



ANTIBACTERIAL ACTIVITY TEST OF SOLID SOAP WITH TORCH GINGER'S (*Etilingera elatior* (Jack) R.M.sm.) FLOWER EXTRACT

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ARTICLE INFO	ABSTRACT
Article history Submission April 8 th , 2022 Revision July 4 th , 2022 Accepted August 18 th , 2022	<i>Ethanol extract of torch ginger's flower (Etilingera elatior) is rich in active compounds such as flavonoids, alkaloids, and saponins, steroids. Flavonoids are bioactive compounds that serve as antioxidants and antibacterials. This study aims to find the antibacterial activity of solid soap with torch ginger's flower extract against S. aureus and P. aeruginosa. This study includes the preparation of simplicia, extracts, moisture content, total ash levels, insoluble acid ash levels, water soluble extract levels. The first evaluation includes organoleptic test, pH, irritation, and stability. The formulation of the tested soap preparations was 5%, 7.5%, 10%. The data analysis was performed with ANOVA. The results of this study revealed that its ethanolic extract had a moderate category of bacterial resistance against S. aureus where in FI (5%) has a clear zone with 7 mm in diameter, FII (7.5%) 8.3 mm and FIII (10%) 10.4 mm. Furthermore, for P. aeruginosa, it has a moderate clear zone with diameter in FI (5%) is 8.86 mm, FII (7.5%) is 9.73 mm, and FIII is 10.6 mm. Torch ginger's flower ethanolic extract had an antibacterial activity against S. aureus and P. aeruginosa with the widest clear zone is in the FIII (10%, v/v) in the number of 10.4 mm against S. aureus and 10.6 mm against P. aeruginosa with moderate resistance category.</i>
Keywords: <i>Etilingera elatior</i> <i>Staphylococcus aureus</i> <i>Pseudomonas aeruginosa</i>	

INTRODUCTION

Cosmetics are materials or preparations intended to be used on the external parts of the human body (hair, nails, lips, external genital organs) or the teeth and mucous membranes of the mouth, especially to clean, perfume, change appearance or improve body odor, protect or maintain the body in good condition (Permenkes, 2014). Our body plays a role in protecting the inside of the body from physical and mechanical distraction,

heat or cold distraction, interference with radiation or ultraviolet rays, interference with germs, bacteria, fungi or viruses in the skin. If the dirty skin was not cleaned, it would easily be infected by bacteria (Sukawaty & Warnida, 2016).

Bath soap is one of the cosmetics for skin treatment. Bath soap can be a good choice to prevent skin infections. Bath soap is used as a cleanser, by adding fragrances and other ingredients that do not harm health. The addition of natural ingredients derived from plants into the soap as antibacterial generally takes into account the presence of chemical compounds contained in plants (Rita *et al.*, 2018). The use of antibacterial soap is used as a solution because it is believed to be able to clean the skin, it can also treat or prevent diseases caused by bacteria. Antibacterial soap containing 0.3% triclocarban were examined against gram positive and gram negative bacterial strains (Kim & Rhee, 2016). Triclocarban is the most widely used antibacterial substance in solid bath soaps, but according to the Food and Drug Administration (FDA) long term use of triclocarban caused bacterial resistance to antibiotics because its chemical composition is similar to some types of antibiotics (Barel *et al.*, 2009).

In September 2016, the U.S. Food and Drug Administration banned its use in over-the-counter hand and body washes because of its toxicity. The withdrawal of triclocarban has prompted the efforts to search for new antimicrobial compounds and several analogues of triclocarban have also been studied (Iacopetta *et al.*, 2021). The cutaneous lesions constitute a gateway for microbial contamination that can lead to chronic wounds and other invasive infections. Chronic wounds are considered as serious public health problems due to the related social, psychological and economic consequences. The group of bacteria known as ESKAPE (*Enterococcus faecium*, *S. aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *P. aeruginosa* and *Enterobacter* sp.) are among the most prevalent bacteria in cutaneous infections (de Macedo *et al.*, 2021).

