MEDFARM: Jurnal Farmasi dan Kesehatan, Vol. 15, No. 1, 2026, Page76-88
e-ISSN : 2715-9957
p-ISSN: 2354-8487

Burn Wound Healing Activity Of Ethanol Extract Gel Of Guava Peel *(Psidium Guajava Linn.)* In Rabbits *(Oryctolagus Cuniculus).*

Mohammad Firdaus Alshol*[1], Mujtahid Bin Abdul Kadir[2], Datin An Nisa Sukmawati[3], Prayoga Fery Yuniarto[4], Herman[5]

[1,3,4,5)] Departemen Of Pharmacy, Faculty Of Health Sciences, Kadiri University, Kediri, East Java
[2)] Departemen Of Pharmacy, Faculty Of Pharmacy, Megarezky University

email:
mohammadfirdausalshol@gmail.com

ABSTRACT

Traditional medicine using natural ingredients such as plants is becoming increasingly popular. Guava is a herbal plant used to treat various ailments, including burns. This study aims to evaluate the effectiveness of guava (*Psidium guajava Linn*.) peel extract gel in healing second-degree burns in rabbits (*Oryctolagus cuniculus*) and to determine the optimal dosage. This study used maceration and phytochemical screening methods, which identified alkaloids, triterpenoids, steroids, saponins, flavonoids, and tannins. Burns were induced using a hot metal on the rabbit's back. Twenty-five male rabbits weighing 1.5–2.5 kg were randomly divided into five groups (n = 5 per group). The experimental design was a Completely Randomized Design (CRD) consisting of a positive control (Bioplacenton gel), a negative control (no treatment), and guava peel extract gel at concentrations of 3%, 5%, and 7%. CRD ensured that each treatment was assigned randomly to minimize experimental bias. Burn wound diameter was measured periodically throughout the treatment period. Data were analyzed using one-way ANOVA followed by the LSD test. The results showed a significant difference between treatments (p = 0.000). 7% guava peel extract gel was the most effective treatment, showing the greatest reduction in burn diameter with an average reduction of 9.08 mm. These findings suggest that guava peel extract gel has potential as an alternative therapy for burn wound healing.

Keywords: Burns, Guava peel extract, *Psidium guajava Linn.*, Rabbit, *Oryctolagus cuniculus.*

Introduction

Burns are a significant global health problem with high morbidity and mortality rates. According to the WHO (2018), an estimated 180,000 deaths occur annually due to burns. In Indonesia, burns are one of the most common unintentional injuries in children and are the 11th leading cause of death in children aged 1-9 years. Burns can cause damage to the skin's layers due to coagulation, protein denaturation, or ionization of cell contents, and can even cause serious disorders in multisystemic injury situations. Skin affected by burns will experience damage to the epidermis, dermis, and subcutaneous tissue. Therefore, effective and safe treatment is needed to accelerate the wound healing process (Gospodarek *et al*., 2022).

Wound healing is a process of repairing damage. The primary treatment for burns is to cool the burned area or reduce inflammation, prevent infection, and allow remaining epithelial cells to proliferate and close the wound surface. The wound healing process consists of three phases: inflammation, proliferation, and maturation (Almadani et al., 2021)Conventional medication can also be used by providing topical local therapy to achieve healing as quickly as possible. Commonly used medications include bioplacenton, hydrogel, silver sulfadiazine, MEBO, and others. However, continuous use of these medications can cause more side effects than traditional medications and is relatively expensive (Du *et al*., 2026).

Indonesia is rich in natural resources in the form of medicinal plants with potential as alternative therapies. One such plant is guava (*Psidium guajava Linn.),* which is known to have antioxidant, antimicrobial, anti-inflammatory, antimutagenic, and analgesic properties. Some chemical compounds contained in guava include polyphenols, carotenes, flavonoids, and tannins. The saponin, tannin, and flavonoid content can aid the wound healing process because they function as antioxidants and antimicrobials that influence wound healing, accelerate epithelialization, and prevent infection (Bilal *et al*., 2024).

Previous research has shown that guava leaf extract has activity in healing burns, especially at certain concentrations. However, research has focused more on the leaves, while the use of guava peel is still limited, despite its potential as a source of bioactive compounds from underutilized waste. Furthermore, topical dosage forms such as gels were chosen because of their good spreadability, cooling effect, and ease of application to the skin (Sutrisno *et al.,* 2024).

