Strada Journal of Pharmacy

ISSN: 2776-3544 (print); 2797-9180 (online)
Vol. 6, No 1, April 2024, pp. 1-13

Antibacterial Test Of Ethanol Extract Gel Preparation Kencur Rhizome (*Kaempferia Galanga*)Against *Staphylococcus Epidermidis*

Husnul Hotimah[1*], Juvita Herdianty[2]
Pharmacy Study Program, Faculty of FAKAR, Strada Indonesia Institute of Health Sciences Kediri
[*]**Corresponding author:** 148.husnulkhotimah@gmail.com

ABSTRACT

Staphylococcus epidermidis is one of the bacteria that causes acne. infections can be treated by using natural antibiotics. galangal rhizome (Kaempferia galanga L.) contains chemical compounds including flavonoids, saponins, tannins, alkaloids and terpenoids/steroids where these active compounds have an antibacterial function that can overcome acne problems on the surface of the skin. Galangal rhizome ethanol extract gel preparations weremade with 3 variations of concentration (10%, 15% and 20%). The aim of this research was to determine whether the ethanol extract gel preparation of kencur rhizome (Kaempferia galanga L.) had antibacterial activity against Staphylococcus epidermidis and to determine the physical quality of the gel preparation. The method used is an experimental laboratory which is useful for determining the effect of ethanol extract of kencur rhizomes with concentrations of 10%, 15% and 20% on Staphylococcus epidermidis bacteria in gel preparations. The antibacterialtest was carried out using the well diffusion method. The antibacterial test results with concentrations of 10%, 15% and 20% respectively were 13.68; 13.60 ; 14.24 mm has an influence on the inhibition zone of Staphylococcus epidermidis bacteria. The research results showed that a concentration of 20% had the highest bacterial inhibitory power.

Keywords: Antibacterial, Ethanol Extract of Kencur Rhizome, Gel, Staphylococcus epidermidis

INTRODUCTION

In Indonesia, many people suffer from skin problems, namely acne, pimples and acne vulgaris, which is inflammation of the skin in the pilosebase glands which can be found in areas that contain lots of oil glands, namely the neck, back, chest and face. Acne is caused by several factors, namely hormones,heredity, kratinocyte decay, climate, increased sebum production and bacterial growth. Even though theappearance of acne will not have a fatal impact, it can cause a lack of self-confidence due to the presenceof acne, especially on the face (Pratiwi, *et al*., 2017). Based on previous research, it shows that of the 42respondents, 16.7% experienced very severe levels of anxiety, while 19% had moderate levels of anxietyand 64.3% had very mild levels of anxiety (Sampelan, *et al*., 2017).

Acne that occurs is closely related to inflammation of the sebaceous glands, apart from being causedby hyperkeratosis in the hair infundibulum and bacterial infections. Most acne occurs due to bacterial infections, this occurs because the skin is damaged due to the surface of dead skin cells (Setyaningrum, 2018). One of the bacteria that can cause acne and infect dead skin is gram-positive bacteria, namely *Staphylococcus epidermidis* (Utami, *et al*., 2020). The *Staphylocuccos epidermidis* bacteria has a role inthe formation of lipolytics which convert sebum fractions into solid masses, which can cause blockages in the sebaceous gland ducts

(Sambou, *et al*., 2017).

Staphylococcus epidermidis bacteria is a pathogen that often causes skin infections in humans. Naturally, this bacteria also lives on skin membranes and also on human mucous membranes. *Staphylococcus epidermidis* bacteria is actually one of the normal flora on the skin. If this bacteria is notin the organ it should be in and must be supported by certain conditions, then the bacteria is opportunistic(causes infection) such as on the lining of the mouth, nose, digestive tract in community and nosocomial, such as *Staphylococcus epidermidis* bacteria (Antika, 2019).

Antibacterial is a compound to prevent, inhibit and kill the growth of bacteria. Currently, there are many synthetic drugs such as clindamycin, tetracycline and salicylic acid (Anggita *et al*, 2015). However,because there are side effects from these chemicals, often used to cure acne, they can provide resistance to bacteria that can cause acne (Wahdaningsih, *et al*., 2014). Therefore, we are looking for alternative herbal medicines to treat acne.

The use of natural ingredients as traditional medicine in Indonesia is one way to use traditional medicine which is considered to have fewer side effects compared to medicines derived from chemicals,besides that the price is also more affordable. Apart from that, another advantage of using traditionalmedicine is that the raw materials are very easy to obtain and the price is relatively cheap.

Some research on antibacterial herbal medicines is research according to (Siburian, 2018) which uses antibacterial tests on the ethanol extract of kencur rhizome (*Kaempferia galanga* L) which can be used as an antibacterial medicine because it contains flavonoid and saponin compounds. Rakhmadhan Niah's research (2019) used red galangal rhizomes. The red galangal rhizome is effective as an antibacterial because the red galangal rhizome extract contains flavonoid compounds. Apart from that, inresearch conducted by Afidatul Muadifah (2019), turmeric rhizome extract can be used as an antibacterialgel because the turmeric rhizome contains flavonoid and alkaloid compounds. From several studies, flavonoid compounds are secondary metabolites that have antibacterial capabilities.

