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PHYTOCHEMICAL TEST AND ANTIBACTERIAL ACTIVITY OF OIL PALM LEAF EXTRACT (*ELAEIS GUINEENSIS* JACQ.) AS SUNSCREEN CREAM

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Abstract

Indonesians tend to have oily skin, which has a high potential to cause acne. Acne, or acne vulgaris, is caused by several factors such as an increase in the amount of bacteria on the skin and the accumulation of oil that clogs pores, leading to inflammation. Sun exposure can also cause acne by inducing comedogenic peroxidation and inflammatory reactions. This study aims to formulate an anti-acne sunscreen from palm leaf extract, which has been proven to have antibacterial activity. The phytochemical testing includes tests for alkaloids, flavonoids, saponins, terpenoids, and tannins. The antibacterial activity test was conducted using the agar well diffusion method against the bacteria *Propionibacterium acnes*. The results of the phytochemical tests showed that the secondary metabolites found in the ethanol extract of palm leaves are flavonoids, alkaloids, saponins, terpenoids, and tannins. The results of the antibacterial activity test of the palm leaf extract cream in formulas F1 (1,5%), F2 (3%), and F3 (4,5%) showed moderate inhibitory activity with inhibition zones of 6,33 mm, 8,667 mm, and 10,317 mm, respectively, against *Propionibacterium acnes*. Based on the research results, it can be concluded that the cream with palm leaf extract has moderate activity against *Propionibacterium acnes*, with the F3 (4,5%) formulation showing the largest inhibition zone diameter.

Keywords: Oil Palm Leaf (s), antibacterial, *Propionibacterium acnes*, phytochemical test, Sunscreen Cream.

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INTRODUCTION

Indonesia is one of the tropical countries, with the highest temperature in Bengkulu reaching 35°C, according to the Bengkulu Statistical Agency (BPS Provinsi Bengkulu, 2024). This results in Indonesians being exposed to very strong sunlight. The skin serves as the first line of defense against foreign objects. Indonesian skin tends to be more oily, either all over the face or only in the T-zone, which includes the forehead, nose, and chin. Oily skin is caused by Indonesia's tropical climate. Oily skin has several common issues, such as excessive oil production, large facial pores, and a high

potential for acne development. Acne, or acne vulgaris, is an inflammation of the skin, particularly on the face, caused by several factors such as an increase in the amount of bacteria on the skin and the accumulation of oil that clogs the pores, leading to skin inflammation. (Sifatullah & Zulkarnain, 2021). Acne can affect people of all ages, regardless of gender. Studies have shown that 85% of the teenage population frequently suffers from acne vulgaris, and it is also found in adults with a prevalence of 20-40%. In a study conducted at a hospital in Yogyakarta, the majority of acne vulgaris patients were female, accounting for 72,2%. The most common treatment administered was oral antibiotics, specifically minocycline (Putri *et al*., 2023).

In addition to bacteria, according to Teresa (2020) in her journal, sun exposure can also be a cause of acne. This can occur due to ultraviolet exposure, which leads to comedogenic peroxidation and inflammatory reactions. For this reason, it is necessary to have skincare products that offer antibacterial support and protection from sun exposure. One such skincare product that can protect the skin from sun exposure and acne is sunscreen with antibacterial properties. Sunscreen is a preparation that can block UV rays from penetrating the skin. Sunscreen has become an essential need, especially for people in tropical regions with abundant sun exposure. (Tjitda, 2018).

To this day, acne treatment still heavily relies on antibiotics; however, several journals have reported cases of antibiotic resistance in the treatment of acne vulgaris. For instance, in France, resistance to erythromycin and clindamycin has reached more than 50% in the treatment of acne vulgaris, and in Hong Kong, antibiotic resistance has reached 54,8% (Karadag *et al*., 2020). This has prompted researchers to develop natural antibacterial agents with the aim of reducing the potential for resistance in patients suffering from acne vulgaris.