Based on this, this study aims to evaluate the activity of guava fruit peel *(Psidium guajava Linn.)* ethanol extract gel on healing second-degree burns in rabbits *(Oryctolagus cuniculus)* and to determine the most effective concentration in the wound healing process.

Methodology Research Design

This study used a laboratory experimental study with a Completely Randomized Design (CRD) to evaluate the activity of guava fruit peel *(Psidium guajava Linn)* ethanol extract gel on healing second-degree burns in rabbits *(Oryctolagus cuniculus).*

Tools and Materials

The tools used in this study were an oven (B-ONE), a knife (Oxone), a measuring cup (PYREX), an Erlenmeyer flask (PYREX), a test tube (PYREX), a test tube rack (IWAKI), a dropper pipette (PYREX), a stirring rod, wooden tongs, a 50 mL measuring flask (PYREX), aluminum foil (Total Warp), a glass funnel (HERMA), tweezers (OneMed), a 23 mm 500 rupiah coin, tissue, sterile gauze (OneMed), a cage, plastic, scissors (JOYKO), a caliper (Kenmaster), an analytical balance (Fleco), a Bunsen burner, a razor blade (LIKELY), a blender (Miyako), a filter paper (Whatman), gloves (HandSeal), a rotary evaporator (IKA), a Stromer viscometer, a glass jar, and a mesh sieve (ABM).

The materials used in this study were guava fruit peel (Psidium guajava Linn.) simplicia, 96% ethanol (Merck), bioplacenton (Kalbe), Dragendorf reagent (Chemical Nitrate), Mayer reagent (Chemical Nitrate), Wagner reagent (Chemical Nitrate), Mg powder (Merck), distilled water (Waterone), HCl (Merck), FeCl3 1% (Merck), H2SO4 (Merck), NaOH 10% (Merck), glycerin (Brataco), 70% alcohol (OneMed), CH3COOH (Merck), ether (Smartlab), lidocaine anesthetic (Indofarma), HPMC gel base (Brataco), propylene glycol (C3H8O2) (Brataco), nipagin (Brataco), water injection (Otsu) and male rabbits.

Work Procedures

Sample preparation

Guava peels were first dried and made into a simple extract, then extracted using a maceration method with 96% ethanol. The resulting extract was subjected to phytochemical screening to identify secondary metabolites such as alkaloids, flavonoids, saponins, tannins, triterpenoids, and steroids. The extract was then formulated into a gel preparation with varying concentrations of 3%, 5%, and 7%.

Preparation of gel

Tabel 1. Gel Formulation

Ingredients	F1	F2	F3	Function
guava peel extract	3	5	7	active ingredients
HPMC	8	8	8	Gelling agent
Glyserin	15	15	15	Humectant
Propylene Glycol	15	15	15	Humectant
Nipagin	0,2	0,2	0,2	Preservative
distilled water ad	100ml	100 ml	100 ml	solvent

The gel is made by weighing all the ingredients according to the gel formulation table. HPMC is first developed in sufficient hot water, then ground until a homogeneous gel base is formed. Then, other ingredients are added according to the formula. Afterward, the guava peel extract is dissolved in a portion of water heated to 50°C. The mixture is stirred continuously until a gel forms (Rinaldi *et al.*, 2020).

Organoleptic Test

Organoleptic test was carried out by visually checking the color, odor, shape and clarity of the three gel formulas (Rinawati *et al.,* 2022).

Homogeneity Test

The homogeneity test is performed by taking 0.1 grams of the gel preparation and spreading it on a transparent glass. If there are no coarse grains, the preparation is considered homogeneous (Salenda *et al.*, 2018).

Viscosity Test

The viscosity test is performed by inserting the gel preparation into a Stromer viscometer equipped with a rotor with a rotation speed of 1000 rpm. A gel preparation is said to meet the requirements for viscosity testing if its viscosity value is between 5,000 and 60,000 cP, indicating that the gel preparation is stable (Anggraeni et al., 2025)

pH analysis

The pH analysis was performed by dissolving 1 g of guava peel ethanol extract gel in 10 mL of distilled water and then measuring it using a universal pH indicator. A good pH value for topical preparations is in the range of 4.5–8.0 according to SNI 16-4399-1996 and corresponds to the skin's pH, which is 4.5–7.5 (Ansong *et al*., 2023).

Spreadability Test

The spreadability test was performed by placing 0.5 g of gel preparation in the center of a glass slide, then covering it with another transparent glass slide and leaving it for 1 minute. The spreadability diameter was measured before and after adding a load of 50–250 g every 1 minute. The test was performed three times, and then the spreadability diameter was calculated as the average value. The gel preparation was declared to have good spreadability if its diameter was in the range of 5–7 cm (Salenda *et al.,* 2018).

