

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

Muhammad Faruqi Perdana^{1*}, Vonny Kurnia Utama², Isna Wardaniati³, Nengreha Paujiah⁴

^{1,2,3,4}Undergraduate Pharmacy Study Program, Faculty of Pharmacy and Health Sciences, Abdurrahman University

Corresponding Author : Muhammad Faruqi Perdana

ABSTRACT: Guava leaves (*Psidium guajava* L.) are known to contain active compounds such as flavonoids, tannins, saponins, and triterpenoids, which have potential antibacterial activity. This study aimed to formulate a topical cream preparation containing ethanol extract of guava leaves and to evaluate its antibacterial activity against *Staphylococcus aureus*. The extract was obtained through maceration using 96% ethanol. The cream was formulated with extract concentrations of 1.5% (F1), 2.5% (F2), and 5% (F3). Physical evaluation of the cream included organoleptic test, homogeneity, pH, viscosity, spreadability, cream type, and skin irritation test. Antibacterial activity was assessed using the disc diffusion method for the extract and the well diffusion method for the cream formulations. The results showed that the ethanol extract exhibited antibacterial activity with inhibition zones ranging from 7.33 mm to 14.22 mm. However, none of the cream formulations (F1, F2, or F3) showed any inhibition zones (0 mm), indicating that the active compounds were not effectively delivered in cream form. Despite this, all cream formulations passed the physical evaluation criteria, demonstrating good homogeneity, a neutral pH (approximately 7.2–7.4), appropriate viscosity and spreadability, oil-in-water (O/W) cream type, and no signs of skin irritation in test subjects. In conclusion, the ethanol extract of guava leaves is effective as an antibacterial agent against *Staphylococcus aureus* in pure form, but its activity is not retained when formulated as a topical cream. Further formulation optimization is necessary to enhance skin delivery of the active compounds.

KEYWORDS: guava leaves (*Psidium guajava* L.), antibacterial, cream, *Staphylococcus aureus*.

I. INTRODUCTION

Cosmetics are substances or preparations intended for application to the external parts of the human body, such as the epidermis, hair, nails, lips, external genital organs, teeth, and the oral mucosa, primarily for cleansing, perfuming, altering appearance, correcting body odor, or protecting and maintaining the body in good condition (BPOM, 2019). One of the most popular and widely used cosmetic dosage forms is cream.

Cream is a semisolid topical preparation intended for external application to the skin and contains one or more active ingredients dissolved or dispersed in a suitable base. In general, cream formulations consist of an oil phase dispersed in a water phase and contain a higher concentration of humectants than lotions. Advances in science and technology have encouraged cosmetic manufacturers to develop innovative facial cream formulations by incorporating bioactive compounds that provide additional skin health benefits (Yumas, 2016). Cream formulations can enhance drug permeation through the skin, improve bioavailability, and prolong the residence time of active compounds on the skin surface. Compared with gels, creams generally exhibit better physical stability, particularly in terms of color and phase separation, while their formulation also enables controlled drug release. Consequently, creams are considered more effective for topical drug delivery in certain therapeutic applications (Khattak et al., 2022). Currently, there is growing interest in cosmetics formulated with natural ingredients, one of which is guava leaves (*Psidium guajava* L.).

Guava (*Psidium guajava* L.) is a medicinal plant that has long been utilized in traditional medicine. Empirically, guava leaves have been used as an antimicrobial agent for the treatment of diarrhea, while the fruit has been used as a laxative. In addition, the tannin compounds present in guava possess astringent properties by constricting blood vessels. Almost every part of the guava

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

plant exhibits pharmacological activities that are beneficial to human health, although the types and concentrations of bioactive compounds vary among plant parts. Guava leaves contain several phytochemical constituents, including flavonoids, eugenol, tannins, and terpenoids, which exhibit antibacterial activity by disrupting bacterial cell membrane integrity. Furthermore, these leaves possess various pharmacological properties, including anti-inflammatory, analgesic, and antioxidant activities (Akiyama et al., 2001). Guava leaves have also been reported to exhibit astringent, wound-healing, anti-allergic, and skin-repairing effects, as well as antimicrobial activity against bacteria commonly associated with surgical wound and soft tissue infections, including *Staphylococcus aureus* and *Streptococcus* spp. (Desiyana et al., 2016). Therefore, guava leaves have demonstrated considerable potential as a natural antibacterial agent for the treatment of skin infections.

Phytochemical screening is an essential step in evaluating medicinal plants because it enables the identification of bioactive compounds present in plant materials, thereby providing scientific evidence for their potential therapeutic applications. A previous study on the phytochemical screening of guava leaf (*Psidium guajava* L.) ethanol extract identified the presence of alkaloids (+), indicated by an orange color change; flavonoids (+), indicated by an orange color change; tannins (+), indicated by a green color change; and saponins (+), indicated by the formation of stable foam (Risman Tunny et al., 2023).

Previous studies have also demonstrated that the ethanol extract of guava leaves effectively inhibits the growth of *Staphylococcus aureus*. Risman Tunny et al. (2023) reported inhibition zone diameters of 16 mm, 17 mm, and 17.5 mm at extract concentrations of 105%, 110%, and 115%, respectively, all of which were classified as exhibiting strong antibacterial activity (Risman Tunny et al., 2023).

Based on the aforementioned background, this study aims to develop a novel cream formulation containing ethanol extract of guava leaves (*Psidium guajava* L.) and to evaluate its antibacterial activity against *Staphylococcus aureus*.

II. METHODS

WORKING PROCEDURES

Sample Collection and Preparation

A total of 3 kg of fresh guava (*psidium guajava* l.) Leaves were collected and subjected to wet sorting to remove adhering impurities such as soil, gravel, and other foreign materials. The leaves were then washed thoroughly under running water two to three times, cut into small pieces to facilitate the drying process, and air-dried at room temperature. After drying, dry sorting was performed to remove remaining impurities, foreign organic matter, and damaged plant materials resulting from the previous processing steps. The dried leaves were subsequently ground into powder using a blender and sieved through a 40-mesh sieve to obtain a uniform particle size. The resulting powdered material was used as the dried simplicia for further extraction (fitriani & nashihah, 2021).

