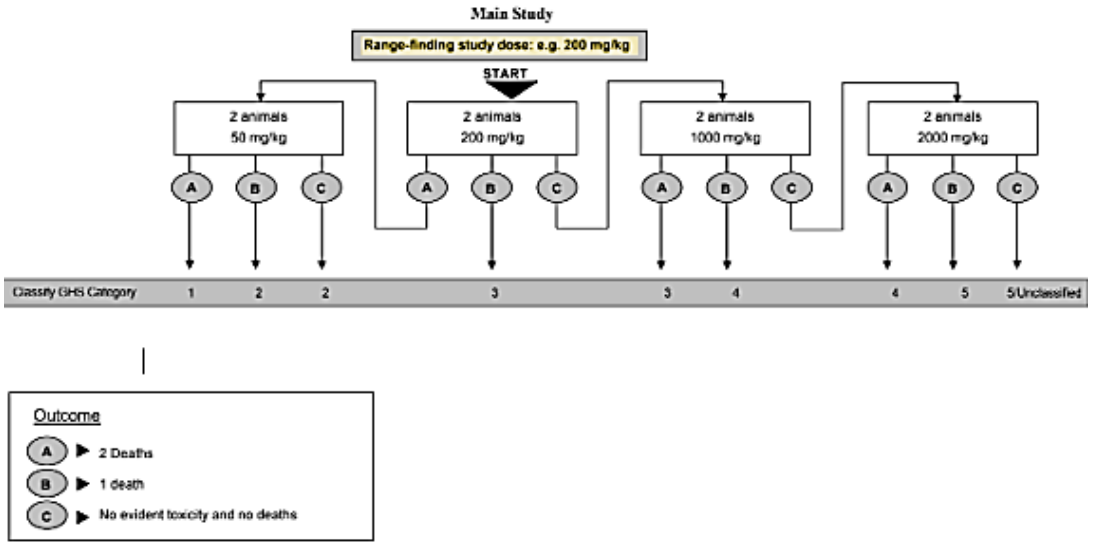

Figure 2. Main evaluation stages (OECD, 2017).

Table 1. Classification of Dermal Acute Toxicity (United Nations, 2011)

Category	Value	Danger Level
1	0 < mg/kg BW ≤ 50	Fatal in contact with skin
2	50 < mg/kg BW ≤ 200	Fatal in contact with skin
3	200 < mg/kg BW ≤ 1000	Toxic in contact with skin
4	1000 < mg/kg BW ≤ 2000	Dangerous in contact with skin
5	2000 < mg/kg BW ≤ 5000	May be dangerous in contact with skin

Table 2. Results of observations and preliminary test evaluation

Parameter	Dose	
	1000 mg/kg BW	2000 mg/kg BW
Clinical observation	There were no mortality or visible clinical symptoms	There were no mortality or visible clinical symptoms
Primary irritation index	0 (Not irritating)	0 (Not irritating)
Body weight (g)	(+) 15,09	(+) 18,82
Interpretation	Followed by a higher dose	Doses used in the main evaluation

Table 3. Mortality rate of experimental animals

Group	Mortality rate (%)
P0	0
P1	0

(P0) Placebo (Vaseline alba/ointment base), (P1) Simplicial ointment 40% 2000 mg/kg BW.

Table 4. Clinical signs and behavioral patterns of experimental animals

Parameter	Control		Treatment	
	P0 (6-Hour)	P0 (24-Hour)	P1 (6-Hour)	P1 (24-Hour)
Skin and hair changes	+	+	+	+
Eyes and mucous membranes	-	-	-	-
Respiratory system	Normal	Normal	Normal	Normal
Changes in behavior	-	-	-	-
Somatomotor activity	Normal	Normal	Normal	Normal
Toxicity symptoms	-	-	-	-

(P0) Placebo (Vaseline alba/ointment base), (P1) Simplicial ointment 40% 2000 mg/kg BW.