Kencur (*Kaempferia galanga* L) is one of the components that contains secondary metabolite compounds of flavonoids, saponins, polyphenols and essential oils. Flavonoids are a group of phenolic compounds that are found in many plant tissues. Flavonoids are actually found in all plants including roots, leaves, wood, flowers (Ilhani, *et al*., 2018). Kencur (*Kaempferia galanga* L) is a plant that is well known in the community as a medicinal ingredient and also as an ingredient in traditional medicine (jamu), phytopharmaceuticals, and the cosmetics industry (Utami, *et al*., 2020). Empirically, galangal is used as an appetite enhancer, bacterial infection, expectorant, and cough medicine. Several previous studies have shown that flavonoids not only function as antioxidants but also have benefits for protectingcell structures, increasing the effectiveness of vitamin C, anti-inflammatory, anti-diarrhea and even antibiotics (Ilhani, *et al*., 2018). Galangal rhizomes have been tested and the results were positive for containing flavonoids. Flavonoid compounds are good production compounds, inhibiting many oxidationreactions, both enzyme and non-enzyme. Flavonoids are the largest group of phenolic compounds. The mechanism of action of flavonoids functions as an antibacterial by forming complex compounds with extracellular proteins which disrupt the integrity of bacterial cell membranes, disrupt the function of microorganism cells and inhibit the microbial cell cycle (Utami, *et al*., 2020).

Based on research (Prihannensia, *et al*., 2018) it is stated that by testing the activity of gel preparations with galangal extract (*Alpinia galanga* L) against *Staphylococcus epidermidis* bacteria in vitro with concentrations of 10%, 15% and 20%, it shows antibacterial activity. In this research, the authoris interested in conducting research on the Antibacterial Test of Ethanol Extract Gel Preparations of Kencur Rhizome (*Kaempferia galanga* L) Against *Staphylococcus*

epidermidis, galangal extract made with concentrations of 10%, 15% and 20%.

METHODS

The research method carried out used an experimental method (*experimental research*), which compared the effect of increasing the active ingredient content of the ethanol extract of kencur rhizome (*Kaempferia galanga* L) on the antibacterial test against *Staphylococcus epidermidis* on the ethanol extract gel of kencur rhizome with different concentrations of 10%, 15% and 20%. Each formula was replicated three times in each test. Analysis of gel preparation data was obtained from measuring the bacterial inhibition zone. Then proceed with One Way Anova analysis of variance using the SPSS 22 application. The purpose of this data analysis is to see where there are significant differences from the differences in gel preparation formulas.

A. Extraction Making

The extraction method used is maceration. Coarse powder of galangal rhizome (*Kaempferia galanga* L.) was obtained from the Kediri market using 96% ethanol solvent (1000 ml) then extractedwith a ratio of 1:5, namely 200 grams of kencur rhizome powder. Next, put it in a dark colored bottleand then soak it with 1000 ml of 96% ethanol solution in a ratio of 1:5 until all the ingredients are submerged. The maceration process is carried out for 3x24 hours, while stirring occasionally, then the maceration results are filtered and the filtrate is separated. The maserate was separated using a

Buchner funnel and flannel cloth until a liquid extract was obtained, the filtering process was repeatedtwice with the same amount of solvent. All the macerate was collected and then concentrated using a rotary evaporator at a temperature of 40°C until a thick extract was obtained (Sumantri, Astuti, & Nuria, 2010).

B. Identification of Secondary Metabolite Compounds (Phytochemical Screening)

The phytochemical screening test that will be carried out is as follows:

- *Flavonoid Examination*

A total of 0.5 grams of sample was added with 2 mL of 50% methanol. Heated at 50˚C then cooled. Magnesium metal was added, 5 drops of concentrated hydrochloric acid were added. If ared/orange color appears then it is positive for containing flavonoids (Pertiwi, *et al*., 2022).

- *Steroid/Triterpenoid examination*

Put 0.5 gram of sample into the test tube, then dissolve the filtrate with 0.5 mL of chloroformand add 0.5 mL of anhydrous acetic acid, then add concentrated H2SO4 through the tube wall. Ifit shows a brownish or violet color at the border of the solution it will indicate the presence of triterpenoids, whereas if it shows a greenish blue color it indicates the presence of steroids (Pertiwi, *et al*., 2022).

- *Alkaloid examination*

A total of 0.5 grams of sample was added with 0.5 ml of 2 N HCL and the solution was dividedinto two tubes. In tube one, 3 drops of Dragendrof's reagent were added, in tube two, 3 drops of Meyer's reagent were added. If tube one forms an orange precipitate and in tube two a yellowishor white precipitate forms, this indicates the presence of alkaloids (Hayati, *et al*., 2015).