Frequently antimicrobial-resistant strains appear; therefore, alternative methods to control them must be investigated, for example, the use of plant products (de Oliveira *et al.*, 2017). One of the plants that can be used as an antibacterial is torch ginger's flower. The flowers have been used by the public as medicines for cancer, tumors and also as natural cosmetic ingredients such as powder mixing materials. Baduy tribe use torch ginger's flowers as soap, toothpaste, and shampoo (Agustina *et al.*, 2016). Torch ginger or kecombrang is a spice plant belongs to the Zingiberaceae and has been used as

medicine and flavour enhancers. This plant contains phenols, flavonoids, glycosides, saponins, tannins, steroids, and terpenoids (Silalahi, 2017; Juwita *et al.*, 2018).

The 70% ethanol extract of torch ginger's flowers could inhibit the growth of *P. acnes* bacteria at a concentration of 20% at 5.83 mm, 40% at 6.17 mm, 60% at 6.67 mm, 80% at 7.67 mm. Based on the results of the antibacterial activity test, the inhibitory power of the ethanolic extract of the torch ginger's flowers at all concentrations was moderate (Soemarie *et al.*, 2019). Preparations of 96% ethanolic extract of torch ginger's flowers performed antibacterial activity against *S. aureus*. The 300 mg of torch ginger's flowers extract showed the largest inhibition zone diameter (21.12 mm) against *S. aureus* (Pulungan *et al.*, 2018). In this study we evaluate the antibacterial activity of solid soap contained various concentration of torch ginger's flower extract against *S. aureus* and *P. aeruginosa*.

MATERIALS AND METHODS

This research was conducted at the Laboratory of Microbiology, Insitut Kesehatan Helvetia. The research subject is *E. elatior*.

Tools and materials

The tools used were 100 ml beaker glass (pyrex), 10 ml measuring cup (pyrex), test tube (pyrex), test tube rack, pH meter (ATC), parchment paper, filter paper, disc paper, pipette drops, micro pipette, spatula, wire loop, erlenmeyer 250 ml (pyrex), scale ruler, analytical balance (CHQ), Bunsen lamp, tripod, petri dish, autoclave (Techmech), rotary evaporator (Heidolph), incubator (B-ONE Plus), oven (Mettler), Laminar Air Flow (LAF)(Bestech).

The materials used in this study were torch ginger's flowers, coconut oil, olive oil, NaOH, cocamid-DEA, distilled water, 96% ethanol, Mueller Hinton Agar (MHA), Manitol Salt Agar (MSA), Nutrient Agar (NA), *S. aureus* and *P. aeruginosa* were cultured in the pharmaceutical laboratory of the University of North Sumatera.

Torch ginger's flowers extract

Extraction was carried out for 5 days, where each 1 kg of torch ginger's flower simplicia (*E. elatior*) was put into a container then soaked using 7.5 L of 96% ethanol

solvent and covered with aluminum foil for 3 days (daily stirring) then filtered using filter paper to obtain filtrate 1 and dregs 1. The dregs were pre-soaked using 2.5 L of 96% ethanol solvent for 2 days (daily stirring), then filtered using filter paper to obtain filtrate 2 and dregs. Furthermore, filtrates 1 and 2 were combined into one, then concentrated using a rotary evaporator until a thick extract was obtained.

Solid soap preparations

Coconut oil and olive oil were mixed and heated at 60-70°C for 15 minutes (mass of NaOH and aquadest are mixed and stirred ad homogeneously (mass 2). Add mass 2 to mass 1, stirred ad homogeneous. Then put cocamid-DEA while stirring until dissolved and homogeneous, at 50-60°C. Torch ginger's flower extract (*E. elatior*) was added and slowly stirred then distilled water was added in the mixture and homogenized. This procedure was performed until thickens to form soap then stop stirred. Enough perfume, the solution into the soap mold, leave it for 1-2 days at room temperature until the soap hardens completely, removed the soap from the mold and packed it (Masobar, 2015).