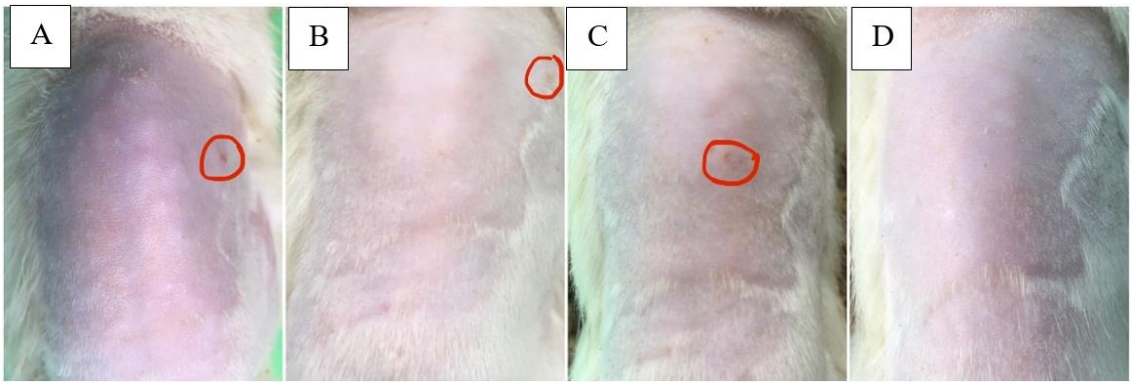

Figure 3. Observation of skin anatomical pathology in (P1) 2nd animal treatment group. (A) 0-hour observation, (B) 24-hour observation, (C) 48-hour observation, (D) 72-hour observation.

Table 5. Irritation index scoring according to the Amended Draize System

Group	Animal No.	Irritation score	
		Erythema	Edema
P0	1	2	0
	2	4	0
P1	1	4	0
	2	4	0
Total score (P0 — P1)		6	8
PII (P0 — P1)		0,75	1
Results (P0 — P1)		Slightly irritating	Slightly irritating

(P0) Placebo (Vaseline alba/ointment base), (P1) Simplicial ointment 40% 2000 mg/kg BW, (PII) Primary Irritation Index.

Table 6. Rat body weight before and after evaluation

Group	Initial weight (g)	$\bar{x}$ ± SD	Final weight (g)	$\bar{x}$ ± SD	Δ BW
P0	225,18 221,63	223,41 ± 2,51	230,27 232,12	231,20 ± 1,31	7,79 ± 3,82*
P1	234,15 253,35	243,75 ± 13,58	240,78 266,18	253,48 ± 17,96	9,73 ± 4,38

*not significantly different (p > 0,05) when compared with the treatment group.

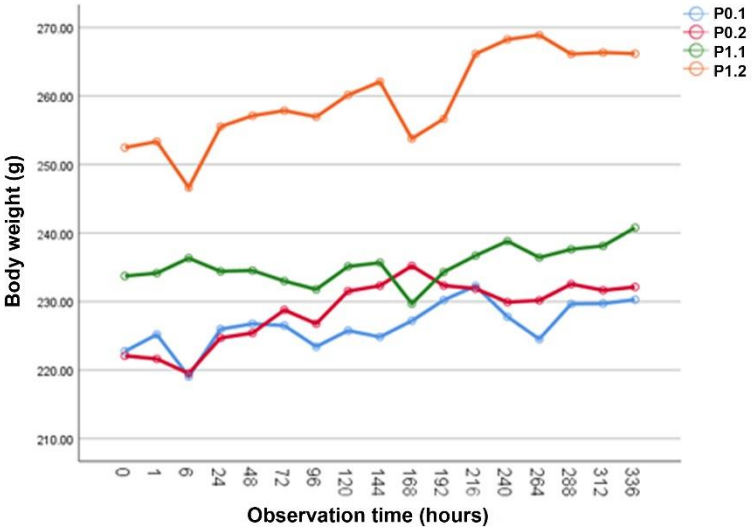

Figure 4. Body weight of experimental animals during 14-days of observation.

0, 24, 48, and 72-hours of observation. At each observation an assessment was carried out, and a score was given as shown in Table 5. The results of calculating the Primary Irritation Index (PII) showed that the control group and the treatment group had values that were not very different and were classified as experiencing mild irritation.