- *Tannin examination*

Put 0.5 grams of sample into a test tube, add 5 mL of distilled water then mix with 2 drops of1% FeCl3 solution, if the solution shows a dark blue or greenish black color, this indicates the presence of tannins and polyphenols (Pertiwi, *et al*., 2022).

- *Saponin examination*

A total of 0.5 grams of sample in a test tube was added with water while shaking for 1

minute.If it produced foam, 2 drops of 1 N HCl were added and left for 10 minutes. If the foam formed remained stable then the extract was positive for containing saponin (Hayati, *et al.* , 2015).

C. Formulation

Table 1. Galangal Rhizome Extract Gel Formulation (%)

Material Name	Material Function	Control (Base)	Concentration (g) F1	F2	F3	Control +
Galangal Rhizome Extract	Active substance		10	15	20	
Carbopol	Gelling agent	0,1	0,1	0,1	0,1	
Tritanolamine (TEA)	Alkalizing agent	0,4	0,4	0,4	0,4	**Clindamycin gel**
Methyl Paraben	Preservative	0,04	0,04	0,04	0,04	
Glycerin	Humectant	3	3	3	3	
Propylene glycol	Humectant	2	2	2	2	
Aquadest	Solvent	100	100	100	100	

D. Evaluation of Physical Quality of Gel Preparations

- Organoleptic Test

Organoleptic testing is carried out by observing the gel preparation in terms of shape, aroma andcolor of the preparation (Pricillya, 2015).

- Homogeneity Test

Homogeneity testing is carried out by applying 0.1 gram of gel to the surface of the object glass.The gel preparation is said to be homogeneous if there are no coarse grains on the object glass (Pricillya, 2015).

- pH test

Gel pH measurements were carried out using a pH meter. A total of 0.5 grams of galangal rhizomeextract gel was dissolved in 50 mL of distilled water in a beaker. The 44 pH meter is calibrated

first using standard buffer 4 solution; 7; and 9. The electrode is immersed in a beaker for 10 minutes(Pricillya, 2015).

- Viscosity Test

The gel viscosity test is intended to determine the viscosity of each gel. This test was carried outusing a portable viscometer (Zulfa, *et al*., 2015).

- Spreadability Test

The spreading power test is carried out by installing a pair of glass plates, one of which is scaled. A total of 0.5 grams of gel was placed on a scaled glass plate. A scaled glass plate was placed symmetrically on top of the gel with an additional load on it of 0 grams to 150 grams for 1 minute, then the diameter of the gel was measured with a ruler. A 50 gram load is placed on a glass plate andleft for 1 minute until the load is 150 grams, then measured. Diameter measurements were carried out transversely and longitudinally, then the diameter of the gel spread was recorded. The spreadability indicating a semisolid consistency is 5-7cm (Thomas, *et al*., 2019).

E. Antibacterial Testing of Galangal Rhizome Extract Gel Preparations

Antibacterial testing on galangal rhizome extract gel preparations was carried out using the agar well diffusion method. A total of 1 mL of *Staphylococcus epidermidis* bacterial suspension was put into a petri dish then mixed with 20 mL of NA which had been sterilized by autoclaving at 121°C for15 minutes. Then sterile NA media was put into a petri dish containing 1 mL of *Staphylococcus epidermidis* bacterial suspension. Then shake the petri dish so that the bacterial suspension and mediabecome homogeneous, then let it sit until it solidifies.

In the solid media, holes were made with a diameter of 6 mm using a modified sterile glass Pasteur pipette. The next stage is that the wells are filled with each test solution of galangal rhizome leaf extract gel preparation (*Kaempferia galanga* L.)with a concentration of 10%, 15%, and 20%, the negative control uses a gel base, and the positive control uses a gel base with additional ingredients. clindamycin. The media filled with each test solution was incubated at 37℃ for 1 x 24 hours. After incubation, the inhibition zone formed was observed by looking at the clear area around the disc and measuring the diameter of the inhibition zone using a caliper (Wahdaningsih, Untari, & Fauziah, 2014).

F. Analysis of Results

Physical evaluation data analysis of galanga rhizome (*Kaempferia galanga* L) gel preparations wascarried out descriptively and data analysis of the diameter of the inhibition zone of *Staphylococcus epidermidis* bacteria was carried out using One Way ANOVA statistics.

RESULTS AND DISCUSSION

This research is a type of experimental research that tests antibacterial gel preparations of galangal rhizome (Kaempferia galanga L.) with concentrations of 10%, 15%, and 20% against Staphylococcus epidermidis bacteria using the well diffusion method.

G. Plant Identification

Plant identification was carried out at the Batu Indonesian Materia Medica Herbal Laboratory UPT, Malang, East Java, stating that the plant used in this research was galangal rhizome (*Kaempferia galanga* L). Obtained from Kediri market.