Preparation of The Ethanol Extract

A total of 500 g of powdered simplicia was weighed and extracted by the maceration method using 96% ethanol as the extraction solvent. The extraction was carried out with a total solvent volume of 4.5 L, using 1.5 L of ethanol for each maceration cycle. The maceration process was performed for 3 × 24 hours with three consecutive extraction cycles. At the end of each cycle, the extract was filtered to separate the filtrate from the plant residue. The combined ethanol extracts were then concentrated under reduced pressure using a rotary evaporator to obtain a viscous extract. The extraction yield (%) was calculated using the following equation (Mutiarra et al., 2016):

$$\text{Extraction Yield (\%)} = \frac{\text{Weight of the concentrated extract obtained (g)}}{\text{Weight of the dried simplicia extracted (g)}} \times 100\%$$

CREAM FORMULATION

FORMULATION

Table 1. Formulation of Guava (*Psidium guajava* L.) Leaf Extract Cream

Formulation Ingredients	Amount (g)				Function	Reference
	F0	F1	F2	F3		
Guava (<i>Psidium guajava</i> L.) Leaf Ethanol Extract	0	0,75	1,25	2,5	Active ingredient	(Putri et al., 2022)
Adeps Lanae	1,0	1,0	1,0	1,0	Base	(Tari & Indriani, 2023)

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

Stearic Acid	8,3	8,3	8,3	8,3	Emulsifying agent	(Witanti & Endriyatno, 2024)
Propylene Glycol	3,4	3,4	3,4	3,4	Humectant	(Putri <i>et al.</i> , 2022)
Triethanolamine	2,1	2,1	2,1	2,1	Emulsifying agent	(Tari & Indriani, 2023)
Glycerin	5,5	5,5	5,5	5,5	Humectant	(Putri <i>et al.</i> , 2022)
Methyl Paraben	0,15	0,15	0,15	0,15	Preservative	(Tari & Indriani, 2023)
Purified Water (<i>Aqua destillata</i>)	Ad 50	Ad 50	Ad 50	Ad 50	Solvent	(Witanti & Endriyatno, 2024)

Cream Preparation

All equipment and materials were prepared prior to the formulation process. The oil phase was prepared by accurately weighing 1.0 g of Adeps lanae and 8.3 g of stearic acid into a porcelain dish, followed by heating on a hot plate until completely melted. The aqueous phase was prepared separately by weighing 0.15 g of methyl paraben, 2.1 g of triethanolamine, 3.4 g of propylene glycol, and 5.5 g of glycerin into a separate beaker, and heating the mixture on a hot plate until all components were completely dissolved. The molten oil phase was then gradually added to the aqueous phase and homogenized using a homogenizer until a homogeneous cream base was obtained. Subsequently, guava (*Psidium guajava* L.) leaf extract was incorporated into the cream base according to the respective formulations (F1, F2, and F3) and mixed thoroughly until homogeneous. Purified water was then added q.s. to 50 g as the solvent, and the mixture was stirred gently until all ingredients were uniformly dispersed. Finally, the prepared cream was transferred into suitable containers and tightly sealed (Erza, 2016).

PHYSICAL EVALUATION

Organoleptic Evaluation

The organoleptic properties of the cream were evaluated by observing its color, odor, and the presence or absence of phase separation (Muthoharoh & Ratna Rianti, 2020).

Homogeneity Test

A total of 0.5 g of cream was spread evenly onto a glass microscope slide and covered with another slide. The preparation was then visually examined to determine its homogeneity, smoothness, and uniformity of distribution (Juwita *et al.*, 2013).

PH Determination

The pH of the cream was measured using a calibrated pH meter. Prior to measurement, the pH meter was calibrated using standard buffer solutions of pH 4.0, 6.0, and 9.0. The electrode was then immersed into the cream sample until fully covered, and the measurement was allowed to stabilize before the pH value was recorded (Pratasik *et al.*, 2019).

Spread ability Test

One gram of cream was placed at the center of a glass slide and covered with another glass slide. After standing for 1 minute, sequential loads of 50, 100, 150, and 200 g were applied. Each load was maintained for 1 minute before the diameter of the spread area was measured (Pratasik *et al.*, 2019).

Viscosity Test

The viscosity of the cream was determined using a Brookfield viscometer. Approximately 50 g of cream was transferred into the sample container, and viscosity measurements were performed using spindle No. 3 at a rotational speed of 60 rpm. The viscosity value was recorded once the instrument displayed a stable reading. A viscosity range of 2,000–40,000 cP was considered acceptable for cream formulations (Erliani *et al.*, 2023).

Cream Type Determination

Approximately 0.5 g of cream was spread onto a glass microscope slide, followed by the addition of one drop of methylene blue solution. If the dye was uniformly distributed throughout the cream, the formulation was classified as an oil-in-water (O/W) emulsion. Conversely, if the dye remained separated, the formulation was classified as a water-in-oil (W/O) emulsion. Cream type may also be determined using either methylene blue or Sudan III as the staining agent (Kristiani & Filadelfian, 2024).

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

Irritation Test

The skin irritation test was performed by applying 0.5 g of the cream to the inner forearm of each volunteer. The application site was then covered with sterile gauze and secured with adhesive tape. The treated area was observed for 12 hours to evaluate any signs of skin irritation, such as erythema, edema, itching, or other adverse skin reactions (Kristiani & Filadelfian, 2024). Inclusion and exclusion criteria for the irritation test were as follows:

1. Exclusion Criteria
 - History of allergy to herbal plants or herbal-based products.
 - Pregnant or breastfeeding women.
 - Individuals with existing skin disorders or dermatological diseases.
 - Individuals unwilling to comply with the study protocol.
2. Inclusion Criteria
 - Adults aged 20–30 years.
 - No history of severe allergic reactions.
 - Willing to provide written informed consent for participation.
 - Not currently using any topical medications.

Antibacterial Activity Assay

The antibacterial activity of guava (*Psidium guajava* L.) leaf extract against *Staphylococcus aureus* was evaluated using the following procedures.

1. Sterilization of Equipment and Materials

All laboratory equipment was thoroughly cleaned and dried prior to sterilization. Each piece of equipment was individually wrapped in paper. Test tubes were plugged with cotton wool wrapped in gauze. The wrapped glassware was sterilized in a hot-air oven at 170°C for 2 h. Syringes and culture media were sterilized in an autoclave at 121°C for 15 min. The inoculating loop (ose) was sterilized by flaming over a Bunsen burner until red-hot before each use.
 2. Preparation of Guava Leaf Extract Solutions

Guava leaf ethanol extract was prepared at concentrations of 1.5%, 2.5%, 5%, 10%, 20%, 40%, and 80% (w/v) using 5% dimethyl sulfoxide (DMSO) as the solvent.
 - a. 1.5% (w/v): 0.075 g of extract was dissolved in 5% DMSO and the volume was adjusted to 5 mL.
 - b. 2.5% (w/v): 0.125 g of extract was dissolved in 5% DMSO and the volume was adjusted to 5 mL.
 - c. 5% (w/v): 0.25 g of extract was dissolved in 5% DMSO and the volume was adjusted to 5 mL.
 - d. 10% (w/v): 0.50 g of extract was dissolved in 5% DMSO and the volume was adjusted to 5 mL.
 - e. 20% (w/v): 1.00 g of extract was dissolved in 5% DMSO and the volume was adjusted to 5 mL.
 - f. 40% (w/v): 2.00 g of extract was dissolved in 5% DMSO and the volume was adjusted to 5 mL.
 - g. 80% (w/v): 4.00 g of extract was dissolved in 5% DMSO and the volume was adjusted to 5 mL.
3. Preparation of Nutrient Agar (NA)

A total of 0.56 g of Nutrient Agar (NA) powder was dissolved in 20 mL of distilled water in an Erlenmeyer flask. The medium was heated to boiling while covered with a cotton plug wrapped in gauze and stirred until completely dissolved. The medium was sterilized in an autoclave at 121°C under 2 atm pressure for 15 min (Assabila, 2023).
4. Preparation of Mueller–Hinton Agar (MHA)