These results indicate that there were false positives shown in the control group who experienced erythema, which is difficult to happen because only an ointment base, namely vaseline album, was applied. Vaseline has long been known to be used as the most effective treatment for dry skin because it can retain water in the skin so that the skin remains moist and the skin barrier remains healthy (Hamishehkar *et al*., 2015). Vaseline also strongly modulates antimicrobial action and helps the skin barrier in blocking invading pathogens (Czarnowicki *et al*., 2015). According to Ordonez-Toro *et al*. (2022), vaseline can reduce erythema. Maarouf *et al*. (2019), also suggested the use of vaseline to improve the skin barrier and erythema. Zahara *et al*. (2016) in their article also stated that Vaseline is safe to use on the skin. Vaseline can be dangerous if swallowed or in contact with the eyes (Heller, 2021). Based on this description, it is known that vaseline does not have toxic potential which can cause irritation if used appropriately, this is also supported by research results from Maru and Lahoti (2019), Nareswari and Kuncoro (2016), and Mukhlishah *et al*. (2016) which showed that album vaseline did not show skin irritating potential.

The occurrence of erythema in this test is thought to be caused by an imbalance in the skin's normal microflora which causes increased skin sensitivity. According to Seite and Misery (2018), there is a relationship between normal skin microflora, skin barrier function, and skin sensitivity, including skin care products that can improve everything. Skin can be influenced by the environment, genetics, diet, and lifestyle (Pratiwi and Susanti, 2021). This imbalance can also be influenced by the presence of external parasites such as mites, fleas, ticks, or fleas because they can also have toxic effects (Guner *et al*., 2021; Krol *et al*., 2019). Erythema is thought

to also occur due to the possibility that the test animal's skin was scratched during shaving so that the skin was injured, causing the skin barrier to be disrupted and causing permeability to increase so that the ointment was absorbed percutaneously, which should be indicated for topical use, similar to what was declared by Hakim *et al*. (2018).

Simplicial ointment which is based on vaseline album is an epidermal ointment that after being applied topically to the skin will not be absorbed and only produces local effects and is intended to protect the skin (Djarami, 2022). The saponin contained in the preparation can trigger irritation of mucous membranes such as skin at certain levels because of its nature as an irritant (Brandenburg, 2018; Janjic, 2021). Laras *et al*. (2014), also declared that the saponin contained in the mangosteen rind extract is capable of causing irritation to the skin due to the activity of saponin as a surfactant, however, the results of their research show an irritation index of 0 which is thought to be caused by the concentration of the saponin contained being still in the tolerable range. According to Zeng *et al*. (2020), saponins from *Periploca forrestii* can induce Atopic Dermatitis by modulating macrophage activation. Based on the description above, saponin content at certain concentrations can trigger erythema, however, in this study, false positives occurred so further research needs to be carried out to ensure that the saponin concentration is still within a tolerable range so that it does not affect the emergence of skin irritation reactions or modulate macrophage activation such as in cases of atopic dermatitis.

Body Weight Evaluation

The results of this study showed that there was no weight loss at the end of the observation period which is presented in Table 6, this indicates the absence of systemic toxicity (Merdana *et al*., 2020b). Based on the paired t-test, a significance value of 0,129 ($p > 0,05$) was obtained, which means that the change in body weight between the treatment group and the control group was not significantly different, indicating that there was no effect of treatment on body weight. These results are in line with the research results of Zahi *et al*. (2015), on noni fruit extract and Banerjee *et al*. (2013), on transdermal patch prophylaxis against Anatoxin-A poison. In general, changes in a mouse's body weight will reflect death after exposure to harmful substances. Changes in body weight are a marker of the adverse effects of drugs and chemicals which will be a concern if there is a weight loss of more than 10% of the initial weight (Zahi *et al*., 2015). In the first 6-hour of observation, it was seen that almost all the test animals experienced weight loss (Figure 4), this was thought to be influenced by stress due to the restraint applied during bandaging and removing the bandage after the 24-hour period of exposure to the test material. Guedri *et al*. (2017), stated that there is a relationship between stress due to restraint and weight loss, which can refer to a decrease in food intake and consumption of energy reserves. This is also supported by the findings of Sari *et al*. (2016), in their research regarding the acute dermal toxicity of areca nut extract at a dose of 15.000 mg/kg BW that there was a decrease on the 2-day of observation which was thought to be due to stress due to bandaging during treatment.