One natural ingredient with significant potential is palm leaf. Previous research has tested the antibacterial content of palm leaves, finding that they contain alkaloids and steroids. Alkaloids work by disrupting the peptidoglycan components of bacterial cells, while steroids reduce membrane integrity, causing the cell membrane to become altered and fragile (Aritonang *et al*., 2021). Based on this information, researchers are interested in exploring the potential of palm leaf as an antibacterial agent and incorporating it into a sunscreen formulation that is safe for acne-prone skin.

MATERIALS AND METHODS

Time and Place

This research is an experimental study aimed at determining the phytochemistry and antibacterial activity of 70% ethanol extract of palm leaf (*Elaeis guineensis* Jacq.) against Propionibacterium acnes. The study was conducted at the Basic Pharmaceutical Laboratory of the S1 Pharmacy Program for formulation preparation and the Phytochemical Testing Laboratory at the Basic Science Biology

Laboratory, Faculty of Mathematics and Natural Sciences, University of Bengkulu, from June to August 2024.

Tools And Materials

The equipment used includes an autoclave, petri dishes (Pyrex), 250 mL Erlenmeyer flasks (Iwaki), 250 mL beakers (Pyrex), digital incubator (Lab Companion), caliper, filter paper (Whatman No.42), micropipettes (Dragon Lab), oven, test tubes (Pyrex), and digital balance (Sartorius). Orbital shaker-incubator ES-20 (Biosan), magnetic Stirer (Lab Companion), Laminar Air Flow (Biobase), Aautoclave (ALP).

The materials used include Aquadest (Waterone), magnesium, 2N HCl, Wagner's reagent, Dragendorff's reagent, FeCl3, chloramphenicol antibiotics, P. acnes bacterial culture, 70% ethanol, Nutrient Agar, palm leaves (*Elaeis guineensis* Jacq.), and a commercial anti-acne sunscreen preparation (Azarine Anti-Acne Sunscreen, SSCAA®).

Procedures

Extraction

The palm leaf samples used were collected from Kandang Mas, Kampung Melayu District, Bengkulu City. After collection, the samples underwent plant verification to ensure the accuracy of the plant used. The next step involved preparing the samples in the form of simplisia, which involved the following processes: collecting raw materials, wet sorting, washing, draining, drying, dry sorting, and grinding to obtain a dry powder known as simplisia powder. The simplisia powder was then macerated and remacerated once using 70% ethanol at a ratio of 1:10 for 24 hours. During the soaking period, the mixture was stirred every 6 hours in a brown glass bottle. The resulting filtrate was filtered through filter paper. The macerated extract was then evaporated using a rotary evaporator and concentrated with a water bath until a thick extract of palm leaf powder was obtained.

Determination of Yield

The determination of extract yield id used to calculate the percentage of extract obtained from palm leaves, using the following formula :

$$\text{Yield } (\%) = \left(\frac{\text{Weight of Extract}}{\text{Weight of Simplisia}} \right) \times 100$$

Phytochemical Screening.

Phytochemical content testing of 70 % ethanol extract of palm leaves :

a. Flavonoid Test

   The flavonoid test involves taking 1-2 mL of the sample and adding magnesium powder, 2N HCl, and 4-5 drops of ethanol. The mixture is then stirred until a color change to red, yellow, or orange occurs, indicating that the sample is positive for flavonoids (Fadilah *et al*., 2023).

b. Alkaloid Test

The alkaloid test involves taking the palm leaf extract and placing it into a test tube. The test tube is then treated with 4-5 drops each of Wagner's reagent and Dragendorff's reagent. The mixture is observed for any color changes and the formation of yellow-red, purple, or orange precipitates, indicating that the sample contains alkaloids (Fadilah *et al*., 2023).

c. Tannin Test

The tannin test involves taking the palm leaf extract and adding a few drops of FeCl3. The mixture is then observed for a color change to greenish-black, which indicates that the sample contains tannins (Fadilah *et al*., 2023).

d. Saponin Test

The saponin test involves taking 1 mL of the palm leaf extract, adding water, and shaking vigorously for 10 minutes. The sample is then observed for the formation of stable foam, which indicates that the sample contains saponins (Fadilah *et al*., 2023).

e. Terpenoid Test

The terpenoid test involves taki

ng 1 gram of the sample and adding Liebermann-Burchard reagent. The mixture is then gently shaken and allowed to stand for a few minutes. Positive results are indicated by the formation of a red or purple color and a brownish ring (Azalia *et al*., 2023).