H. Making Simplicia

The process of making kencur rhizome simplicia is carried out at the Pharmaceutical Laboratory, Faculty of FAKAR, Strada Indonesia Institute of Health Sciences, Kediri. The galangal rhizome powder produced in this research was 200 grams. After the simplicia powder is finished, the water content is tested using a moisture balance tool. The average results obtained in the water content test were 5.7%, not more than 10% (Rahmadani, 2015).

I. Extraction

Extraction of galangal rhizomes was carried out by weighing 200 grams of simplicia powder thenextracted by maceration with 1000 ml of 96% ethanol solvent and extracted for 3 days. The thick extract produced was 103.98 grams. The yield of galangal rhizome extract with 96% ethanol solvent obtained a yield of 27%. The calculation method is the weight of the powder minus the weight of thethick extract of galangal rhizome.

J. Identification of Secondary Metabolite Compounds (Phytochemical Screening)

The results obtained can be seen in the table below:

Table 2. Results of Identification of Secondary Metabolite Compounds (Phytochemical Screening)

Secondary Metabolite Compounds	Phytochemical Screening Results
Flavonoids	+
Triterpenoids	+
Alkaloids (Mayer's reaction)	+
Alkaloids (dragendroff preaction)	+
Tannin	+

Identification of secondary metabolite compounds is carried out by testing phytochemical screening. The results of the phytochemical screening test for examining flavonoids, triterpenoids, alkaloids (Mayer and Dragendroff's reagents), and tannins were positive (+). Secondary metabolite compounds contained in galangal rhizomes have antimicrobial properties by damaging the structuralcomponents of bacterial cell membranes

(Sepriani, *et al*., 2020).

K. Ethanol Free Testing

The results obtained can be seen in the table below:

Table 3. Ethanol Free Test Results

Testing	Results
Ethanol free test	+

The ethanol-free test shows that the galangal rhizome extract does not contain ethanol because itdoes not give an ester odor and the color is purple (Muadifah, *et al*., 2019)

L. Making Test Media and Bacterial Rejuvenation

NA media is produced which will be used for the bacterial rejuvenation process by streaking purebacteria onto slanted NA media, then incubating for 24 hours. Making a bacterial suspension is doneby adding 10 ml of 0.9% NaCl solution then inoculating it into a test tube and adding the bacterial culture results then shaking until homogeneous using a vortex. The turbidity of the suspension that has been made is equal to the McFarland turbidity standard of 0.5. The McFarland turbidity standardof 0.5 was used to replace bacterial counts (Arniati, *et al*., 2015).

M. Bacterial Identification

The results obtained can be seen in the image below:

• Microscopic

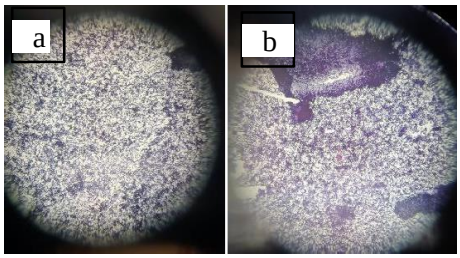

Figure 1. Results of microscopic identification of bacteriaInformation :

a : Magnification 10 times b : Magnification 40 times

Identification of bacteria is carried out by morphology which is observed microscopically. The results obtained were that the *Staphylococcus epidermidis* bacteria is a gram-positive type of bacteria and is purple when viewed under a microscope. This is due to the defense of the crystal violet dye

during the bacterial staining process, so that the bacteria will appear blue or purple. The shape of the *Staphylococcus epidermidis* bacteria from observations is in the form of a cocci (round) and is arranged in irregular groups or clustered together.

N. Antibacterial Testing of Kencur Rhizome Extract

The results obtained can be seen in the table and figure below:

Table 4. Results of the Inhibitory Zone of Kencur Rhizome Extract

Extract Formula	Replication (mm)			Average (mm)
	1	2	3	
P1 (10%)	14,30	13,40	13,35	13.68 (Strong)
P2 (15%)	13,53	12,75	14,54	13,60 (Strong)
P3 (20%)	15,18	15,00	12,55	14,24 (Strong)

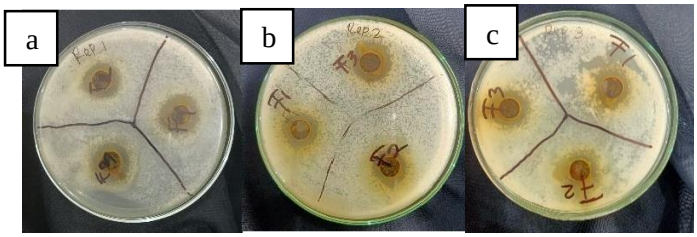

Figure 2. Results of the Inhibitory Zone of Kencur Rhizome ExtractInformation :
a: Extract inhibition zone results (10, 15, 20%) replication 1
b : Results of extract inhibition zone (10, 15, 20%) replication 2
c: Extract inhibition zone results (10, 15, 20%) replication 3