Formulation of solid bath soap

Table 1. Formulation of solid bath soap

Ingredient name (g)	F0	F1	F2	F3
Torch ginger's flower extract	-	5%	7.5%	10%
Coconut oil	30g	30g	30g	30g
Olive oil	5g	5g	5g	5g
NaOH	10g	10g	10g	10g
Cocmid DEA	20g	20g	20g	20g
Perfume	Qs	Qs	Qs	Qs
Aquadest	Ad 100	Ad 100	Ad 100	Ad 100

Information:

F0 : Blank (without torch ginger's flower ethanol extract)

F1 : Solid bath soap with 5% torch ginger's flower ethanol extract

FII : Solid bath soap with 7.5% torch ginger's flower ethanol extract

FIII : Solid bath soap with 10% torch ginger's flower ethanol extract

K+ : Positive control commercial brand solid soap

Evaluation of Solid Soap Preparation

Evaluation of the physical quality of the preparation includes organoleptic test, degree of similarity (pH), irritation test, foam stability test.

Organoleptic test

Organoleptic analysis is carried out every preparation of solid soap judging from newly created physical texture containing torch ginger's flower extract, with some concentration during test storage time which in done color, shape (texture) and aromatic.

Potential of hydrogen (pH)

pH testing is carried out using pH meter. How the electrodes are first washed with aquadest, then dried with a tissue, then the electrodes are calibrated with a buffer solution. Prepared 1 gram of the preparation soap each concentration and dissolved with 100 ml of aquadest, then the electrode is dipped in the solution. Left the tool until indicates a constant value, the number indicated pH meter is pH of the preparation. The test was performed 3 repetitions for each other concentration (BSN, 1994).

Foam stability test

The measurement of foam height in aquadest, with 10 g of chopped soap inserted into a 100 ml glass, 3 cm in diameter by flipping through the measuring cup, then immediately observe the height of the foam produced and 5 minutes later observe the height of the foam again.

Irritation test

The experiment could be conducted on 12 female volunteers aged 18-25 years. A solid bath soap preparation is applied to the back ear of the volunteer, then left for 24 hours, and changed of the skin, in the form of irritation of the skin, itching, and imposition.

Antibacterial activity assay

This method uses paper disc media. Determination of the inhibition of bacterial growth was carried out by measuring the diameter of the clear area using a caliper. One mL of bacteria test was put into a petri dish, then add 20 ml of sterile MHA media, homogenized and allowed to solidify. Furthermore, the paper disc (diameter 6 mm) was dripped with 25 L of test solution (soap with various concentrations) then allowed to stand until the test solution was absorbed and placed on the surface of the agar medium. Then

incubated at 36-37°C for 18-24 hours. Furthermore, the diameter of the inhibition area around the paper disc was measured using a caliper (Octaviani *et al.*, 2019).

Statistical Analysis

The data obtained are presented in the form of a table that is the result of the measurement of the inhibition zone. Furthermore, the data obtained from the research result are processed with statistics, namely the analysis of variance test (ANOVA).

RESULTS AND DISCUSSION

Organoleptic test

Organoleptic examination aims to determine the appearance of solid soap in the form of shape, color and aroma which is carried out visually (**Table 2**). This test needs to be done because it is related to the convenience of use as a topical preparation.

Table 2. The result of organoleptic test

Treatment	Organoleptic		
	Form	Color	Form
F0	Congested	F0	Congested
FI	Congested	FI	Congested
FII	Congested	FII	Congested
FIII	Congested	FIII	Congested
K+	Congested	K+	Congested

The results of the organoleptic test evaluation showed that the use of torch ginger's flower ethanol extract affect on changes in the soap color and odor. The soap without ethanol extract of the torch ginger flower gave no color to the soap and the aromatic odor of the torch ginger's flower in solid soap, while soap with ethanol extract of torch ginger's flowers addition resulted color changes. Higher concentration of torch ginger's flower extract in soap solution produced darker brown color of solid soap.