Adhesion Test

The adhesion test was performed by placing 0.25 g of gel on a glass slide, then placing another glass slide on top and applying a 300 g load for 5 minutes. After the load was removed, the time required to separate the two glass slides was recorded as the adhesion strength. This test was performed three times. A gel preparation was declared to have good adhesion if the adhesion time was more than 1 second (Khonsa, 2025).

Treatment of Test Animals

Treatment on experimental animals was carried out by shaving the back hair of rabbits (Oryctolagus cuniculus) and sterilizing them using 70% alcohol, then administering lidocaine anesthesia subcutaneously. Burns were made using a 23 mm diameter metal heated at 180°C for 1 minute, then attached to the skin of the rabbit's back for 5 seconds until a shallow second-degree burn was formed, characterized by redness and the formation of blisters (fluid-filled bubbles). The burns were made on each rabbit. After the wound diameter was measured, the experimental animals were divided into five groups: a positive control given Bioplacenton, a negative control without therapy, and a treatment group given a 96% ethanol extract gel from guava fruit peel at concentrations of 3%, 5%, and 7% (Puruhita *et al*., 2025). Treatment was carried out once daily for 14 days, and the wound diameter was measured on days 0, 2, 4, 6, 8, 10, 12, and 14 to evaluate the burn healing process (Sutrisno *et al*., 2024).

Data Analysis

The parameters observed in this study were the diameter of the burn wounds, which were measured periodically to assess the healing process. The data obtained were analyzed using data processing software and presented as the mean and standard deviation for each group. Data were analyzed using normality tests, homogeneity tests, one-way ANOVA tests, and further testing using the least significant difference (LSD) test to determine significant differences between the treatment and control groups.

Result and Discussion

Preparation of sample

Extraction of guava fruit peel (Psidium guajawa Linn) was carried out by maceration method using 4500 ml of 96% ethanol solvent. This method was chosen because the procedure and equipment used are simple and to prevent the decomposition of compounds that are not heat resistant, thereby reducing the possibility of damage to the active substance . From 600 grams of simplicia powder macerated for 3 x 24 hours and re-macerated twice and stirred every 1 x 24 hours. a thick extract of 59 grams was obtained with a yield of 9.8%. The resulting extract has thick characteristics, is blackish yellow in color and has a distinctive odor. The yield obtained shows that 96% ethanol is effective in extracting secondary metabolite compounds, both polar and semi-polar. In addition, the concentration process uses a temperature of 40°C because secondary metabolite compounds such as flavonoids, phenols and tannins are active compounds that are sensitive to temperature (thermolabile) so that when the temperature is above 50°C it can damage the levels of these secondary metabolite compounds.

Spreadability Test

Based on the test results, all formulas showed an increase in spreadability with increasing load. At a load of 250 g, F1 had the highest spreadability (5.9 cm), while F2 and F3 each had 5.6 cm. These results indicate that all formulas met the spreadability requirements. Differences in spreadability are influenced by the viscosity of the preparation, where spreadability is inversely proportional to viscosity (Puspa Widiyana *et al.*, 2022). With good spreadability, the gel preparation is expected to be easy to apply and able to support the burn wound healing process optimally.

Adhesion Test

Tabel 2. Adhesion Test Results

Formulation	Weight	Attachment time (seconds)	Average (seconds)± SD
Bioplacenton	300 gr	1.87	1.85 ± 0.74
		1.10	
		2.58	
F1	300 gr	2.27	2.10 ± 0.57
		2.56	
		1.46	
F2	300 gr	2.72	2.27 ± 0.40
		1.97	
		2.13	
F3	300 gr	3.03	5.12 ± 2.10
		5.12	
		7.22	

Adhesion tests were conducted three times and determined based on the time required to separate the two slides. The test results showed that all formulas met adhesion requirements (>1 second), with average adhesion times of 2.10 seconds for F1, 2.27 seconds for F2, and 5.12 seconds for F3. These results indicate that increasing the extract concentration tends to improve the adhesion of the formulations. Good adhesion can prolong the contact time of the preparation with the skin, thereby improving the diffusion of the active ingredient and its effectiveness.