Dermal Acute Toxicity Assessment

In this study, a dose of 2000 mg/kg BW was the highest dose used based on The OECD Guideline for Testing of Chemicals – No. Test: 402. During the evaluation, no abnormal behavioral changes were found indicating toxicity, no mortality occurred, and reversibility was achieved as seen from hair growth at the end of the observation period. Based on the analysis of the erythema and edema scoring results, the PII was 0,75 in the control group and 1,00 in the treatment group so it was categorized as slightly irritating based on the Amended Draize Test. The PII calculation results were invalid because there were false positives so it could be assumed that hibiscus leaf simplicial ointment was not irritating because the PII value was not much different from the control group. The acute dermal LD50 value could not be analyzed using the Thompson-Weil method because there were no deaths during the test so only the pseudo acute dermal LD50 could be obtained. LD50 is declared as pseudo LD50 if

the maximum dose given to test animals does not cause death (Hafid and Rahayu, 2022). Based on the description above, according to the Globally Harmonized system, hibiscus leaf simplicial ointment 40% is classified into category 5/unclassified with an acute dermal LD50 value of > 2000 mg/kg BW, which means the test material may be dangerous if it comes into contact with the skin (OECD, 2017).

CONCLUSION

It can be concluded that hibiscus leaf simplicial ointment with a concentration of 40% was safe to use topically on the skin with the highest dose that can still be administered being > 2000 mg/kg BW.

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REFERENCES

Adiyasa, M. R., & Meiyanti. (2021). Review Article: Pemanfaatan obat tradisional di Indonesia: distribusi dan faktor demografis yang berpengaruh. *Jurnal Biomedika dan Kesehatan*, 4(3), 130–138.

Al-Idrus, H. R., Iswahyudi, I., & Wahdaningsih, S. (2014). Uji Aktivitas Antioksidan Ekstrak Etanol Daun Bawang Mekah (*Eleutherine americana Merr*.) Terhadap Gambaran Histopatologi Paru Tikus (*Rattus norvegicus*) Wistar Jantan Pasca Paparan Asap Rokok. *Jurnal Fitofarmaka Indonesia*, 1(2), 51–60.

Al-Snafi, A. E. (2018). Chemical constituents, pharmacological effects and therapeutic importance of *Hibiscus rosa-sinensis*-A review. *IOSR Journal of Pharmacy*, 8(7), 101–119.

Arts, J. W. M., Kramer, K., Arndt, S. S., & Ohl, F. (2014). Sex Differences in Physiological Acclimatization after Transfer in Wistar Rats. *Animals*, 4, 693–711.

Baldisserotto, A., Buso, P., Radice, M., Dissette, V., Lampronti, I., Gambari, R., Manfredini, S., & Vertuani, S. (2018). *Moringa oleifera* Leaf Extracts as Multifunctional Ingredients for "Natural and Organic" Sunscreens and Photoprotective Preparations. *Molecules*, 23(664), 1–16.

Banerjee, S., Chattopadhyay, P., Ghosh, A., Pathak, M. P., Singh, S., & Veer, V. (2013). Acute Dermal Irritation, Sensitization, and Acute Toxicity Studies of a Transdermal Patch for Prophylaxis Against (+) Anatoxin-A Poisoning. *International Journal of Toxicology*, 32(4), 308–313.

Brandenburg, W. E. (2018). Phytodermatitis: A Brief Review of Human Skin Reactions Caused by The Kindom Plantae. *Journal of Plant Pathology Research*, 1(1), 1–5.

Czarnowicki, T., Malajian, D., Khattri, S., Rosa, J. C., Dutt, R., Finney, R., Dhingra, N., Xiangyu, P., Xu, H., Estrada, Y., Zheng, X., Gilleaudeau, P., Sullivan-Whalen, M., Suarez-Farinas, M., Shemer, A., Krueger, J. G., & Guttman-Yassky, E. (2015). Petrolatum: Barrier repair and antimicrobial responses underlying this "inert" moisturizer. *Journal Allergy Clinical Immunology*, 137(4), 1091–1102.