Antibacterial testing on Kencur Rhizome extract was carried out to determine the ability of an extract to inhibit or kill bacteria. The media that has been made is divided into 3 areas, namely P1 (contains extract with a concentration of 10%), P2 (contains extract with a concentration of 15%), and P3 (contains extract with a concentration of 20%). The inhibitory zone for good bacteria, namelyan inhibitory zone diameter of less than 5 mm, is categorized as weak, 5-10 mm is categorized as medium, 10-20 mm is categorized as strong, and 20 mm or more is categorized as very strong (Tjiptoningsih, 2020). Based on the results of the antibacterial test, it was found that the inhibition zone in the P1(5%) well area was 9.00 mm, which had a medium category of antibacterial inhibition.Meanwhile, in the P2(10%) well area of 10.90 mm and the P3(15%) well area of 13.60 mm, the antibacterial inhibitory power was in the strong category. Thus, it can be concluded that galangal rhizome extract has inhibitory power against the growth of Staphylococcus epidermidis bacteria.

O. Making Gel Preparations

The results obtained can be seen in the image below:

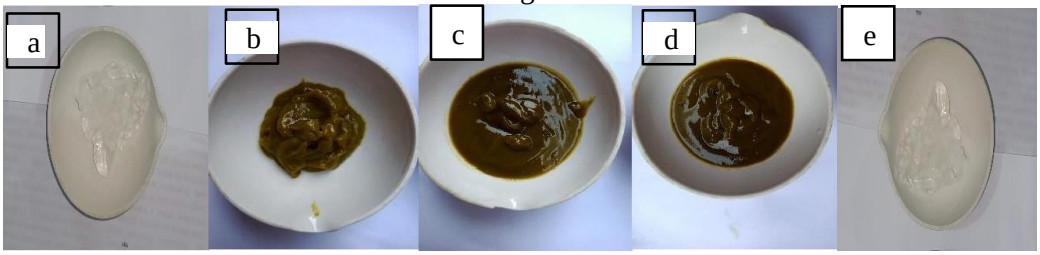

Figure 3. Gel preparation

Information :

a : Control – (base)

b : Gel preparation with a concentration of 10% (F1) c: Gel preparation with a concentration of 15% (F2) d : Gel preparation with a concentration of 20% (F3) e : Control + (base + clindamycin)

The gel preparation in this study was made with 3 main formulas, namely formula 1, formula 2,and formula 3. Each formula was made using an aseptic manufacturing process. Apart from the 3 main formulas, in this study other gels were made for comparison, including control - (without the active ingredient) which is usually called base and control + (with the addition of the active ingredient clindamycin gel).

P. Evaluation of Physical Quality of Gel Preparations

The gel that has been made is then tested to evaluate the physical quality of the preparation including Organoleptic Test, Homogeneity Test, pH Test, Viscosity Test, Spreadability Test, and Adhesion Test.

- Organoleptic Test

The results obtained can be seen in the table below:

Table 5. Organoleptic Test Results

Formulas	**Organoleptic Test Assessment Parameters**		
	Form	**Color**	**Aroma**
Control –	Thick	Clear	Typical base
Formulation 1	Thick	Green	Typical galangal rhizome
Formulation 2	Thick	Deep green	Typical galangal rhizome
Formulation3	Thick	Blackish green	Typical galangal rhizome
Control +	Thick	Clear	Typical of clindamycin

In the organleptic test, the test is carried out by observing the shape, aroma and color of apreparation. Organleptic tests on gel preparations that have been made include 4 formulas (control-, formula 1, formula 2, and formula 3) which meet the criteria and requirements for a gelpreparation because they do not have a rancid aroma, are easy to use, and are homogeneous.

- Homogeneity Test

The results obtained can be seen in the table below:

Table 6. Homogeneity Test Results

Formulas	**The results obtained**
Control –	Homogeneous
Formulation 1	Homogeneous
Formulation 2	Homogeneous
Formulation 3	Homogeneous
Control +	Homogeneous

Homogeneity testing is carried out by applying the gel preparation thinly to a glass

object, then covering it with a glass object and observing under light whether there are coarse particles orinhomogeneities (Pricillya, 2019). From the results of observations of the galangal rhizome extractgel formula I, formula II and formula III, there were no visible coarse particles so that it could produce a homogeneous gel preparation. Because the additional ingredients and extracts as activesubstances made into gel preparations are mixed evenly.

- Test pH

The results obtained can be seen in the table below:

Table 7. pH test results

Formulas	Replication			Average
	1	2	3	
Control –	5,19	5,59	4,95	5,2
Formulation 1	5,02	5,22	5,15	5,13
Formulation 2	6,65	7,39	6,38	6,8
Formulation 3	6,49	7,00	7,64	7,0

A good gel pH value is 4.5 – 7.0 or in accordance with the pH value of human skin. The resultsof the pH test showed that the gel preparations of all formulas met the requirements and had a stable average pH value of between 4.95-7.0 during the testing process (Pricillya, 2019).