Potential of hydrogen (pH)

pH measurement testing aims to see the pH of the preparation that affects the irritating properties of the skin. Observation of the pH of the preparation is determined using a pH meter.

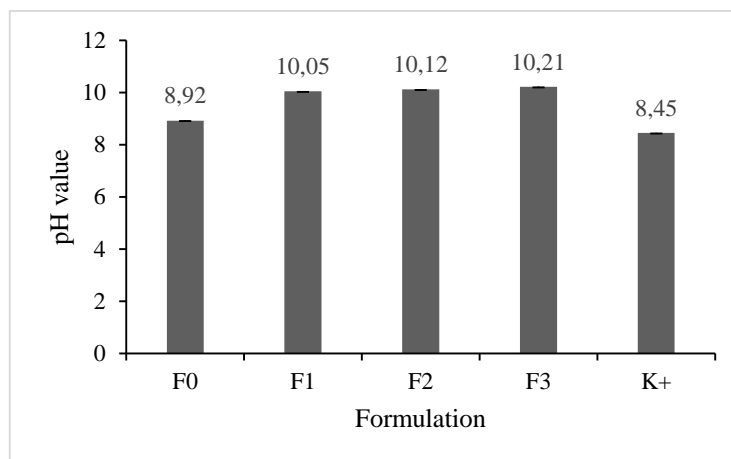


Figure 1. pH value of solid soap with torch ginger's flower extract

The pH value is a very important parameter in solid soap preparations because the pH value determines whether the soap is suitable or not. The difference in pH values in each formulation was due to the addition of extracts at each concentration, where higher concentration of torch ginger's flower extract in soap solution produced higher pH value (**Figure 1**). The requirements for soap pH according to SNI generally range from 9-11 so that from the observation the solid soap preparations of torch ginger's flower ethanol extract met the pH requirements that suitable for the skin.

Foam stability test

The foam stability test aimed to determine the stability of the foam produced by soap. Higher concentration of torch ginger's flower extract in soap solution produced higher foam. Ratnah & Salasa (2019) reported result of foam height assay that the addition of torch ginger's leaf extract 6.2% and 8.75% into soap formulation produced foam height at 5.7 and 7.4 respectively. The foam resistance assay for each formula met the requirements, due to its resistance in foaming more than 60-70% after being shaken for 5 minutes (**Figure 2**).

Irritation test

Irritation test was carried out to determine whether or not there is a reaction in the form of irritation to the skin. Irritation is observed by observing the occurrence of changes in the skin such as redness, itching, and roughness. Based on the results of irritation tests that have been carried out on volunteers, it shows that all volunteers did not felt redness,

itching, rough skin so that solid soap with torch ginger's flower ethanol extract was suitable and safe for skin.

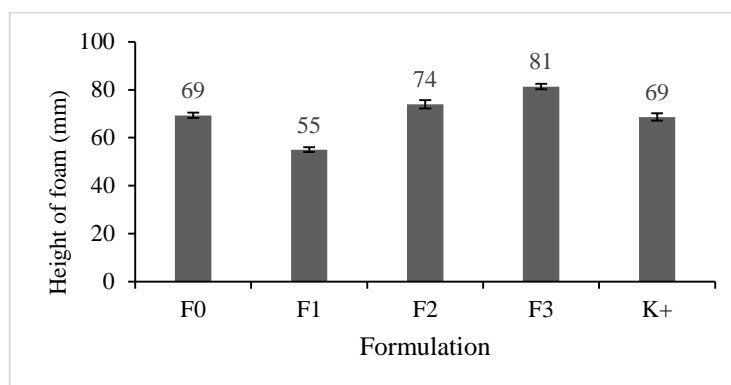


Figure 2. The height of foam of solid soap with torch ginger's flower extract

Antibacterial Activity Assay

The antibacterial assay was carried out with the disc diffusion method. The absence of an inhibition zone in the negative control (F0) indicated that the solid soap base used did not contribute to perform antibacterial activity. In each test parameter, it can be seen that higher concentration of torch ginger's flower extract in soap solution produced larger diameter of inhibition (**Figure 3**). So it revealed that the ethanolic extract of torch ginger's flowers had antibacterial activity against *S. aureus* and *P. aeruginosa*.