Davis, S. E., Tulandi, S. S., Datu, O. S., Sangande, F., & Pareta, D. N. (2022). Formulasi dan Pengujian Sediaan Salep Ekstrak Etanol Daun Kembang Sepatu (*Hibiscus rosa-sinensis* L.) Dengan Berbagai

Variasi Basis Salep. *Jurnal Biofarmasetikal Tropis*, 5(1), 66–73.

Dharma, M. A., Nocianitri, K. A., & Yusasrini, N. L. A. (2020). Pengaruh Metode Pengeringan Simplisia Terhadap Kapasitas Antioksidan Wedang Uwuh. *Jurnal Ilmu dan Teknologi Pangan*, 9(1), 88–95.

Djarami, J. (2022). Penyuluhan Tentang Obat Sediaan Salep kepada Masyarakat di Desa Hila. *Jurnal JPIKES*, 2(1), 53–55.

Efendy, J. (2018). Aktivitas Harian dan Deteksi Stress Pada Sapi Peranakan Ongole (PO). *Maduranch*, 3(2), 53–58.

Endarini, L. H. (2016). Farmakognisi dan Fitokimia. Edisi 1. Kementerian Kesehatan, pp: 11–15.

Guedri, K., Frih, H., Chettoum, A., & Rouabhi, R. Chronic Restraint Stress Induced Neurobehavioral Alterations and Histological Changes in Rat. *Toxicology Environment Health Science*, 9(2), 123–129.

Guner, R. Y., Tosun, M., Akyol, M., & Hayta, S. B. (2021). Demodex infestation as a cause of sensitive skin in a dermatology outpatient clinic. *Journal Cosmetic Dermatology*, 1–6.

Hafid, M., & Rahayu. (2022). Uji Toksisitas Akut (LD50) Ekstrak Etanol Daun Gedi Merah (*Abelmoschus manihot*) Asal Sorong Selatan terhadap Mencit (*Mus musculus*). *Fito Medicine: Journal Pharmacy and Sciences*, 12(2), 84–87.

Hakim, Z. R., Purbarini, K. A., & Tjiptasurasa, T. T. (2018). Uji Iritasi Akut Dermal Pada Hewan Uji Kelinci Albino Terhadap Sediaan Body Lotion Ekstrak Kulit Biji Pinang (*Areca catechu L.*). *Farmaka*, 18(1), 1–13.

Hamishehkar, H., Same, S., Adibkia, K., Zarza, K., Shokri, J., Taghaee, M., & Kouhsoltani, M. (2015). A comparative histological study on the skin occlusion performance of a cream made of solid lipid nanoparticles and Vaseline. *Research in Pharmaceutical Sciences*, 10(5), 378–387.

Handoyo, D. L. Y., & Pranoto, M. E. (2020). Pengaruh Variasi Suhu Pengeringan Terhadap Pembuatan Simplisia Daun Mimba (*Azadirachta Indica*). *Jurnal Farmasi Tinctura*, 1(2), 45–54.

Heller, J. L., Emeritus, Zieve, D., & Conaway B. (2021). Petroleum jelly overdose. MedlinePlus.

Janjic, V. (2021). Plant-Caused Skin Disorders. Edisi 1. Cambrige Scholars Publishing.

Krismayogi, G. A., Ratnayanti, I. G. A.D., Linawati, N. M., Wiryawan, I. G. N. S., Sugiritama, I. W., Wahyuniari, I. A. I., & Arijana, I. G. K. N. (2018). Purple Cabbage Extract Cream Effect on Erythema Score of Male Wistar Rat's Back Skin Exposed To UV-B Radiation. *Biomedical & Pharmacology Journal*, 11(1), 343–351.

Krissanti, I., Hanifa, R., & Dwiwina, R. G. (2023). Efektivitas dan Pengaruh Kombinasi Anestesi Ketamine-Xylazine pada Tikus (*Rattus norvegicus*). *Gunung Djati Conferences Series*, 245–252.