- Viscosity Test

The results obtained can be seen in the table below:

Table 8. Viscosity Test Results

Formulas	Replication (cPs)			Average (cPs)
	1	2	3	
Control –	9811	9810	9812	9811
Formulation 1	9811	9812	9810	9811
Formulation 2	9808	9804	9777	9796
Formulation 3	9810	8520	8582	8970
Control +	9797	9370	9675	9614

Viscosity testing functions to determine the viscosity (thickness) of the gel. Viscosity is a parameter that describes the amount of resistance a liquid has to flow. The greater the resistance, the greater the viscosity. Viscosity determination was carried out using a Brookfield Viscometer using spindle number 1 and at a speed of 60 rpm. The results of viscosity testing of galangal rhizome extract gel preparations for formulation 1 showed an average value of 9811 cP, for formulation 2 the value was 9796 cP and for formulation 3 it had an average value of 8970 cP forthe negative control with a value of 9811 cP and the positive control with a value of 9614 cP. Thisshows that the viscosity value of the gel preparation is good, because it meets the viscosity standard, namely 2000-4000 cP (Muazham, 2017). Meanwhile, the average value of the three formulas exceeds the specified viscosity value.

- Spreadability Test

The results obtained can be seen in the table below:

Table 9. Spreadability Test Results

Formulas	Replication (cm)			Average (cm)
	1	2	3	
Control –	5,3	5,3	5,2	5,2
Formulation 1	3,0	3,5	4,7	3,7
Formulation 2	4,4	4,6	5,1	4,7
Formulation 3	5,3	4,8	5	5,0
Control +	5,0	5,1	5,2	5,1

The spreadability of the gel is said to be good if the diameter is around 5 – 7 cm. The

measurement of the diameter of the spreadability of the gel was carried out when the gel was addedafter adding a load of 150 grams. The diameter of the gel spreadability in formula 1 and formula 2shows that both formulas do not meet the requirements with an average diameter of spreadability of 4.7 cm. In formula 3, it has a spreadability diameter of 5.0 cm, control - has a spreadability

diameter of 5.2 cm, and control + has a spreadability diameter of 5.1 cm. This shows that the threeformulas (formula 3, control - and control +) meets the requirements for good spreadability becausethe results of the spreadability test show an average diameter of 5 – 5.2 cm (Lasut, *et al*., 2019).

- Adhesion Test

The results obtained can be seen in the table below:

Table 10. Adhesion Test Results

Formulas	Replication (Seconds)			Average (Second)
	1	2	3	
Control -	02,70	02,93	02,90	2,84
Formulation 1	01,50	01,72	0,92	1,38
Formulation 2	01,65	01,58	01,00	1,41
Formulation 3	01,38	0,93	01,19	1,16
Control +	02,04	01,80	01,97	1,93

A gel adhesion test was carried out to be able to determine whether the preparation adhered to the skin. The general characteristic of gel preparations is that they are able to stick to the surface where they are applied for quite a long time before the preparation is washed or cleaned. The longerthe adhesion of the gel preparation, the better the gel preparation. The results of the adhesion test ofthe galangal rhizome gel preparation showed that the adhesion power of each gel preparation was different. Formulation 1 has an average value of 1.38 seconds, formulation 2 has an adhesion of 1.41seconds and for formulation 3 has an average value of 1.16 seconds, for the negative control the value is 2.84 seconds and for the positive control the value an average of 1.93 seconds means thereis a significant difference between each formula. There are no special requirements regarding the adhesion of semisolid preparations (Hariningsih, 2019). However, the adhesion of the gel preparation should be more than 1 second (Sukartinibgsih, 2019).

Q. Minimum Inhibitory Concentration Testing (KHM)

Formulas	Replication (mm)		
	1	2	3
Control –	+	+	+
Formulation 1	++	++	++
Formulation 2	+	+	+
Formulation 3	-	-	-
Control +	-	-	-

Description: +++ very turbid, ++ : turbid, + : slightly turbid, - : clear

Determination of the inhibitory concentration for drinking is to determine the minimum concentration of 96% kencur rhizome ethanol extract which can inhibit bacterial growth. The minimum inhibitory concentration of the ethanol extract of kencur rhizomes against different test bacteria can be seen in the concentration determining the diameter of the inhibitory zone. In this study, MIC determination was carried out on test bacteria using ethanol extract concentrations of galangal rhizomes of 10%, 15% and 20%. Determination of MIC is carried out by controlling media contamination, controlling the growth of test bacteria and negative control. A test solution concentration is said to be an MIC if the dilution results show clear

results, which means the test solution can inhibit bacterial growth (Satriyajati, 2010). the three formulas, namely formula 1 with a concentration of 10%, show that there is turbidity for formula 2 with a concentration of 15%, it is slightly cloudy and for formula 3 the concentration is 20%, namely clear. Of the three formulas, the best is formula 3. This proves the antibacterial power of the galangal rhizome extract formula with a high concentration. Research (Rahmawati, 2014) states that bacteria will be killed more quickly if theconcentration of active antibacterial substances is higher.