Based on the evaluation of physical and chemical properties, including homogeneity, viscosity, pH, spreadability, and adhesion, all formulas met the established requirements. All three formulas demonstrated good homogeneity, viscosity values in the range of 5,000–60,000 cP, a pH compatible with skin pH (4.5–7.5), a spreadability of 5–7 cm, and an adhesion time of more than 1 second. Overall, Formula III (7%) demonstrated the best physical and chemical characteristics compared to the other formulas.

Phytochemical Screening

Phytochemical screening results of ethanol extracts of guava (*Psidium guajava Linn.)* peels revealed the presence of secondary metabolites, including alkaloids, flavonoids, saponins, tannins, triterpenoids, and steroids. The presence of these compounds was indicated by color changes or the formation of specific precipitates in each test, indicating a positive result for the tested compound group.

Table 3. Phytochemical Compound Identification Results

Class of compounds	Screening reagent	Theoretically positive results	Research result	Information
Alkaloid	Thick extract 1g + aquadestilata + HCL + dragendorff reagent	Color change to reddish precipitate (Simbolon *et al.,* 2021)	A reddish color forms	+
	Thick extract 1g + aquadestilata + HCL + Wagner reagent	Color change to yellow (Simbolon *et al.,* 2021)	Yellow color is formed	+
	1g thick extract + aquadestilata + HCL + Meyer reagent	Color change to white (Simbolon *et al.,* 2021)	White color is formed	+
Triterpenoid and steroid	Thick extract 1g + aquadestilata + H2SO4 + anhydrous acetic acid + diethyl ether	A color change to purple or red indicates a positive presence of triterpenoids, a green or blue color indicates a positive presence of steroids (Simbolon *et al.,* 2021)	Red and green colors are formed	+
Saponin	1g thick extract + distilled water → shaken for 1 minute + HCL	Foam or froth forms (stable for 10 minutes) (Simbolon *et al.,* 2021)	Foam is formed	+
Flavonoid	1g thick extract + distilled water + magnesium powder + concentrated HCL	Color changes to pink, purple or yellow (Simbolon *et al.,* 2021)	Yellow color is formed	+
Tanin	Thick extract 1g + aquadestilata + FeCL3	Color changes to bluish black or brownish green (Simbolon *et al.,* 2021)	A bluish black color is formed	+

Alkaloid Compound Identification Test

Alkaloid testing on guava (*Psidium guajava Linn.)* peel extract was conducted using Dragendorff, Wagner, and Mayer reagents. The results showed that guava *(Psidium guajava Linn.)* peel contains alkaloid compounds, indicated by color changes in each reagent to red, yellow, and white. Alkaloid compounds are toxic to bacteria, inhibiting bacterial growth and even killing themm (Simbolon *et al*., 2021).

Identification Test for Triterpenoid and Steroid Compounds

Triterpenoid and steroid tests on guava (*Psidium guajava Linn*.) peel extract were conducted by adding 1 drop of concentrated H2SO4, 1 drop of anhydrous acetic acid, and 2 drops of diethyl ether. The results showed a color change to red indicating the presence of triterpenoids and a green color indicating the presence of steroids. Triterpenoid compounds function as astringents and antimicrobials in wound contraction and increasing the rate of epithelialization. Steroids function as anti-inflammatories that can help accelerate the healing of open wounds, working by inhibiting the phospholipase enzyme, maintaining salt balance, and increasing metabolism (Purwanto *et al.,* 2024).

Saponin Compound Identification Test

The saponin test on guava (*Psidium guajava Linn*.) peel extract was conducted using a foaming method using distilled water and the addition of 2N HCl. The results showed the formation of foam, indicating the presence of saponin compounds. Generally, if the result is positive, the addition of 2N HCl aims to increase polarity so that the hydrophilic groups will bind more stably and the resulting foam becomes stable. Saponin content can accelerate the wound healing process through re-epithelialization of the epidermis and infiltration of cells in the wound area, as well as anticoagulants that can inhibit blood clotting (Simbolon *et al.,* 2021).

Flavonoid Compound Identification Test

Flavonoid testing on guava (*Psidium guajava Linn.)* peel extract was conducted using Mg and 2N HCl reagents (Wilstätter test). The results showed the formation of a yellow color in the test tube. Flavonoids are influential in the healing process because they contain fractions that can shorten the inflammation period, inhibit bacterial growth in vitro, and inhibit bleeding by increasing platelet count.