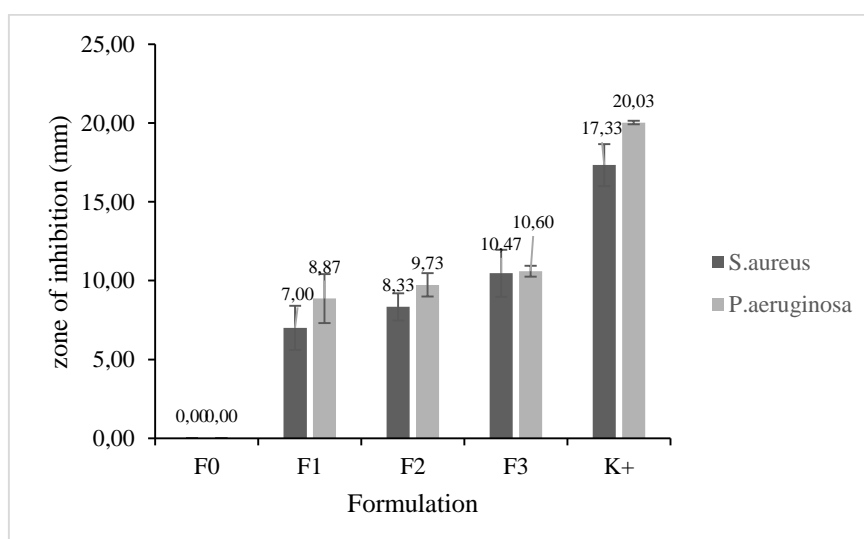


Figure 3. The diameter of inhibition/clear zone in disk diffusion method to obtain the effect of solid soap with torch ginger's flower extract to *S. aureus* and *P. aeruginosa* growth

Based on previous research, the ethanolic extract of torch ginger's flowers can inhibit the growth of *P. acnes* at a concentration of 20% at 5.83 mm, 40% at 6.17 mm, 60% at 6.67 mm, and 80% at 7.67 mm. The results indicated that the ethanolic extract of torch ginger's flower at all concentrations was moderate (Ghasemzadeh *et al.*, 2015). The presence of an inhibition zone in the extract formulation was most likely due to the ethanolic extract of torch ginger's flowers which is rich in active compounds such as flavonoids, alkaloids, and saponins, steroids. Flavonoids are bioactive compounds that exhibit various useful activities, such as antioxidant and antibacterial. Flavonoids are phenolic compounds that act as protein coagulators in bacteria. Proteins function in protein synthesis which ultimately causes death in bacteria.

Flavonoids are also able to interact with bacterial DNA and causes damage to the permeability of bacterial cell walls, microsomes, and lysosomes. Flavonoids can interact with bacterial DNA and inhibit the function of the bacterial cytoplasmic membrane which in turn will damage the permeability of the bacterial cell wall membrane. Flavonoids can also be enzyme inhibitors so that bacteria cannot produce enzymes properly (James *et al.*, 2008). Some synthetic derivatives of flavonoids also exhibited remarkable antibacterial activities with 20- to 80-fold more potent activity than the standard drug against multidrug-resistant Gram-negative and Gram-positive bacteria (including *E. coli*, *P.s aeruginosa*, and *S.s aureus*) (Farhadi *et al.*, 2018).

CONCLUSION

Torch ginger's flower (*E. elatior*) ethanolic extract had inhibitory activity against *S. aureus* and *P. aeruginosa* with the widest diameter of inhibition zone is in the 10% concentration. The solid soap with torch ginger's flower extract was suitable and safe for human skin, so it may use as a new invention in solid soap production.

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