A total of 11.4 g of Mueller–Hinton Agar (MHA) powder was dissolved in 300 mL of distilled water and transferred into an Erlenmeyer flask sealed with a cotton plug. The medium was sterilized in an autoclave at 121°C for 15 min. After cooling to approximately 60°C, the sterile medium was aseptically poured into sterile Petri dishes and allowed to solidify. The prepared plates were incubated at 37°C for 24 h to confirm sterility. Clear media without contamination were used for the cultivation of *Staphylococcus aureus* (Nazar, 2023).
5. Rejuvenation of *Staphylococcus aureus*

A loopful of *Staphylococcus aureus* culture was aseptically inoculated onto Nutrient Agar slants using the zigzag streak method. The inoculated cultures were incubated at 37°C for 24 h to obtain fresh bacterial cultures for subsequent testing (Assabila, 2023).
6. Preparation of McFarland Standard

The McFarland 0.5 standard, equivalent to approximately 1×10^8 CFU/mL, was prepared by mixing 99.5 mL of 1% sulfuric acid (H_2SO_4) with 0.5 mL of 1.175% (w/v) barium chloride (BaCl_2). The mixture was shaken thoroughly in a sterile test tube

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

and tightly sealed. Bacterial suspensions exhibiting turbidity equivalent to the McFarland standard were considered to contain approximately 1×10^8 CFU/mL.

7. Preparation of *Staphylococcus aureus* Suspension

A bacterial suspension was prepared by transferring two loopfuls of a pure *Staphylococcus aureus* culture into 10 mL of sterile 0.9% sodium chloride (NaCl) solution. The turbidity of the suspension was adjusted to match that of the 0.5 McFarland standard prior to use (Nazar, 2023).

8. Antibacterial Activity of the Cream Formulation by the Well Diffusion Method

The antibacterial activity of the guava leaf extract cream against *Staphylococcus aureus* was evaluated using the agar well diffusion method. A 50 μ L aliquot of the bacterial suspension was transferred into an Erlenmeyer flask containing 50 mL of molten Mueller–Hinton Agar (MHA), mixed thoroughly, and aseptically poured into sterile Petri dishes. The plates were gently rotated in a figure-eight motion to ensure uniform bacterial distribution and allowed to solidify.

Sterile wells with a diameter of 5 mm were then made in the agar using a sterile cork borer. Cream formulations F1, F2, and F3 were introduced into separate wells. Chloramphenicol served as the positive control, while the cream base without guava leaf extract (F0) was used as the negative control. The plates were incubated at 37°C for 24 h. Antibacterial activity was assessed by measuring the diameter of the clear inhibition zones surrounding each well using a digital caliper (Daeli & Ridho, 2023).

9. Antibacterial Activity Assay of Guava (*Psidium guajava* L.) Leaf Extract Using the Disc Diffusion Method

The antibacterial activity of guava (*Psidium guajava* L.) leaf extract against *Staphylococcus aureus* was evaluated using the disc diffusion method. A 50 μ L aliquot of the *Staphylococcus aureus* suspension was transferred into an Erlenmeyer flask containing 50 mL of molten Mueller–Hinton Agar (MHA). The mixture was aseptically poured into sterile Petri dishes and gently rotated in a figure-eight motion to ensure uniform distribution of the bacterial suspension. The agar was allowed to solidify before testing.

Sterile paper discs (6 mm in diameter) were impregnated with guava leaf extract solutions at concentrations of 1.5%, 2.5%, 5%, 10%, 20%, 40%, and 80% (w/v) by soaking them for 15 min. The impregnated discs were then aseptically placed onto the surface of the inoculated MHA plates. The plates were incubated at 37°C for 24 h, after which the antibacterial activity was evaluated by measuring the diameter of the inhibition zones surrounding each disc (Assabila, 2023).

Data Analysis

The inhibition zone diameters and the results of the physical evaluation of the cream formulations were statistically analyzed using one-way analysis of variance (One-Way ANOVA) with IBM SPSS Statistics software. The analysis was performed to determine whether there were significant differences in the antibacterial activity of the cream formulations against *Staphylococcus aureus*. A *p*-value of < 0.05 was considered statistically significant.

III. RESULTS

MACERATION YIELD

Based on the research conducted, the following results were obtained.

Table II. Extraction Yield of Guava (*Psidium guajava* L.) Leaf Simplicia

Sample (g)	Initial Weight (g)	Final Weight (g)	Yield (%)
Dried Simplicia	3000 g	1300 g	43,33%

Table III. Extraction Yield of Guava (*Psidium guajava* L.) Leaf Ethanol Extract

Sample (g)	Initial Weight (g)	Final Weight (g)	Yield (%)
Concentrated Extract	500 g	122 g	24,4%

RESULTS OF THE EVALUATION OF GUAVA (*PSIDIUM GUAJAVA* L.) LEAF ETHANOL EXTRACT CREAM FORMULATIONS

The formulated cream preparations were subjected to a series of physicochemical evaluation tests to determine whether the formulations met the required quality standards and were suitable for topical application.

1. Organoleptic Evaluation

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

Table IV. Organoleptic Characteristics of Guava (*Psidium guajava* L.) Leaf Extract Cream Formulations

Formulation	Color	Odor	Appearance
F0	White	Characteristic odor of the cream base	Semisolid
F1	Brown	Characteristic aromatic odor	Semisolid
F2	Yellowish brown	Characteristic aromatic odor	Semisolid
F3	Dark brown	Characteristic aromatic odor	Semisolid

Note :

F0: Formulation 0 (Negative control)

F1: Formulation 1 (1.5% guava (*Psidium guajava* L.) leaf extract)

F2: Formulation 2 (2.5% guava (*Psidium guajava* L.) leaf extract)

F3: Formulation 3 (5% guava (*Psidium guajava* L.) leaf extract)

2. Homogeneity Test

Table V. Homogeneity Test Results of Guava (*Psidium guajava* L.) Leaf Ethanol Extract Cream Formulations

Formulation	Homogeneity
F0	Homogeneous
F1	Homogeneous
F2	Homogeneous
F3	Homogeneous

Note :

F0: Formulation 0 (Negative control)

F1: Formulation 1 (1.5% guava (*Psidium guajava* L.) leaf ethanol extract)

F2: Formulation 2 (2.5% guava (*Psidium guajava* L.) leaf ethanol extract)

F3: Formulation 3 (5% guava (*Psidium guajava* L.) leaf ethanol extract)

3. pH Test

Table VI. pH Values of Guava (*Psidium guajava* L.) Leaf Ethanol Extract Cream Formulations

Formulation	Replicate			Mean $\pm$ SD	Acceptable Range
	P1	P2	P3		
F0	7,96	7,95	7,94	7,9500 $\pm$ 3,9750	3,5 - 8
F1	7,12	7,18	7,61	7,3033 $\pm$ 3,6581	3,5 - 8
F2	7,10	7,21	7,42	7,2433 $\pm$ 3,6240	3,5 - 8
F3	7,37	7,40	7,42	7,3966 $\pm$ 3,6983	3,5 - 8

Note:

F0: Formulation 0 (Negative control)