Tannin Compound Identification Test

The tannin test on guava (Psidium guajava Linn.) peel extract was conducted by adding FeCl3 reagent to the test tube. The results showed that it contained tannin compounds with a color change to bluish black. Tannin compounds have astringent properties, increase the formation of capillary blood vessels, increase the rate of epithelialization, and inflammation of the mucous membrane as well as new cell regeneration, and 51 as antibiotics that work by forming complexes with extracellular produced by pathogens or by disrupting the metabolic processes of these pathogens (Harahap & Ulil Amna, 2021).

Preparation of gel

Gel preparations are made by mixing the active ingredient with a suitable gel base. The gel formulation is made with a composition based on % w / w. The gel preparation consists of the active ingredient, gel base and additional ingredients (Tsabitah, 2020). The gel preparation is made with HPMC as a gelling agent, with the addition of glycerin and propylene glycol as humectants, nipagin as a preservative, and distilled water as a solvent. The gel is formulated in 3 formulas with varying concentrations of guava peel extract (*Psidium guajava Linn*.). Formula I is a gel containing a thick extract of guava peel *(Psidium guajava Linn*.) with a concentration of 3%. The second gel formula is a gel containing a thick extract of guava peel *(Psidium guajava Linn.)* with a concentration of 5%. Formula III is a gel preparation containing a thick extract of guava peel (Psidium guajava Linn.) with a concentration of 7%. Each formula will be formulated with other ingredients without any variation in concentration (Setiawan *et al*., 2023).

The manufacturing process involves dissolving HPMC in sufficient hot water and then grinding it until a homogeneous gel base is achieved. Other ingredients are then added according to the formula. Afterward, guava peel extract is dissolved in a portion of water heated to 50°C. The mixture is stirred continuously until a gel forms (Rinaldi *et al.,* 2020).The use of HPMC produces a clear liquid, provides a cooling effect, and maintains a gel with good viscosity over a long period of time. HPMC has a good drug release rate and broad spreadability.

Organoleptic Test

Based on the organoleptic test results, Bioplacenton, as a positive control, had a white color, a distinctive odor, a semi-solid form, and a clear consistency. Formula I (3%) and Formula II (5%) produced a brownish-yellow gel, while Formula III (7%) produced a blackish-brown color due to the increased concentration of guava peel extract. All formulas had a distinctive odor, a semi-solid form, and a thick consistency. Organoleptic tests were conducted to evaluate the quality of the preparations and their comfort on the skin. The test results showed that all formulas had physical characteristics suitable for application in burn wound healing.

Homogenity Test

Based on the homogeneity test results, Bioplacenton and all guava peel extract gel formulas (F1, F2, and F3) showed homogeneous results, characterized by the absence of coarse grains or lumps in the preparation. The homogeneity test was conducted to ensure that the active ingredients and gel base were evenly mixed to produce optimal preparation effectiveness. Inhomogeneity of a preparation can affect the resulting effectiveness. These results indicate that all formulas have good homogeneity and are suitable for application in burn wound healing.

Viskocity Test

Viscosity tests were conducted using a Stromer viscometer to determine the viscosity level of the formulation, which affects comfort of use and gel stability. Based on the test results, the viscosity values of Bioplacenton, F1, F2, and F3 were 21,493 ± 1,308.64 cP; 20,120 ± 1,327.25 cP; 19,413 ± 300.22 cP; and 22,693 ± 1,092.03 cP, respectively. All formulas met the viscosity requirements for gel formulations, which are in the range of 5,000–60,000 cP. Differences in viscosity values between formulas are thought to be influenced by variations in the concentration of the extract used. Appropriate viscosity can improve the stability of the formulation, facilitate application to the skin, and support the penetration of active ingredients, thus expected to provide optimal burn healing effects.

Activity Test of Guava Peel Extract Gel on Healing Second Degree Burns in Male Rabbits

The activity test of guava fruit peel extract gel (*Psidium guajava Linn.)* on healing type II burns in male rabbits aims to determine the activity or effect on reducing the diameter of type II burns. This test was carried out experimentally on test animals, namely rabbits (*Oryctolagus cuniculus*). This study used 25 rabbits (Oryctolagus cuniculus) as experimental animals, which were randomly divided into five treatment groups (n = 5 per group). The first group received Bioplacenton as a positive control, the second group served as a negative control without treatment, while the other groups received guava peel extract gel with concentrations of 3%, 5%, and 7%, respectively.