R. Antibacterial Testing of Gel Preparations

The results obtained can be seen in the table and figure below:

Table 11. Antibacterial Test Results for Gel Preparations

Formulas	Replication (mm)			Average (mm)
	1	2	3	
Control –	0	0	0	0
Formulation 1	10,32	9,64	9,13	9,69
Formulation 2	13,43	11,54	9,52	11,49
Formulation 3	13,98	9,68	12,40	12,02
Control +	28,72	26,77	30,97	28,82

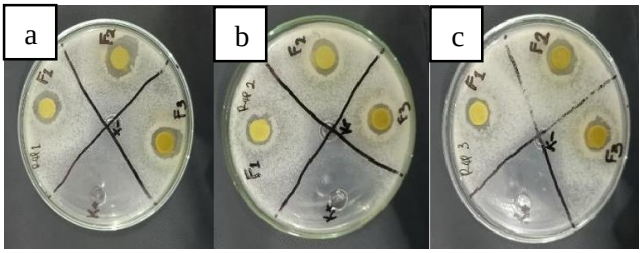

Figure 4. Inhibition Zone Results of Galangal Rhizome Extract Gel Preparation Information :

a: Results of the inhibition zone of extract gel (10, 15, 20%) of replication 1b: Results of the inhibition zone of extract gel (10, 15, 20%) of replication 2c: Results of the inhibition zone of extract gel (10, 15, 20%) of replication 3

Antibacterial testing uses the well diffusion method. The inhibition zone of a good bacteria, namelywith an inhibition zone diameter of less than 5 mm, is categorized as weak, 5-10 mm is categorized as medium, 10-20 mm is categorized as strong, and 20 mm or more is categorized as very strong. Based on the results of the antibacterial test on the galangal rhizome extract gel preparation, it was found that the inhibition zone in formula 1 was 9.69 mm. This indicates that with a concentration of 10%, the galangal rhizome extract has a medium category of antibacterial inhibition. The inhibition zone in formula 2 is 11.49 mm with a concentration of 15% and formula 3 is 12.02 mm with a concentration of 20% in the strong category. Meanwhile, the control formula + was 28.82 mm, indicating that the addition of the active substance in the form of clindamycin had a very strong antibacterial inhibitory power. Thus, it can be concluded that the galangal rhizome extract gel preparation has inhibitory power against the growth of Staphylococcus epidermidis bacteria. The higher the concentration of galangal rhizome extract used, the higher the inhibitory power produced (Surjowardojo, 2016).

S. Analysis of Results

Based on the results of data analysis carried out using SPSS 22, homogeneous results were obtained for the galangal rhizome extract. Normality test was carried out with Kolmogorov-Smirnov. Data is normally distributed if Sig > 0.05 and if Sig < 0.05 then the data is not normally distributed (Surjarweni, 2012). Normally distributed data was then analyzed

using One Way Anova. Data is accepted if Sig < 0.05. The One-Way Anova assumption is carried out with a homogeneity test whichaims to test the similarity (homogeneity) of several samples, namely whether or not the variations in samples taken from the same population are uniform (Muadifah, 2019). Homogeneity testing was carried out using Levene statistics. The variation test of galangal rhizome extract showed that the normality test with Kolmogorov-Smirnov produced a Sig of 0.200, which means the data has a normaldistribution to be continued in the Homogeneity of variences test. and obtained an ANOVA test resultof 0.000.

CONCLUSIONS

Based on the research results, it can be concluded as follows:

1. Gel preparations of ethanol extract of galanga rhizome (*Kaempferia galanga* L) with concentrations of 10%, 15% and 20% ethanol extract of kencur rhizome have an effect on the inhibition zone of *Staphylococcus epidermidis* bacteria. Where the higher the concentration of kencur rhizome ethanol extract, the larger the zone of inhibition obtained.
2. Galangal rhizome ethanol extract gel preparation with a concentration of 20% is a formula that has the highest diameter of the inhibition zone for *Staphylococcus epidermidis* bacteria comparedto concentrations of 10% and 15%.

REFERENCES

Andriyawan, F. (2015). Uji Aktivitas Antibakteri Ekstrak Etanol Daun Cengkodok (*Melastoma Malabathricum* L.) Terhadap *Escherichia Coli* Secara In Vitro

Antika, R. (2019). Uji Aktivitas Antibakteri Ekstrak Buah Pedada (*Sonneratia caseolaris* L.) Terhadap *Staphylococcus epidermidis*. palembang: Program Studi Pendidikan Biologi Fakultas Kegurusn Dan Ilmu Pendidikan Universitas Muhammadiyah Palembang Agustus 2019.

Hayati, E. K., Ningsih, R., & Latifah. (2015). Antioxidant Activity of Flavonoid from Rhizome Kaemferia galanga L. Extract. ALCHEMY: Journal of Chemistry,, 127-137.