F1: Formulation 1 (1.5% guava (*Psidium guajava* L.) leaf ethanol extract)

F2: Formulation 2 (2.5% guava (*Psidium guajava* L.) leaf ethanol extract)

F3: Formulation 3 (5% guava (*Psidium guajava* L.) leaf ethanol extract)

R1: Replicate 1

R2: Replicate 2

R3: Replicate 3

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

4. Viscosity Test

Table VII. Viscosity Test Results of Guava (*Psidium guajava* L.) Leaf Ethanol Extract Cream Formulations Using a Brookfield Viscometer (Spindle L-3, 60 rpm)

Formulation	Replicate			Mean $\pm$ SD	Acceptable Range
	P1	P2	P3		
F0	917,7	457	158	383,1 $\pm$ 382,7	2000-50000 cPs
F1	4231	3525	3125	2720,2 $\pm$ 560,0	2000-50000 cPs
F2	4165	3520	2987	2668 $\pm$ 589,8	2000-50000 cPs
F3	4381	3457	2002	2460 $\pm$ 199,3	2000-50000 cPs

Note:

F0: Formulation 0 (Negative control)

F1: Formulation 1 (1.5% guava (*Psidium guajava* L.) leaf ethanol extract)

F2: Formulation 2 (2.5% guava (*Psidium guajava* L.) leaf ethanol extract)

F3: Formulation 3 (5% guava (*Psidium guajava* L.) leaf ethanol extract)

R1: Replicate 1

R2: Replicate 2

R3: Replicate 3

5. Spread ability Test

Table VIII. Spread ability Test Results of Guava (*Psidium guajava* L.) Leaf Ethanol Extract Cream Formulations

Spread ability Test (cm)				
Applied Load (g)	Formulation			
	F0	F1	F2	F3
50	5,22	5,25	5,30	5,36
100	5,88	5,51	5,42	5,61
150	6,37	6,34	6,35	6,31
200	6,63	6,50	6,61	6,67
Mean	6,02	5,9	5,92	5,98
Acceptable Range	5-7 cm	5-7 cm	5-7 cm	5-7 cm

Note:

F0: Formulation 0 (Negative control)

F1: Formulation 1 (1.5% guava (*Psidium guajava* L.) leaf ethanol extract)

F2: Formulation 2 (2.5% guava (*Psidium guajava* L.) leaf ethanol extract)

F3: Formulation 3 (5% guava (*Psidium guajava* L.) leaf ethanol extract)

6. Cream Type Test

Table IX. Cream Type Test Results of Guava (*Psidium guajava* L.) Leaf Ethanol Extract Cream Formulations

Formulation	Cream Type
F0	O/W
F1	O/W
F2	O/W
F3	O/W

Note:

F0: Formulation 0 (Negative control)

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

F1: Formulation 1 (1.5% guava (*Psidium guajava* L.) leaf ethanol extract)

F2: Formulation 2 (2.5% guava (*Psidium guajava* L.) leaf ethanol extract)

F3: Formulation 3 (5% guava (*Psidium guajava* L.) leaf ethanol extract)

O/W: Oil-in-Water Emulsion

7. Skin Irritation Test

Table X. Skin Irritation Test Results of Guava (*Psidium guajava* L.) Leaf Ethanol Extract Cream Formulations

Formulation	Observed Symptoms	Respondent									
		1	2	3	4	5	6	7	8	9	10
F0	Erythema (Redness)	-	-	-	-	-	-	-	-	-	-
	Itching	-	-	-	-	-	-	-	-	-	-
	Burning sensation	-	-	-	-	-	-	-	-	-	-
	Skin swelling	-	-	-	-	-	-	-	-	-	-
F1	Erythema (Redness)	-	-	-	-	-	-	-	-	-	-
	Itching	-	-	-	-	-	-	-	-	-	-
	Burning sensation	-	-	-	-	-	-	-	-	-	-
	Skin swelling	-	-	-	-	-	-	-	-	-	-
F2	Erythema (Redness)	-	-	-	-	-	-	-	-	-	-
	Itching	-	-	-	-	-	-	-	-	-	-
	Burning sensation	-	-	-	-	-	-	-	-	-	-
	Skin swelling	-	-	-	-	-	-	-	-	-	-
F3	Erythema (Redness)	-	-	-	-	-	-	-	-	-	-
	Itching	-	-	-	-	-	-	-	-	-	-
	Burning sensation	-	-	-	-	-	-	-	-	-	-
	Skin swelling	-	-	-	-	-	-	-	-	-	-

Note:

(-) No skin reaction or irritation observed.

(+) Erythema (skin redness).

(++) Erythema accompanied by itching.

(+++) Skin swelling (edema).

ANTIBACTERIAL ACTIVITY OF GUAVA (*PSIDIUM GUAJAVA* L.) LEAF CREAM FORMULATIONS USING THE AGAR WELL DIFFUSION METHOD

Table XI. Inhibition Zone Diameters of Guava (*Psidium guajava* L.) Leaf Ethanol Extract Cream Against *Staphylococcus aureus*

Concentration	Inhibition Zone Diameter (mm)			Mean $\pm$ SD	Activity Category
	P1	P2	P3		
1,5%	7,0	7,55	7,45	7,3333 $\pm$ 0,2929	Moderate
2,5%	7,3	8,5	7,95	7,9167 $\pm$ 0,6006	Moderate
5%	8,0	8,7	8,25	8,3167 $\pm$ 0,3547	Moderate

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

10%	11,0	9,8	10,0	10,2667±0,6429	Strong
20%	12,6	11,0	12,05	11,8833±0,8129	Strong
40%	13,1	12,05	12,75	12,6333±0,5346	Strong
80%	14,7	13,15	14,8	14,2167±0,9251	Strong

Note:

(-): Negative control (cream base without guava leaf extract).

(+): Chloramphenicol cream (positive control).

F1: Formulation containing 1.5% guava (*Psidium guajava* L.) leaf ethanol extract.

F2: Formulation containing 2.5% guava (*Psidium guajava* L.) leaf ethanol extract.

F3: Formulation containing 5% guava (*Psidium guajava* L.) leaf ethanol extract.

R1: Replicate 1.

R2: Replicate 2.

R3: Replicate 3.

ONE-WAY ANOVA ANALYSIS

Table XIII. One-Way ANOVA Results for the Antibacterial Activity of Guava (*Psidium guajava* L.) Leaf Ethanol Extract

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	125.030	6	20.838	52.314	.000
Within Groups	5.577	14	.398		
Total	130.607	20			

Based on the ANOVA results, the significance value ($p < 0.001$) was lower than the significance level of 0.05, indicating a statistically significant difference in the inhibition zone diameters among the tested extract concentrations.