Krol, G., Tomaszewska, A., Wrobel, G., Paprocka, P., Durnas, B., Piktel, E., & Bucki, R. (2019). Toxicity of Parasites and their unconventional use in medicine. *Annals of Agricultural and Environmental Medicine*, 26(4), 523–531.

Kuncari, E. S., Iskandarsyah, & Praptiwi. (2015). Uji Iritasi dan Aktivitas Pertumbuhan Rambut Tikus Putih: Efek Sediaan Gel Apigenin dan Perasan Herba Seledri (*Apium graveolens L.*). *Media Litbangkes*, 25(1), 15–22.

Laras, A. A. I. S., Swastini, D. A., Wardana, M., & Wijayanti, N. P. A. D. (2014). Uji Iritasi Ekstrak Etanol Kulit Buah Manggis (*Garcinia mangostana L.*). *Jurnal Farmasi Udayana*, 3(1), 74–77.

Lazuardi, M. (2019). Bagian Khusus Ilmu Farmasi Veteriner. Edisi 1. Airlangga University Press, pp: 59–75.

Lestaridewi, N. K., Jamhari, M., & Isnainar. (2017). Study of Plant Utilization as Traditional Medicines at Tolai Village, Torue Subdistric, Parigi Moutong District. *E-JIP BIOL*, 5(2), 92–108.

Liu, E., & Fan, J. (2018). Fundamentals of Laboratory Animal Science. Edisi 1. CRC Press.

Maarouf, M., Kromenacker, B. W., Brucks, E. E., & Shi, V. Y. (2019). Expedited Resolution of 5-Fluorouracil-Induced Reaction and Barrier Dysfunction with White Petrolatum. *SKIN The Journal of Cutaneous Medicine*, 3(4), 279–282.

Mappasomba, M., Wirasmanto, B., Malaka, M. H., Wahyuni, & Sahidin. (2019). Penapisan Fitokimia dan Uji Toksisitas Akut Ekstrak Metanol Beberapa Tanaman Obat Terhadap Larva Udang Artemia Salina Leach. *Pharmauho*, 5(2), 30–34.

Maru, A. D., & Lahoti, S. (2019). Formulation and Evaluation of Ointment Containing Sunflower Wax. *Asian Journal of Pharmaceutical and Clinical Research*, 12(8), 115–120.

Meena, A. K., Jain, A., Pandey, K., & Singh, R. K. (2014). Acute Toxicityand Genotoxic Activity of *Hibiscus rosa sinensis* Flower Extract. *American Journal of Phytomedicine and Clinical Therapeutics*, 2(4), 524–529.

Merdana, I. M., Arjana, A. A. G., Widyastuti, S. K., Tetrania, T., Budiasa, K., Sudimartini, L. M., & Sudira, I. W. (2020a). Assesment of the Dermal Acute Irritation Potential of Natural Veterinary Medicine Minyak Rajas in Albino Rabbits. *Journal of Pharmaceutical Research International*, 32(10), 17–24.

Merdana, I. M., Azizati, S. T. K. N., Arjana, A. A. G., Adi, A. A. A. M., & Sudira, I. W. (2020b). Penilaian Potensi Toksisitas Akut Dermal Obat Hewan Alami Minyak Rajas pada Tikus Wistar. *Buletin Veteriner Udayana*, 12(2), 205–214.

Mukhlishah, N. R. I., Sugihartini, N., & Yuwono, T. (2016). Daya Iritasi dan Sifat Fisik Sediaan Salep Minyak Atsiri Bunga Cengkeh (*Syzigium aromaticum*) pada Basis Hidrokarbon. *Majalah Farmaseutik*, 12(1), 372–376.

Nareswari, N., & Kuncoro, A. (2016). Pembuatan Salep Minyak Atsiri Daun Jeruk Limau (*Citrus amblycarpa*) dan Uji Stabilitas Terhadap Tipe Basis yang Digunakan. *Biofarmasi*, 14(2), 63–68.