This study used bioplacenton gel as a positive control containing 0.5% neomycin sulfate and 10% placental extract. Placental extract contains FGF (Fibroblast Growth Factor) and TGF (Transforming Growth Factor) which play an important role in the re-epithelialization process by increasing the migration of keratinocytes and fibroblasts and stimulating cell regeneration or triggering the formation of new tissue, while neomycin sulfate can act as a bacteriocidal agent that can prevent infection in wounds (Protzman *et al.,* 2023).

The results of the study showed that guava peel extract gel (Psidium guajava Linn.) accelerated the healing of second-degree burns in rabbits (Oryctolagus cuniculus), as indicated by a progressive decrease in wound diameter from day 0 to day 14 in all treatment groups.

Table 4. Burn Wound Diameter Measurement Data

Treatment Dose	**Burn Day – (mm)**							
	H-0	**H-2**	**H-4**	**H-6**	**H-8**	**H-10**	**H-12**	**H-14**
Positive control	23	21.5	19,6	18.05	16.35	13.8	10.45	8.33
	23	20.1	19	17.45	16.1	14.5	11	9.25
	23	21.35	19,1	16.75	15.37	12.95	11.6	9.45
	23	21	19,4	17.6	16.65	14.3	11.45	10.1
	23	21	19,5	17.95	16.9	14.8	11.75	10.3
Negative Control	23	22.5	21,5	19,8	18,75	17,3	16,5	14,35
	23	22	21,5	19,1	17,95	16,1	16,5	13,4
	23	22.5	21	19,6	18,5	17,1	14,9	14,1
	23	22	21	19,25	18,25	16,9	15,1	13,2
	23	22.5	21,5	19,2	17	16,2	14,9	13,3
Formula 1 (3%)	23	22	21	19	18	16,75	14,2	13,1
	23	21.5	20	18,9	17,8	16,5	13,9	12,8
	23	22	21,5	19,5	17,75	15,25	13,9	12,5
	23	22.5	21	19	17,4	15	13,4	12
	23	22	20	18,5	17,8	16,6	14,4	13
Formula 2 (5%)	23	21.5	20,2	19,5	17	16,5	13	11,1
	23	21	20	18,5	16,2	14,5	12,9	10,9

	23	22	20,8	19,2	17,35	15,5	13,5	11,8
	23	22	20	18	17,15	15,25	12,6	11
	23	21.5	20.2	18,5	17	15,15	12,4	10,75
Formula 3 (7%)	23	20	19.1	17,9	15,25	13,8	11,25	9
	23	20	19	17	15,7	13,75	11,4	8,5
	23	20.5	19,2	17,5	15,3	13,4	11,75	8,8
	23	20	18,8	16,9	14,99	12,75	10,9	9,35
	23	21	19,5	16,8	14,5	13,5	10,8	9,75

The positive control group (bioplacenta) showed faster wound healing due to the presence of active compounds that function as antibacterial agents and promote tissue regeneration. In the treatment group, the 3% and 5% extract gel formulations showed improved healing compared to the negative control, but were less effective than the positive control. The 7% extract gel (Formula III) showed the most significant effect, with an average wound diameter of 9.08 mm on day 14, approaching that of the positive control group.

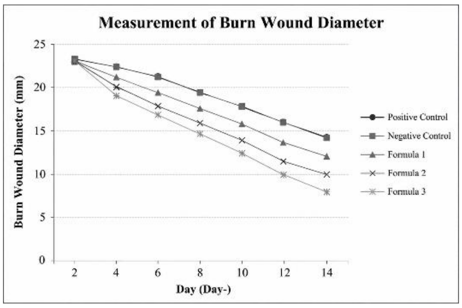

Figure 1. Burn Wound Diameter Measurement Chart in Rabbits

The results of statistical analysis showed that the data were normally distributed (p = 0.200) and homogeneous (p = 0.526). One-Way ANOVA showed a significant difference between groups (p = 0.000), and further analysis using LSD showed that the 7% extract gel was not significantly different from the positive control (p = 0.251), indicating comparable effectiveness.

Burn wound healing with guava peel extract gel also occurs due to the presence of secondary metabolites such as alkaloids, triterpenoids and steroids, saponins, flavonoids, and tannins. Alkaloid compounds are toxic to bacteria, inhibiting bacterial growth and even killing them. Triterpenoid compounds function as astringents and antimicrobials in wound contraction and increasing the rate of epithelialization. Steroids function as anti-inflammatories that can help accelerate the healing of open wounds, working by inhibiting the phospholipase enzyme, maintaining salt balance, and increasing metabolism (Nasrudin *et al.*, 2017).