Preparation of Sunscreen Cream

The preparation of the cream starts with making a cream base (O/W). The base consists of two phases: the oil phase and the water phase. For the oil phase, stearic acid and cetyl alcohol are placed in a porcelain dish, then propylparaben is added and melted over a water bath at 70°C. For the water phase, TEA, glycerin, and aquadest are placed in a beaker, and methylparaben dissolved in some aquadest is added and heated to 70°C until fully dissolved. The melted oil phase is poured into a warm mortar and stirred until homogeneous. The water phase is gradually added while stirring slowly until a cream mass is formed. The thick palm leaf extract is then added to the cream mass gradually, and mixed until homogeneous (Opod *et al*., 2024).

Antibacterial Activity Test

The antibacterial activity of sunscreen cream with concentrations F0 0%, F1 1.5%, F2 3%, and F3 4.5% of 70% ethanol palm leaf extract was tested against Propionibacterium acnes using the agar well diffusion method. The positive control used was chloramphenicol at a concentration of 30 µg/mL, and the SSCAA® preparation was also used. Nutrient Agar (NA) was used as the medium, which was supplemented with 0.1 mL of Propionibacterium acnes bacterial culture, homogenized, and allowed to solidify. After solidification, wells with a diameter of 5.2 mm were created, and each

sample (F0, F1, F2, F3), the positive control, and the negative control were placed into the wells. The plates were then incubated at 37°C for 24 hours. The clear zones formed around the wells were measured using a caliper (Amimi & Rizkuloh, 2023).

Table 1. Classification of Antimicrobial Activity Based on Inhibition Zone Diameter (Yoghiapiscessa *et al*., 2016)

Table 1. Classification of Antimicrobial Activity

Classification	Zone of Inhibition Diameter
Weakly Inhibitory	1-5 mm
Moderate Inhibitory	6 – 10 mm
Strongly Inhibitory	11 – 20 mm
Very Strong Inhibitory	≥ 21mm

RESULTS AND DISCUSSION

Extraction Results

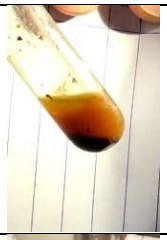
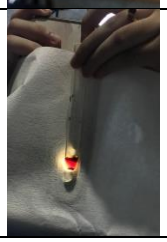
Oil Palm Leaf Plant (*Elaeis guineensis* Jacq.) used in this study was verified at the Basic Science Laboratory of the Faculty of Mathematics and Natural Sciences, University of Bengkulu. The verification results prove that the plant used is *Elaeis guineensis* Jacq. In the dry simplicia extraction process used as much as 300 g, using 70% solvent at a ratio of 1:10 and remaceration was carried out 1 time. The extraction results obtained were a thick extract of 64,96 grams or 21,6% of the dry extract. According to the Indonesian Herbal Pharmacopoeia, the requirement for the yield of thick extract is a value of not less than 10%. So it can be said that the yield results meet the requirements (DepKes, 2017).

Phytochemical Screening Results

The phytochemical screening results indicate that the 70% ethanol extract of palm leaves is positive for the presence of flavonoids, alkaloids, tannins, and saponins, as shown in the following Table 2:

Table 2. Phytochemical test results

Phytochemical Compound	Test Result Images	Result
Flavonoid		positive (+)

Alkaloid		positive (+)
Tannin		positive (+)
Saponin		positive (+)
Terpenoid		positive (+)

Based on the results presented in the table above, the palm leaf extract is positive for flavonoids, alkaloids, tannins, and saponins. This is consistent with the research conducted by Febriani *et al.* (2020). These compounds are responsible for coagulating bacterial proteins, which then impacts the inhibition of nutrient growth in microorganisms (Sulistiarini *et al.*, 2022).