Nath, P., & Yadav, A. K. (2014). Acute and sub-acute oral toxicity assessment of the methanolic extract from leaves of *Hibiscus rosa-sinensis L*. in mice. *Journal of Intercultural Ethnopharmacology*, 4(1), 70–73.

OECD. (2017). Test No. 402: OECD Guideline for The Testing of Chemical – Acute Dermal Toxicity: Fixed Doses Procedure. OECD Publishing.

Ordonez-Toro, A., Montero-Vilchez, T., Munoz-Baeza, J., Sanabria-De-la-Torre, R., Buendia-Eisman, A., & Arias-Santiago, S. (2022). The Assessment of Skin Homeostatis Changes after Using Different Types of Excipients in Healthy Individuals. *International Journal of Environmental Research and Public Health*, 19(16678), 1–11.

Petruk, G., Giudice, R. D., Rigano, M. M., & Monti, D. M. (2018). Antioxidants from Plants Protect against Skin Photoaging. *Oxidative Medicine and Cellular Longevity*, 1–11.

Prasetya, I. P. D., Arijana, I. G. K. N., Linawati, N. M., Sugiritama, I. W., & Sudarmaja, I. M. (2020). Krim Ekstrak Kulit Buah Naga Super Merah (*Hylocereus costaricensis*) Meningkatkan Kelembapan Kulit Tikus Wistar (*Rattus norvegicus*) yang Dipapar Sinar Ultraviolet B. *Jurnal Medika Udayana*, 10(8), 86–91.

Pratiwi, E. D., & Susanti. (2021). Manfaat Probiotik dalam Perawatan Kulit: Review. *Majalah Farmasetika*, 6(4), 359–374.

Pratiwi, S., & Husni, P. (2017). Artikel Tinjauan: Potensi Penggunaan Fitokonstituen Tanaman Indonesia sebagai Bahan Aktif Tabir Surya. *Farmaka*, 15(4), 18–25.

Puspitasari, V., Wahjuni, R. S., Saputro, A. L., Hamid, I. S., & Wibawati, P. A. (2021). Effectiveness of Clove Flower Extract (*Syzygium Aromaticum L.*) as Analgesic on Licking Time Reaction in Male Mice with Formalin Induction. *Jurnal Medik Veteriner*, 4(2), 226–230.

Rahmi, H. (2017). Review: Aktivitas Antioksidan dari Berbagai Sumber Buah-buahan di Indonesia. *Jurnal Agrotek Indonesia*, 2(1), 34–38.

Ridwan, Y., Satrija, F., & Handharyani, E. (2020). Toksisitas Akut Ekstrak Daun Miana (*Coleus Blumei Benth*) pada Mencit Mus Musculus. *Acta Veterinaria Indonesia*, 8(1), 55–61.

Rivai, H., Wahyuni, A. H., & Fadhilah, H. (2013). Pembuatan dan Karakterisasi Ekstrak Kering Simplisia Jati Belanda (*Guazuma ulmifolia Lamk*). *Jurnal Farmasi Higea*, 5(1), 1–8.

Samirana, P. O., Pratiwi, D. M. N., Musdwiyuni, N. W., Andhini, D. A. A., Mahendra, A. M. Mahendra, A. M., & Yadnya-Putra, A. A. G. R. (2018). Uji Pendahuluan Toksisitas Akut Dermal Sediaan Salep Ekstrak Etanol 70% Daun Binahong (*Anredera scandens (L.) Moq.*) Tersandar. *Jurnal Kimia*, 12(2), 107–112.

Sari, L. M., Suyatna, F. D., Subita, G. P., & Auerkari, E. I. (2016). Acute Dermal Toxicity Study of *Areca catechu Linn*. Extract in Sprague-Dawley Rats. *Asian Journal of Pharmaceutical and Clinical Research*, 9(3), 1–3.

Sasmito, W. A., Wijayanti, A. D., Fitriana, I., & Sari, P. W. (2015). Pengujian Toksisitas Akut Obat Herbal Pada Mencit Berdasarkan Organization for Economic Co-operation and Development (OECD). *Jurnal Sain Veteriner*, 33(2), 234–239.