ANTIBACTERIAL ACTIVITY OF GUAVA (*PSIDIUM GUAJAVA* L.) LEAF ETHANOL EXTRACT USING THE DISC DIFFUSION METHOD

Table XII. Inhibition Zone Diameters of Guava (*Psidium guajava* L.) Leaf Ethanol Extract Against *Staphylococcus aureus*

Treatment	Inhibition Zone (mm)			Mean ± SD	Activity Category
	P1	P2	P3		
F1	5,2	5,4	5,7	5,4333±0,2516	Moderate
F2	5,8	6,0	6,1	5,9666±0,1527	Moderate
F3	6,9	7,1	7,8	7,2666±0,4725	Moderate
Control (+)	42,75	44,4	46,6	44,5833±1,9315	Very Strong
Control (-)	0	0	0	0±0	No Inhibition

Note:

P1 : Replicate 1

P2 : Replicate 2

P3 : Replicate 3

IV. DISCUSSION

In this study, a cream formulation containing guava (*Psidium guajava* L.) leaf extract was developed. The guava leaves used as the research sample were collected from H.R. Soebrantas Street, Teratai Alley, Sidomulyo Barat Village, Tuah Madani District, Pekanbaru, Riau Province, Indonesia. The plant material was taxonomically identified at the Biology Laboratory, Faculty of Mathematics and Natural Sciences, Universitas Riau. The identification confirmed that the scientific name of the plant used in this study was *Psidium guajava* L. The purpose of the taxonomic identification was to ensure that the primary raw material used in the

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

formulation of the cream preparation originated from the correct plant species, thereby ensuring the validity and reproducibility of the research.

The preparation of guava leaves consisted of several stages, including sample collection, wet sorting, washing, slicing, drying, dry sorting, grinding, and storage. Wet sorting was performed to remove dirt, twigs, and other foreign materials before the leaves were washed thoroughly under running water. The cleaned leaves were then cut into small pieces to accelerate the drying process and facilitate grinding. Drying was carried out by air-drying the leaves at room temperature while avoiding direct sunlight and covering them with a black cloth to minimize exposure to light. This process aimed to reduce the moisture content and prevent microbial deterioration. After drying, the leaves were ground into a fine powder using a blender and stored in an airtight container in a cool, dry place protected from direct sunlight to maintain their quality and stability during storage (Indraswara et al., 2024).

The extraction method employed in this study was maceration. Maceration is a simple extraction technique performed by soaking powdered plant material in a suitable solvent. This method was selected because it minimizes the degradation of thermolabile compounds. In addition, maceration offers the advantages of a simple procedure and the use of uncomplicated equipment. The principle of this method is based on the ability of the extraction solvent to penetrate plant cell walls containing various bioactive compounds, allowing the active constituents to dissolve and diffuse into the solvent (Asworo & Widwastuti, 2023). Ethanol 96% was used as the extraction solvent due to its ability to dissolve a wide range of phytochemical constituents, including polar, semi-polar, and non-polar compounds. Furthermore, 96% ethanol is relatively non-toxic and highly volatile, facilitating solvent removal after extraction. Compared with 70% ethanol, 96% ethanol exhibits superior penetration into plant cell membranes and more efficiently extracts intracellular compounds such as tannins, phenolic compounds, and flavonoids. This advantage also accelerates the maceration process and improves the efficiency of obtaining a concentrated extract. The maceration process was repeated three times to maximize the extraction of bioactive compounds. The combined filtrates were subsequently concentrated using a rotary evaporator at 50 rpm and 50°C until a concentrated extract was obtained.

A total of 500 g of powdered guava leaf *simplicia* was subjected to extraction. The concentrated extract obtained weighed 122 g, corresponding to an extraction yield of 24.4%. This result indicates that 24.4% of the extracted material consisted of ethanol-soluble constituents. The extraction yield exceeded the minimum standard specified by the Indonesian National Standard (SNI), which requires a yield greater than 10% (Indraswara et al., 2024), indicating that the extraction process was efficient.

The concentrated extract was subsequently formulated into cream preparations at three different concentrations, namely 1.5%, 2.5%, and 5.0%. The formulation contained several excipients with specific functions. Stearic acid served as an emulsifying agent and contributed to the formation of a thick, smooth, and stable cream structure (Fendi Yoga Wardana & Riska, 2023). Triethanolamine (TEA) functioned as an emulsifier and facilitated the formation and stabilization of an oil-in-water (O/W) emulsion. Adeps lanae acted as the cream base and emulsifying agent, enhancing water absorption and maintaining skin moisture (Tari & Indriani, 2023). Glycerin functioned as a humectant by retaining moisture and preventing the cream from drying out or cracking. Propylene glycol also acted as a humectant by attracting water into the skin, thereby improving skin hydration. Methyl paraben was incorporated as a preservative to inhibit microbial growth and prolong the shelf life of the formulation. Distilled water was added to a final weight of 50 g as the solvent (Witanti & Endriyatno, 2024).

The cream formulations containing *Psidium guajava* L. leaf ethanol extract exhibited several desirable characteristics. The creams had a smooth texture, spread easily over the skin, and were non-sticky due to the presence of glycerin and propylene glycol. The combination of stearic acid and triethanolamine produced a physically stable oil-in-water emulsion with minimal phase separation. Furthermore, adeps lanae and glycerin contributed to maintaining skin hydration, making the cream comfortable to apply without causing dryness or irritation. The inclusion of methyl paraben enhanced microbial stability, thereby improving product safety and extending its storage stability (Witanti & Endriyatno, 2024).

The prepared cream formulations were subjected to a series of physicochemical evaluations. Organoleptic evaluation showed that F0 exhibited a white color with the characteristic odor of the cream base, F1 appeared brown with a characteristic aromatic odor, F2 was yellowish-brown with a characteristic aromatic odor, and F3 exhibited a dark brown color with a characteristic aromatic odor derived from the guava leaf extract. All formulations possessed a semisolid consistency. An increase in extract concentration resulted in a darker color and a thicker consistency of the cream formulation (Siregar, 2022). The organoleptic evaluation results are presented in Table IV.

The homogeneity test was performed to determine the presence of coarse particles and to evaluate whether all components were uniformly distributed throughout the formulation. All four cream formulations exhibited homogeneous characteristics without visible coarse particles, indicating satisfactory uniformity. The homogeneity test results are presented in Table V.

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

The pH test was conducted to determine the acidity or alkalinity of the cream formulations. The average pH values were 7.95 for F0, 7.30 for F1, 7.24 for F2, and 7.39 for F3. Statistical analysis using the Kruskal–Wallis H test (Table 17) yielded a significance value of 0.80 ($p > 0.05$), indicating that no statistically significant differences in pH were observed among the formulations. Moreover, all formulations complied with the acceptable skin pH range of 3.5–8.0 (Budianor et al., 2022). The pH evaluation results are presented in Table VI.

The viscosity test was conducted to determine the consistency of the cream preparation. In addition, the viscosity test was also carried out to determine the flow properties of the preparation. The higher the viscosity of the preparation, the greater the force required for the liquid to flow. The viscosity test results showed that F0 had an average viscosity of 383.175 cPs, F1 had an average viscosity of 2720.25 cPs, F2 had an average viscosity of 2668 cPs, and F3 had an average viscosity of 2460 cPs. Based on the statistical analysis using the One-Way ANOVA test, it can be concluded that there were significant differences among the formulations. Meanwhile, the Tukey post-hoc test showed two groups of differences, namely F0 with F1, F2, and F3. This means that the extract significantly affected the viscosity of the preparation, whereas the different amounts of guava leaf ethanol extract in F1, F2, and F3 did not significantly affect the viscosity.