Antibacterial Test

Figure 1: Antibacterial Test of Palm Leaves Extract Cream Using the Well Diffusion Method

Table 3. Result of the Inhibition Zone Diameter for Palm Leaf Extract Cream

Formulation	Zone of Inhibition Diameter (mm)	Categories
F0 (base)	1,817 ± 0,480	Weak
F1	6,333 ± 0,115	Moderate
F2	8,667 ± 0,230	Moderate
F3	10,317 ± 0,236	Moderate
K (+) antibiotics	17,900 ± 0,390	Strong
K (+) sunscreen comersial	4,333 ± 0,321	Weak

Explanation :

F0 : Preparation with 0 % Palm leaf extract (*Elaeis guineensis* Jacq.)

F1 : Preparation with 1,5 % Palm leaf extract (*Elaeis guineensis* Jacq.)

F2 : Preparation with 3 % Palm leaf extract (*Elaeis guineensis* Jacq.)

F3 : Preparation with 4,5 % Palm leaf extract (*Elaeis guineensis* Jacq.)

K (+) : Chloramphenicol antibiotic

K (+) : Commercial Sunscreen

(±) Standard Deviation

The method used for measuring the inhibition zone in the antibacterial activity test of palm leaf extract cream is the agar well diffusion method with Nutrient Agar (NA) as the medium. This test aims to assess the antibacterial activity of the palm leaf extract cream by measuring the diameter of the clear zone around Propionibacterium acnes after incubation for 24 hours. F0 (base) serves as a correction factor because the base contains preservatives such as methylparaben and propylparaben, which may have antibacterial activity. The F0 base produces a weak inhibition zone of 1,817 mm (Afianti & Murrukmihadi, 2015). The positive control, chloramphenicol antibiotic, shows strong inhibition with a zone of 17,9 mm, while the positive control branded anti-acne sunscreen shows a weak inhibition with a zone of 4,33 mm.

Testing of palm leaf extract cream at concentrations of 5%, 10%, and 15% showed antibacterial activity with the formation of an inhibition zone around the well. The diameter of the inhibition zone was measured using a caliper by measuring both horizontally and vertically, and the obtained result was subtracted by the diameter of the well, which is 5,2 mm. The creams with palm leaf extract concentrations of 1,5%, 3,0%, and 4,5% exhibited moderate antibacterial activity with inhibition zones of 6,33 mm, 8,667 mm, and 10,317 mm, respectively. The presence of antibacterial activity in the palm leaf extract cream is attributed to the antibacterial compounds in the palm leaves, including flavonoids, tannins, alkaloids, and saponins. This finding is consistent with Sulistiarini *et al*. (2022), which states that palm leaf extract effectively inhibits the growth of Propionibacterium acnes with an inhibition zone of 5,38 mm.

Flavonoids show antibacterial activity by forming complexes with extracellular proteins, which then dissolve, damaging the bacterial cell membrane and reducing its ability to resist detergents. Alkaloids work by damaging the peptidoglycan components of bacterial cells, preventing the proper formation of the cell wall, leading to cell death. Tannins exhibit antibacterial activity by shrinking the cell wall and disrupting bacterial cell permeability, which impairs its function, thereby inhibiting or even killing bacterial growth. Additionally, saponins lower the surface tension of bacterial cell walls by disrupting membrane permeability, which ultimately threatens bacterial survival (Febriani *et al*., 2020). The mechanism of terpenoids as antibacterials reacts with porins (transmembrane proteins) in the outer membrane of bacterial cell walls, forming strong polymer bonds, resulting in damage to the porins. Damage to porins, which are the entry and exit points for compounds, will reduce the permeability of bacterial cell walls, which will result in bacterial cells lacking nutrition, so that bacterial growth is inhibited (Wulansari *et al*., 2020).

CONCLUSION

Based on the research results, it can be concluded that ethanol extract of palm leaf (*Elaeis guineensis* Jacq.) contains secondary metabolites including flavonoids, alkaloids, saponins, terpenoids, and tannins. The palm leaf extract cream demonstrates antibacterial activity against *Propionibacterium acnes* with formulations F1 (1,5%), F2 (3%), and F3 (4,5%) showing inhibition zones of 6,33 mm, 8,667 mm, and 10,317 mm, respectively, which fall into the moderate category. Formulation F3 is the best formulation, yielding the largest inhibition zone.

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