Seite, S., & Misery, L. (2018). Hypothesis Letter-Skin sensitivity and skin microbiota: Is there a link?. *Experimental Dermatology*, 27, 1061–1064.

Simaremare, E. S., Holle, E., Budi, I. M., & Yabansabra, Y. Y. (2015). Analisis Perbandingan Efektifitas Antinyeri Salep Daun Gatal dari Simplisia *Laportea decumana* dan *Laportea sp*. *Pharmacy*, 12(1), 1–10.

Siregar, R. S., Tanjung, A. F., Siregar, A. F., Salsabila, Bangun, I. H., & Mulya, M. O. (2020). Studi Literatur Tentang Pemanfaatan Tanaman Obat Tradisonal. *Seminar of Social Sciences Engineering & Humaniora*, 385–391.

Soejanto, A. S. (2017). Pemberian Krim Ekstrak Metanolik Buah Delima Merah (*Punica granatum*) Menghambat Penurunan Jumlah Kolagen Dermis Kulit Mencit (*Mus musculus*) yang Dipapar Sinar Ultraviolet B.

E-JURNAL Indonesian Journal of Anti Aging Medicine, 1(1), 1–9.

Solikhah, T., Rani, C. A. M., Septiani, M., Putra, Y. A. S., Rachmah, Q., Solikhah, G. P., Agustono, B., Yunita, M. N., & Purnama, M. T. E. (2022). Antidiabetic of *Hylocereus polyrhizus* peel ethanolic extract on alloxan induced diabetic mice. *Iraqi Journal of Veterinary Sciences*, 36(3), 797–802.

Sudira, I. W., Merdana, I. M., & Qurani, S. N. (2019). Preliminary Phitochemical Analysis of Guava Leaves (*Psidium guajava L.*) as Antidiarrheal in Calves. *Advances in Tropical Biodiversity and Environmental Sciences*, 3(2), 21–24.

Triana, N. M., Wilujeng, E., Putri, M. W. H., Yuda, D. M. P., Hardiono, A. L., Purnama, M. T. E., & Fikri, F. (2020). Antiproliferation effects of *Glycine max Linn* ethanolic extract on induced mammary gland carcinoma in albino rats. *In IOP Conference Series: Earth and Environmental Science*, 441(1), 012103.

Trisnajayanti, I. (2013). Pengaruh Basis Salep Hidrokarbon dan Basis Salep Serap Terhadap Sediaan Salep Ekstrak Daun Bunga Sepatu (*Hibiscus rosa-sinensis L.*). Parapemikir: *Jurnal Ilmiah Farmasi*, 2(3).

United Nations. (2011). Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Yassir, M., & Asnah. (2018). Pemanfaatan Jenis Tumbuhan Obat Tradisional di Desa Batu Hamparan Kabupaten Aceh Tenggara. *Jurnal Biotik*, 6(1), 17–34.

Zahara, Y., Dewi, R., & Saptarini, E. (2016). Efektivitas Penggunaan White Petroleum Jelly untuk Perawatan Luka Tekan Stage 1 di Ruang di Rawat Inap Siloam Hospital Lippo Village. *Indonesian Journal of Nursing Health Science*, 1(1), 15–32.

Zahi, A. K., Hamzah, H., Hutheyfa, S., Shaari, M. R., Sithambaram, S., & Othman, H. H. (2015). Acute and Sub-Acute Dermal Toxicity Studies of *Morinda citrifolia L.* Fruit Extract in Sparague Dawley Rats. *Asian Journal of Pharmaceutical and Clinical Research*, 8(2), 400–408.

Zeng, L., Liu, Y., Xing, C., Huang, Y., Sun, X., & Sun, G. (2020). Saponin from *Periploca forrestii* Schltr Mitigates Oxazolone-Induced Atopic Dermatitis via Modulating Macrophage Activation. *Hindawi*, 1–13.

Zulfiana, D. (2014). Pengujian Toksisitas Akut Oral dan Dermal pada Biolarvasida *Metarhizium anisopliae* Terhadap Tikus Putih Spraque Dawley. *Al-Kauniyah Jurnal Biologi*, 7(1), 1–8.

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