In formulations F1, F2, and F3 with different concentration ranges, the viscosity values still met the required standard, whereas F0 did not meet the requirement. The differences in viscosity among the formulations may be caused by the preparation process, particularly the stirring time, which can affect the viscosity. This is in accordance with the statement of Rowe et al. (2009), who reported that the mixing process, stirring, and the addition of ingredients can affect the viscosity of the formulation. In addition, another factor was the absence of temperature control during the cream preparation process. Uncontrolled temperature may cause changes in the viscosity of the cream, which can alter its spreadability. According to SNI 16-4399-1996, cream preparations should have a viscosity ranging from 2,000–50,000 cPs. Creams with higher viscosity values are thicker than creams with lower viscosity values. This reduces the risk of phase separation and prolongs the stability of the formulation (Dominica et al., 2025). The viscosity test results are presented in Table VII.

The spreadability test was conducted to determine the ability of the cream preparation to spread when applied to the skin. The spreadability test results showed that F0 had an average spreadability of 6.02 cm, F1 had an average of 5.9 cm, F2 had an average of 5.92 cm, and F3 had an average of 5.98 cm. Based on the obtained data, the spreadability test results met the required standard. The higher the viscosity value, the lower the spreadability of the preparation, and conversely, the lower the viscosity, the higher the spreadability of the preparation. This may be influenced by the addition of different extract concentrations to the formulation. The spreadability value is inversely proportional to the viscosity value of the preparation. This is consistent with the viscosity values, where the viscosity of F1, F2, and F3 increased, while the spreadability values of F1, F2, and F3 decreased. The greater the spreadability, the wider the distribution of the active substance on the skin. As shown in Table VII, all four formulations met the required standard of 5–7 cm (Tungadi et al., 2023).

The cream type test was conducted to determine the type of emulsion in the cream preparation, whether it was an oil-in-water (O/W) emulsion or a water-in-oil (W/O) emulsion. The results of the cream type test of *Psidium guajava* L. showed that F1, F2, and F3 had the same cream type, namely an oil-in-water (O/W) cream. Oil-in-water creams have several advantages over water-in-oil creams, including a smoother and softer texture. In addition, O/W creams are more hygroscopic, which helps moisturize the skin and provides relatively better spreadability. The cream type test results are presented in Table IX.

The irritation test was conducted to determine whether a substance or product could cause reactions such as redness at the site of exposure (erythema), swelling, itching, burning, or stinging. The irritation test was carried out using the closed patch test method on 10 respondents who had no history of skin allergies and were 20–30 years old, because this age group generally represents working adults and students who frequently use cosmetic products (Kristiani & Filadelfian, 2024). The irritation test results of the guava leaf ethanol extract cream preparation are presented in Table X.

In addition to the physical evaluation, the cream preparation was also subjected to an antibacterial activity test to determine whether the preparation could inhibit the growth of *Staphylococcus aureus*. The antibacterial activity test was carried out using the agar well diffusion method with Mueller–Hinton Agar (MHA) medium.

As shown in Table X, the cream preparations containing 1.5%, 2.5%, and 5% concentrations against *Staphylococcus aureus* were unable to inhibit bacterial growth, similar to the negative control (cream base). This may have occurred because the concentration of the extract in the cream preparation was low; therefore, a higher concentration of guava leaf ethanol extract is needed to inhibit the growth of *Staphylococcus aureus* (Aditiya, 2021). In contrast, the positive control (chloramphenicol cream) showed an inhibition zone with an average diameter of 44.5583 mm. Chloramphenicol as a positive control is considered resistant if the inhibition zone diameter is <20 mm and sensitive if the inhibition zone diameter is >21 mm (Herrmann & Bucksch, 2014).

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

When compared with the antibacterial activity test of the guava leaf ethanol extract (active substance) at concentrations of 1.5%, 2.5%, 5%, 10%, 20%, 40%, and 80% dissolved in 5 mL of DMSO, as shown in Table XI, the 1.5% guava leaf ethanol extract produced an average inhibition zone of 7.3333 mm, the 2.5% extract produced 7.9167 mm, the 5% extract produced 8.3167 mm, the 10% extract produced 10.2667 mm, the 20% extract produced 11.8833 mm, the 40% extract produced 12.6333 mm, and the 80% extract produced 14.2167 mm.

Based on the statistical analysis using the One-Way ANOVA test, the results showed that there were significant differences among the extract concentrations. After performing the Tukey post-hoc test, the results showed four groups of differences: the first group consisted of concentrations of 1.5%, 2.5%, and 5%; the second group consisted of 10% and 20%; the third group consisted of 20% and 40%; and the fourth group consisted of 40% and 80%. This means that the differences in extract concentration did not significantly affect the antibacterial activity test. Guava leaf ethanol extract at concentrations of 1.5%, 2.5%, and 5% produced inhibition zone diameters that were categorized as moderate, whereas concentrations of 10%, 20%, 40%, and 80% produced inhibition zone diameters that were categorized as strong. According to the classification of antimicrobial activity, inhibition is divided into four categories: weak (<5 mm), moderate (5–10 mm), strong (>10–20 mm), and very strong (>20–30 mm). The inhibitory activity is determined based on the clear zone formed around the paper disc. The bacterial inhibition zone diameter is measured in millimeters (mm) (Herrmann & Bucksch, 2014).

Based on the results above, it can be seen that the ethanol extract of guava leaves was able to inhibit antibacterial activity, as indicated by the presence of an inhibition zone in the antibacterial test. Guava leaves (*Psidium guajava* L.) are considered a natural antibiotic because they contain compounds such as tannins, saponins, polyphenols, and flavonoids. However, the direct use of guava leaves is less efficient, and the active compounds contained in them are not easily absorbed by the facial skin. The compound in guava leaves that is beneficial as an anti-acne agent is flavonoid (Nurfitriyana et al., 2021). However, in this study, a positive control was not used; therefore, a comparison between the positive control and the guava leaf extract could not be made.

According to the study by Yulisma (2018), the mechanism of action of flavonoids is similar to that of alkaloids, namely by damaging the bacterial cell wall, although the mechanism is different. Flavonoids damage bacterial cells by utilizing the difference in polarity between the lipids that make up the bacterial cell membrane and the alcohol groups of flavonoid compounds. Alkaloids utilize the reactive nature of their basic groups to react with amino acid groups in bacterial cells. Alkaloids have pharmacological effects as antibacterial agents in animals. This is because alkaloids have the ability to inhibit the activity of enzymes responsible for bacterial protein synthesis. The inhibition of these enzymes can disrupt bacterial metabolism.