Saponin content can accelerate the wound healing process through the re-epithelialization process in the epidermis tissue and infiltration of cells in the wound area as well as anticoagulants that can inhibit blood clotting (Anjeli, 2020). Flavonoids are influential in the healing process because they contain fractions that can shorten the period of inflammation, can inhibit bacterial growth in vitro and inhibit bleeding by increasing the number of platelets (Anjeli, 2020). Tannin compounds have astringent properties, increase the formation of capillary blood vessels, increase the rate of epithelialization, and inflammation of the mucous membrane and regeneration of new cells, and as antibiotics that work by forming complexes with extracellular produced by pathogens or by disrupting the metabolic processes of these pathogens.

Thus, it can be concluded that increasing the concentration of the extract is directly proportional to the effectiveness of wound healing, and a concentration of 7% is the most optimal formulation compared to 3% and 5%, and is close to the effectiveness of the positive control.

Conclusion

Based on the findings of this study, it can be concluded that the ethanol extract gel of guava fruit peel *(Psidium guajava Linn.)* has activity in accelerating the healing process of type II burns in male rabbits *(Oryctolagus cuniculus).* Based on the results of the activity test, gel preparation formula 3 with a concentration of 7% guava fruit peel extract showed the highest effectiveness compared to other formulas in the healing process of type II burns in male rabbits *(Oryctolagus cuniculus*). In addition, these results in dicate that the right concentration of the extract can increase the effectiveness of wound healing, so it has the potential to be developed as a topical preparation for burn therapy.

Declaration of Competing Interest

The author declare no competing interests related to this research. There are no financial, personal, or professional conflicts that could affect the research outcomes.

Reference

Almadani, Y. H., Vorstenbosch, J., Davison, P. G., & Murphy, A. M. (2021). Wound Healing: A Comprehensive Review. In *Seminars in Plastic Surgery* (Vol. 35, Number 3, pp. 141–144). Thieme Medical Publishers, Inc. https://doi.org/10.1055/s-0041-1731791

Anggraeni, W., Al-Hakim, N. A., & Maharani, N. I. (2025). Evaluation of Sunflower Seed Oil Emulgel with Carbopol 940: Physical Properties and Moisturizing Effectiveness. *Indonesian Journal of Pharmaceutical Education*, *5*(1). https://doi.org/10.37311/ijpe.v5i1.29584

Anjeli, H. (2020). *Studi Literatur Efektivitas Ekstrak Etanol Daun Jambu Biji (Psidium guajava L.) Terhadap Luka Sayat. Karya Tulis Ilmiah.*

Ansong, J. A., Asante, E., Johnson, R., Boakye-Gyasi, M. El, Kuntworbe, N., Owusu, F. W. A., & Ofori-Kwakye, K. (2023). Formulation and Evaluation of Herbal-Based Antiacne Gel Preparations. *BioMed Research International*, *2023*. https://doi.org/10.1155/2023/7838299

Bilal, K., Mehboob, F., Akhtar, N., Mirza, I. A., Okla, M. K., Dar, M. J., Saleh, I. A., Zomot, N., & Fatima, H. (2024). Wound healing, antioxidant and antibacterial activities of polyphenols of Psidium guajava L. leaves. *South African Journal of Botany*, *165*, 538–551. https://doi.org/10.1016/j.sajb.2023.12.026

Du, Y., Lu, J., Guo, X., Xia, Z., & Ji, S. (2026). The Role of Silver and Silver-Based Products in Wound Management: A Review of Advances and Current Landscape. *Journal of Functional Biomaterials*, *17*(1), 27. https://doi.org/10.3390/jfb17010027

Gospodarek, M. A., Kozioł, M., Tobiasz, M., Baj, J., Radzikowska-Büchner, E., & Przekora, A. (2022). Burn Wound Healing: Clinical Complications, Medical Care, Treatment, and Dressing Types: The Current State of Knowledge for Clinical Practice. In *International Journal of Environmental Research and Public Health* (Vol. 19, Number 3). MDPI. https://doi.org/10.3390/ijerph19031338

Harahap, S. I., & Ulil Amna, dan. (2021). Skrining Fitokimia Ekstrak Daun Jeruk Lemon (Citrus limon L.) dari Kota Langsa, Aceh. *Jurnal Kimia Sains Dan Terapan*, *Vol.2 No.1*. https://ejurnalunsam.id/index.php/JQ

Khonsa. (2025). The Effectiveness Test of Tembelekan (Lantana camara L.) Leaf Extract Gel for Cuts Healing in Male White Mice. *Media Farmasi Indonesia*, *20*(1), 1–14. https://doi.org/10.53359/mfi.v20i1.288

Nasrudin, Wahyono, Mustofa, & Susidarti, A. R. (2017). ISOLASI SENYAWA STEROID DARI KUKIT AKAR SENGGUGU (Clerodendrum serratum L.Moon). In *PHARMACONJurnal Ilmiah Farmasi-UNSRAT* (Vol. 6, Number 3).