Hayati, L. N., Tyasningsih, W., Praja, R. N., Chusniati, S., Yunita, M. N., & Wibawati, P. A. (2019).Isolasi dan Identifikasi *Staphylococcus aureus* pada Susu Kambing Peranakan Etawah PenderitaMastitis Subklinis di Kelurahan Kalipuro, Banyuwangi. *Jurnal Medik Veteriner*, 2, 76-82.

Ilhani, A. F., & Ismedsyah. (2018). Uji Aktivitas Antibakteri Kombinasi Ekstrak Etanol Rimpang Kencur (*Kaempferia galanga* L) Dan Ekstrak Etanol Daun Sawo (*Manilkara zapota* L) Pada Bakteri *Escherichia coli*. Jurnal Pelita Informatika, 338-342.

Muadifah, A., Putri, A. E., & Latifah, N. (2019). Aktivitas Gel Ekstrak Rimpang Kunyit (Curcuma Domestica Val) Terhadap Bakteri *Staphylococcus aureus. Jurnal Sain Health*, 45-54.

Pertiwi K, M., Wulandari, K. K., Rodja, H. A., Urjiyah, U. G., Fibriani, E., & Putri, F. A. (2021). Teknik Diagnostik Konvensial Dan Lanjutan Untuk Infeksi Bakteri Dan Resistensi Antibakteri Di Indonesia. 12(98-116).

Pertiwi, R. D., Kristanto, j., & Praptiwi, G. A. (2016). Uji Aktivitas Antibakteri Formulasi Gel Untuk Sariawan Dari Ekstrak Daun Saga (*Abrus precatoriusLinn*.) Terhadap Bakteri *Staphylococcus aureus*. 2(239-247).

Prihannensia, M., Winarsih, S., & Achmad, A. (2018). Uji Aktivitas Sediaan Gel dan Ekstrak Lengkuas (*Alpinia galanga*) terhadap Bakteri *Staphylococcus epidermidis* secara In

Vitro. (23- 28).

Rahmadani, F. (2015). Uji Aktivitas Antibakteri Dari Ekstrak Etanol 96% Kulit Batang Kayu Jawa(Lannea coromandelica) Terhadap Bakteri *Staphylococcus aureus, Escherichia coli, Helicobacter pylori, Pseudomonas aeruginosa.*

Sambou, C. N., Wibowo, A. E., & Taurhesia, S. (2017). Pengembangan Produk Sediaan Gel Kombinasi Ekstrak Daun Sirsak (Annona muricita L.) Dengan Ekstrak Rimpang Temulawak (*Curcuma xanthorhiza Roxb*.) Sebagai Anti Bakteri Penyebab Jerawat (*Propionibacterium acnedan Staphylococcus epidermidis). 6(2302 - 2493).*

Sampelan , M. G., Pangemanan , D., & Kundre , R. M. (2017). Hubungan Timbulnya Acne Vulgaris Dengan Tingkat Kecemasan Pada Remaja Di Smp N 1 Likupang Timur. *Journal Keperawatan*.

Sepriani, O., Nurhamidah, & Handayani, D. (2020). *Potensi Ekstrak Tumbuhan Andaliman (Zanthoxylum acanthopodium DC.) Sebagai Antibakteri Staphylococcus aureus.* Bengkulu:*Jurnal Pendidikan dan Ilmu Kimia*.

Setyaningrum, E. (2018). Aktivitas Antibakteri Fraksi Etil Asetat Daun Sirsak (Annona muricata L.) Terhadap Pertumbuhan *Staphylococcus aureus*. Surakarta : Program Studi DIII Farmasi Sekolah Tinggi Ilmu Kesehatan Nasional Surakarta.

Sibero, H. T., Putra, I. W., & Anggraini, D. I. (2019). Tatalaksana Terkini Acne Vulgaris. *JK UNILA, 3*, 313-320.

Sukartinibgsih, Y. N., Edy, H. J., & Siampa, J. P. (2019). Formulasi Sediaan Gel Ekstrak Etanol Daun Kaliandra (*Calliandra surinamensis benth*) Sebagai Antibakteri. Pharmacon, 801-808.

Thomas, N. A., Abdulkadir, W., & Mohi, M. A. (2019). Formulasi Dan Uji Efektivitas Gel Ekstrak Buah Pare (Momordica charantia L) Terhadap Bakteri *Staphylococcusepidermidisdan Propionibacterium acnes Penyebab Jerawat. 2(46-60).*

Utami, P. L., Tandean, G. P., & Liliawanti. (2020). Pengaruh Pemberian Ekstrak Kencur (Kaempferia galanga L.) terhadapPeningkatan Zona Hambat Pertumbuhan Bakteri *Staphylococcus aureus*. *Jurnal Ilmiah Kedokteran Wijaya Kusuma*, 145-155.

Wahdaningsih, S., Untari, E. K., & Fauziah, Y. (2014). Antibakteri Fraksi n-Heksana Kulit Hylocereus polyrhizusTerhadap *Staphylococcus epidermidis* dan *Propionibacterium acnes*. *1*(180-193).