The antibacterial mechanism of tannins is to kill bacteria by coagulating the bacterial protoplasm, thereby forming stable bonds with bacterial proteins in the digestive tract. Tannins can form hydrogen bonds with proteins present in bacterial cells. When hydrogen bonds are formed, the proteins may become denatured, resulting in disruption of bacterial metabolism (Yulisma, 2018). However, the cream preparation containing guava leaf ethanol extract did not produce the expected results. The absence of an inhibition zone in the test may have been caused by several factors, including the low concentration of guava leaf extract in the cream. Therefore, the guava leaf ethanol extract cream preparation requires a higher extract concentration to inhibit *Staphylococcus aureus*. In addition, the diameter of the inhibition zone is also greatly influenced by the conditions during the preparation of the bacterial culture medium. The absorption or interaction of the active compounds with the agar and the sensitivity of the microorganisms to these compounds determine the test results.

Based on a previous study on the antibacterial activity of a cream preparation containing jasmine flower extract (*Jasminum sambac* L.) against *Propionibacterium acnes*, the positive control produced an average inhibition zone diameter of 16 mm, whereas the negative control, namely the cream base, and the jasmine flower extract cream preparations at concentrations of 10%, 20%, and 30% did not produce any inhibition zone around the wells. From these results, it can be concluded that the jasmine flower extract cream preparation did not exhibit antibacterial activity against *Propionibacterium acnes*. One of the main factors affecting the size of the inhibition zone is the density (viscosity) and thickness of the agar medium, the diffusion rate of the test compound into the agar, the sensitivity of the bacteria or fungi to the compound, and the interaction between the test compound and the components of the medium (Aditiya, 2021).

V. CONCLUSION

In this study, the ethanol extract of guava leaves (*Psidium guajava* L.) was successfully formulated into a cream preparation. However, as the extract concentration increased, the color of the cream preparation became darker. Furthermore, the evaluation test results of the guava leaf ethanol extract (*Psidium guajava* L.) cream preparation met the required standards, except for the viscosity test of F0, which did not meet the specified requirement. The guava leaf ethanol extract cream

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

preparations in Formulations 1, 2, and 3 did not produce an inhibition zone, which was due to the low extract concentrations of 1.5%, 2.5%, and 5%. In contrast, the ethanol extract of guava leaves showed the presence of inhibition zones at concentrations of 1.5%, 2.5%, and 5%, which were classified as having moderate inhibition zones, while concentrations of 10%, 20%, 40%, and 80% were classified as having strong inhibition zones.

ACKNOWLEDGEMENTS

The authors declare that there are no conflicts of interest and no involvement of sponsors or funding in the conduct of this research.

REFERENCES

- 1) Aditiya, A. S. D. (2021). Uji Efektivitas Sediaan Krim Ekstrak Bunga Melati (*Jasminum Sambac* L.) Terhadap Pertumbuhan Bakteri *Propionibacterium Acne*. *Jurnal Farmasi Dan Kesehatan Indonesia*, 1(2), 1–12.
- 2) Akiyama, H., Fujii, K., Yamasaki, O., Oono, T., & Iwatsuki, K. (2001). Antibacterial action of several tannins against *Staphylococcus aureus*. *Journal of Antimicrobial Chemotherapy*, 48(4), 487–491.
- 3) Arsyad, R., Amin, A., & Waris, R. (2023). TEKNIK PEMBUATAN DAN NILAI RENDAMEN SIMPLISIA DAN EKSTRAK ETANOL BIJI BAGORE (*Caesalpinia crista* L.) ASAL POLEWALI MANDAR. *Makassar Natural Product Journal*, 1(3), 2023–2138.
- 4) Assabila, S. A. (2023). Uji Aktivitas Antibakteri Ekstrak Etanol Daun Kemangi (*Ocimum sanctum* L.) Terhadap Pertumbuhan Bakteri *Escherichia coli*. *Jurnal Novem Medika Farmasi*, 2(2), 60–66.
- 5) Asworo, R. Y., & Widwastuti, H. (2023). Pengaruh Ukuran Serbuk Simplisia dan Waktu Maserasi terhadap Aktivitas Antioksidan Ekstrak Kulit Sirsak. *Indonesian Journal of Pharmaceutical Education*, 3(2), 256–263.
- 6) Budianor, B., Malahayati, S., & Saputri, R. (2022). Formulasi dan Uji Stabilitas Sediaan Krim Ekstrak Bunga Melati Putih (*Jasminum Sambac* L.) Sebagai Anti Jerawat. *Journal Pharmaceutical Care and Sciences*, 3(1), 1–13.
- 7) Daeli, I. O., & Ridho, R. (2023). Formulasi dan Uji Aktivitas Antibakteri Krim Ekstrak Daun Johar (*Cassia siamea* L.) terhadap *Staphylococcus aureus*. *Jurnal Farmasi Dan Farmakoinformatika*, 1(2), 88–103.
- 8) Desiyana, L. S., Husni, M. A., & Zhafira, S. (2016). Uji EFEKTIVITAS SEDIAAN GEL FRAKSI ETIL ASETAT DAUN JAMBU BIJI (*Psidium guajava* Linn) TERHADAP PENYEMBUHAN LUKA TERBUKA PADA MENCIT (*Mus musculus*). *Jurnal Natural*, 16(2), 23–32.
- 9) Dominica, D., Putri, Y. H., Versita, R., & Shufyani, F. (2025). Pengaruh penambahan ekstrak kental daun kelapa sawit (*Elaeis Guineensis* Jacq.) terhadap viskositas krim tabir surya anti jerawat. *Journal of Pharmaceutical and Sciences*, 1, 181–186.
- 10) Erliani, D., Sari, M., Islamiyati, R., Minyak, K., & Kelor, B. (2023). FORMULASI DAN PENENTUAN NILAI SPF (*Sun Protection Factor*) SEDIAAN KRIM MINYAK BIJI KELOR (*Moringa oleifera* L .). 7(1), 67–78.
- 11) Fendi Yoga Wardana, & Riska, R. M. (2023). Formulasi Lotion dari Ekstrak Buah Bit (*Beta vulgaris*) dengan Perbedaan Komposisi Asam Stearat. *Jurna Kesehatan Islam: Islamic Health Journal*, 12(2), 28–32.
- 12) Fitriani, T., & Nashihah, S. (2021). Uji DAYA HAMBAT EKSTRAK ETANOL DAUN RAMBAI (*Sonneratia Caseolaris* (L) Engl) TERHADAP BAKTERI *Propionibacterium acnes* DAN *Staphylococcus epidermidis*. *JFIOOnline |Print ISSN 1412-1107 | e-ISSN 2355-696X*, 13(1), 40–53.
- 13) Handarni, D., Putri, S. H., & Tensiska, T. (2020). Skrining Kualitatif Fitokimia Senyawa Antibakteri pada Ekstrak Daun Jambu Biji (*Psidium guajava* L.). *Jurnal Keteknik Pertanian Tropis Dan Biosistem*, 8(2), 182–188.
- 14) Herrmann, H., & Bucksch, H. (2014). Diameter. *Dictionary Geotechnical Engineering/Wörterbuch GeoTechnik*, 371–371.
- 15) Indraswara, H., Nur Aisyah, N., Umami, M., Sains dan Teknologi, F., & Sunan Gunung Djati Bandung, U. (2024). Identifikasi Kandungan Senyawa Metabolit Sekunder pada Daun Jambu Biji (*Psidium Guajava* L Var. *Pyrifera*) di Kabupaten Bandung. *Jurnal Matematika Dan Ilmu Pengelatan Alam*, 2(3), 73–81.
- 16) Juwita, A. P., Yamlean, P. V., & Jaya Edy, H. (2013). Formulasi Krim Ekstrak Etanol Daun Lamun (*Syringodium isoetifolium*). *Pharmacon Jurnal Ilmiah Farmasi-UNSRAT*, 2(2), 8–12.
- 17) Khattak, R. Z., Nawaz, A., Alnuwaiser, M. A., Latif, M. S., Rashid, S. A., Khan, A. A., & Alamoudi, S. A. (2022). Formulation, In Vitro Characterization and Antibacterial Activity of Chitosan-Decorated Cream Containing Bacitracin for Topical Delivery. *Antibiotics*, 11(9).
- 18) Kristiani, M., & Filadelfian, S. (2024). Uji Karakteristik Fisik Dan Uji Iritasi Krim Ekstrak Daun Waru Laut (*Hibiscus tiliaceus* L.). *Indonesian Journal on Medical Science*, 11(1).