Protzman, N. M., Mao, Y., Long, D., Sivalenka, R., Gosiewska, A., Hariri, R. J., & Brigido, S. A. (2023). Placental-Derived Biomaterials and Their Application to Wound Healing: A Review. In *Bioengineering* (Vol. 10, Number 7). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/bioengineering10070829

Puruhita, R., Aldila, S., & Ariyani, D. P. (2025). EFEKTIVITAS PENYEMBUHAN LUKA BAKAR AKIBAT PEMBERIAN GEL ESTRAK ETANOL DAUN CENGKEH (Syzygium aromaticum L.) PADA KELINCI (Oryctolagus cuniculus). *Jurnal Farmasi & Sains Indonesia*, *8*(1), 221–228. https://doi.org/10.52216/jfsi.vol8no1p221-228

Purwanto, U. R. E., Syukur, M., Pebriani, T. H., & Nursofiatun, A. (2024). Nanoemulgel Formulation of Marjoram (Origanum majorana L.) Essential Oil with Potential as Anti-Inflammatory and Anti-Hyperuricemia. *JPSCR: Journal of Pharmaceutical Science and Clinical Research*, *9*(2), 282. https://doi.org/10.20961/jpscr.v9i2.78668

Puspa Widiyana, A., Purnomo, Y., Farmasi, P., & Kedokteran, F. (2022). *PENGARUH JENIS BASIS SALEP TERHADAP PELEPASAN SENYAWA AKTIF ANTIBAKTERI ASAM SALISILAT*.

Rinaldi, Fauziah, Adriani, A., Silviana, E., & Ritazahara. (2020). STUDI FORMULASI GEL EKSTRAK ETANOL DAUN NANGKA (Artocarpus heterophyllus Lam. L) DENGAN BASIS Na-CMC DAN KARBOPOL. In *Agustus* (Vol. 4, Number 3).

Rinawati, Tirta, I., Aulia Eka Putri, D., & Kurniaty, I. (2022). PENGARUH KONSENTRASI EKSTRAK KENTAL DAUN KANYERE (BRIDELIA MONOICA (L). MERR) SEBAGAI ANTIINFLAMASI DALAM SEDIAAN GEL LUKA BAKAR. *Jurnal Teknologi*, *14 No.1*. https://doi.org/10.24853/jurtek.14.1.79-90

Salenda, C. M. E., Yamlean, P. V. Y., & Lolo, W. A. (2018). PENGARUH KONSENTRASI BASIS GEL EKSTRAK ETANOL DAUN TAPAK KUDA (Ipomoea pes-caprae (L.) R. Br.) TERHADAP AKTIVITAS ANTIBAKTERI PADA Staphylococcus aureus. In *PHARMACONJurnal Ilmiah Farmasi-UNSRAT* (Vol. 7, Number 3).

Setiawan, B., Fika, R., Fadhila, M., Trisna, M., Putri, L. A., Farmasi, D.-I., Farmasi, A., & Farma, D. (2023). Effect of Different Concentrations of Propylene Glycol and Glycerin on the Formulation of Guava Leaf (Psidium Guajava Linn.) Body Scrub with White Rice (Oryza sativa Linn.) under a Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC4.0). *Jurnal Eduhealth*, *14*(03), 2023. http://ejournal.seaninstitute.or.id/index.php/healt

Simbolon, A. R., Halimatussakdiah, & Amna, U. (2021). Uji Kandungan Senyawa Metabolit Sekunder pada Ekstrak Daun Jambu Biji (Psidium guajava L. var. Pomifera) dari Kota Langsa, Aceh. *Jurnal Kimia Sains Dan Terapan*, *Vol.3 No.1*. https://ejurnalunsam.id/index.php/JQ

Sutrisno, E., Susilawati, E., Bintang Herdiana, G., & Noviyanti, E. (2024). Gel Formulations of Guava Leaves (Psidium Guajava L) Leaves Ethanol Extract As a Wound Healing Of Burns in Rabbits. *International Journal of Research in Community Service*, *5*(2), 76–81.