Formulation of a Topical Cream Containing Ethanol Extract of Guava Leaves (*Psidium guajava* L.) and Its Antibacterial Activity Against *Staphylococcus aureus*

- 19) Muthoharoh, L., & Ratna Rianti, D. (2020). Uji STABILITAS FISIK SEDIAAN KRIM EKSTRAK ETANOL DAUN KELOR (*Moringa oleifera* L.). *Jurnal Kefarmasian Akfarindo*, 27–35.
- 20) Mutiara, R., Djangi, M. J., & Herawati, N. (2016). Aktivitas Antioksidan Senyawa Metabolit Sekunder Ekstrak Metanol Kulit Buah Mangrove Pidada (*Sonneratia caseolaris*). *Jurnal Chemica*, 17(2), 52–62.
- 21) Nazar, A. (2023). Uji Aktivitas Antibakteri Ekstrak Etanol Herba Seledri (*Apium graveolens* L) Terhadap Bakteri *Staphylococcus aureus* ATCC 25923 Dengan Metode Difusi. *Jurnal Kesehatan*, 10(1).
- 22) Nurfitriyana, N., Yanuarti, R., & Dyah Pangesti, I. (2021). FORMULASI, EVALUASI DAN Uji ANTIBAKTERI SEDIAAN GELEK EKSTRAK ETANOL DUAN JAMBU BIJI (*Psidium guajava* L.) SEBAGAI ANTI JERAWAT. *ISTA Online Teknologi Journal*, 2(2), 50–59.
- 23) Oktavia, M. D., Ayu, S. K., & Halim, A. (2014). Pengaruh Basis Krim Terhadap Penetrasi Kloramfenikol Menggunakan Mencit. *Jurnal Farmasi Higea*, 1(2), 42–49.
- 24) Pratasik, M. C. M., Yamlean, P. V. Y., & Wiyono, W. I. (2019). FORMULASI DAN Uji STABILITAS FISIK SEDIAAN KRIM EKSTRAK ETANOL DAUN SESEWANUA (*Clerodendron squamatum* Vahl.). *Pharmakon*, 8(2), 261.
- 25) Putri, N. R., Agustin, D., & Nisa, K. (2022). Formulasi dan Uji Aktivitas Antioksidan Krim Biji dan Ekstrak Etanol Daun Jambu Biji (*Psidium guajava* L.) sebagai Body Scrub. *Jurnal Kefarmasian Indonesia*, 12(1), 50–57.
- 26) Risman Tunny, Epi Dusra, Annisatul Khoiriyah Kaplale, Jayanti Djarami, & Maritje.S.J. Malisngorar. (2023). Analisis Perbandingan Ekstrak Daun Jambu Biji (*Psidium guajava* L.) Terhadap Pertumbuhan Bakteri *Propionibacterium acnes* dan *Staphylococcus aureus* Dengan Menggunakan Metode Sumuran. *Calory Journal : Medical Laboratory Journal*, 1(4), 39–47.
- 27) Senduk, T. W., Montolalu, L. A. D. Y., & Dotulong, V. (2020). The rendement of boiled water extract of mature leaves of mangrove *Sonneratia alba*. *Jurnal Perikanan Dan Kelautan Tropis*, 11(1), 9.
- 28) Silverman, M., Lee, P. R., & Lydecker, M. (2023). Formularies. *Pills and the Public Purse*, 97–103.
- 29) Siregar. (2022). No ש תא ה מ ש Titleתמאביכה דגנל מיניעההשק תוארל תא ה מ ש 2(8.5.2017), 2003–2005.
- 30) Syamsul, E. S., Amanda, N. A., & Lestari, D. (2020). PERBANDINGAN EKSTRAK LAMUR *Aquilaria malaccensis* DENGAN METODE MASERASI DAN REFLUKS. *Jurnal Riset Kefarmasian Indonesia*, 2(2), 97–104.
- 31) Tari, M., & Indriani, O. (2023). Formulasi Dan Uji Stabilitas Fisik Sediaan Krim Ekstrak Sembung Rambat (*Mikania micrantha* Kunth). *Jurnal Ilmiah Multi Science Kesehatan*, 15(1), 192–211.
- 32) Tungadi, R., Sy. Pakaya, M., & D.as'ali, P. W. (2023). Formulasi dan Evaluasi Stabilitas Fisik Sediaan Krim Senyawa Astaxanthin. *Indonesian Journal of Pharmaceutical Education*, 3(1), 117–124.
- 33) Wahyuni, S., Afidah, M., & Suryanti, S. (2022). STUDI MORFOLOGI ORGAN VEGETATIF DAN GENERATIF VARIETAS JAMBU BIJI (*Psidium guajava* L.). *Bio-Lectura : Jurnal Pendidikan Biologi*, 9(1), 103–113.
- 34) Witanti, L., & Endriyatno, N. C. (2024). FORMULASI DAN Uji FISIK KRIM EKSTRAK HERBA MENIRAN (*Pyllanthus niruri* L.) DENGAN VARIASI ASAM STEARAT DAN TRIETANOLAMIN. *Jurnal Penelitian Farmasi Indonesia*, 13(1), 23–31.
- 35) Yulisma, L. (2018). Uji Efektivitas Antibakteri Ekstrak Daun Jambu Biji Lokal (*Psidium Guajava* L) Terhadap Pertumbuhan *Staphylococcus Aureus* Dan *Bacilus Subtilis* Secara in Vitro. *Quagga : Jurnal Pendidikan Dan Biologi*, 10(2), 1.
- 36) Yumas, M. (2016). FORMULASI SEDIAAN KRIM WAJAH BERBAHAN AKTIF EKSTRA METANOL BIJI KAKAO NON FERMENTASI (*Theobroma cacao* L) KOMBINASI MADU LEBAH. *Jurnal Industri Hasil Perkebunan*, 11(2), 75.



There is an Open Access article, distributed under the term of the Creative Commons Attribution – Non Commercial 4.0 International (CC BY-NC 4.0) (<https://creativecommons.org/licenses/by-nc/4.0/>), which permits remixing, adapting and building upon the work for non-commercial use, provided the original work is properly cited.