Formulation and Antibacterial Activity Test of Emulgel Containing *Citronella Oil* (*Cymbopogon Nardus* L.) with Variaton of Gelling Agent *Carbomer*

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Abstract: *Citronella oil* is the most volatile oil against *Propionibacterium acnes.* An emulgel preparation is made on a carbomer base because it has better release properties of the active substance compared to other bases. The research purpose was to determine the emulgel variation with *carbomer* base 0.5%, 1.0%, and 1.5% containing 2% *Citronella Oil* (*Cymbopogon nardus* L.) on the physical, chemical characteristic and the inhibition of *Propionibacterium acnes* bacteria growth. Emulgel with carbomer base made 3 formulations, namely F1 (0.5%), F2 (1%), and F3 (1.5%) with citronella oil content of 2%. The physical characteristics of the organoleptic, viscosity, homogeneity, dispersal, emulsion type, pH and stability (real time and freeze thaw) tests were performed. Antibacterial testing using the Agar Well Diffusion method. The organoleptic tests on FI (0.5%), FII (1%), and FIII (1.5%) were soft, white and has lemongrass odor. The results of one way Anova statistic showed that there were not significantly different for pH, dispersion, stability (freeze thaw and real time). The viscosity test was significantly different. The diameter of the inhibition zone of each formula has a mean of formula 1 was 12.65 mm formula 2 was 11.58 mm, and formula 3 was 10.25 mm. The conclusion of this experimentally is the effect of variations in emulgel based on 0.5%, 1.0%, and 1.5% carbomers containing 2% *Citronella Oil* on the growth of *Propionibacterium acnes* bacteria has significant difference which means that increasing carbomer levels it can significantly reduce the zone of antibacterial inhibition.

1 INTRODUCTION

Acne or acne vulgaris is a dermatological disease that affects about 80-85% of adolescents globally. Acne is triggered by some species of skin flora such as Propionibacterium acnes and Staphylococcus aureus which are gram-positive bacillus bacteria found in human skin microbiota (Lynn *et al.*, 2016; Ishimura *et al.*, 2018). In people who do not get acne levels of linoleic acid (LA) in sebum and sphingolipid levels in the stratum corneum is higher than in patients with acne (Jin and Lee, 2018).

In the treatment of acne until now, still using antibiotic therapy, which is commonly used is clindamycin because it is considered very useful for treating microbial infections even though it only lasted a few decades. The weakness of this antibiotic that is antibiotic resistant can be transmitted between individuals because the bacterium Propionibacterium acnes can be resistant at certain times (Liu *et al.*, 2014; Walsh, Efthimiou and Dréno, 2016; Yang *et al.*, 2018). So it is necessary to replace active ingredients that function as new antibiotics (Faleiro and Miguel, 2013; Yang *et al.*, 2018).

Lemongrass comes from the Poaceae family, which has pharmacological potential for medicinal plants. Studies show that citronella has antiviral, antibacterial and antifungal activities. The main chemical elements are Oxygen containing monoterpenes, citronellal, geraniol, geranial, citronellol and neral (Lertsatitthanakorn *et al.*, 2010; Shah *et al.*, 2011; De Toledo *et al.*, 2016).

Cymbopogon nardus oil (Citronella oil) is the most active oil against Propionibacterium acnes that has (MIC 0.005-0.3 μL / mL) (MBC 0.625 μL / mL) (Sarlina, Razak and Tandah, 2017). The main target of lemongrass oil is destroying bacterial cell walls and damaging bacterial intracellular material that can

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cause bacterial death Propionibacterium acnes (Bota, Martosupono and Rondonuwu, 2015). Gel dosage forms are better used in the treatment of acne compared to cream dosage forms because this is a gel preparation with polar solvents that is easier to clean from the surface after being used and does not contain oils that can increase the severity of acne (Anggraini, Rahmawati and Hafsah, 2013; Garg, Rath and Goyal, 2015).

The purpose of this study was to determine the variation of emulgel with a carbomer base of 0.5%, 1.0%, and 1.5% containing 2% Citronella Oil to the growth of Propionibacterium acnes bacteria in vitro.

2 METHODS

Materials

The research materials used are Citronella oil, Carbomer, Sorbitan Monolaurate, Polysorbate 80, Propylene glycol, Methylparaben, Propylparaben, BHT, Aquadest (PT. Bratacho), and Triethanolamine from (CV. Jayarindo Pratama), Propionibacterium acnes bacteria and positive control of clindamycin gel were obtained from the Microbiology Laboratory Research Center of FKG Airlangga for testing the activity of emulgel citronella oil.

Methods

The process of making an antibacterial type emulgel (m / a) begins by developing a carbomer added with heated aqua dest ad at a temperature of 700C in the wait and waiting for the ad to expand and adding Triethanolamine as an Alkalizing Agent ad reaching a pH of 7, then carried out by mixing the entire oil phase, namely: Propylparaben, Toluene Hydroxy Butyl, Sorbitan Monolaurate, done in a glass beaker (1) then mixed with the water phase, namely: Methylparaben, Polysorbate 80, Propilengikol, and water. The materials were melted using water bath into one phase at 70□C. After that, an emulsion was made by mixing the oil phase into the water phase and stirred homogeneously. Nearly at the end of the emulsification process, the lemongrass oil added and stirred homogeneously. The emulsion mixture has formed mixed into a gelling agent (carbomer). After the emulgel is formed, it is placed in a container that has been prepared and ready for testing (Razak et al., 2017).

3 RESULTS AND DISCUSSION

Organoleptic test results showed the characteristics of white preparations, soft texture, and the distinctive aroma of citronella oil. Physically, the emulgel preparations appear homogeneous and free from lumps of insoluble particles.

Table 1: Formulation of *Citronella oil emulgel*

Materials	Function	Kontrol - (%)	F1 (%)	F2 (%)	F3 (%)
Citronella Oil	Active Ingredients	-	2,0	2,0	2,0
Carbomer	*Gelling agent*	0,5	0,5	1,0	1,5
Triethanolamine (TEA)	*Alkalizing Agent*	q.s	q.s	q.s	q.s
Sorbitan Monolaurate (Span 20)	Surfactants	2,34	2,34	2,34	2,34
Polysorbate 80 (Tween 80)	Surfactants	2,66	2,66	2,66	2,66
Propylenglycol	Humectant	5	5	5	5
Methyl paraben (Nipagin)	Preservatives	0,1	0,1	0,1	0,1
Propyl Paraben (Nipasol)	Preservatives	0,1	0,1	0,1	0,1
Butyl Hidroxy-toluene (BHT)	Antioxidants	0,03	0,03	0,03	0,03
Purified Water	Solvent	Ad 100	Ad 100	Ad 100	Ad 100

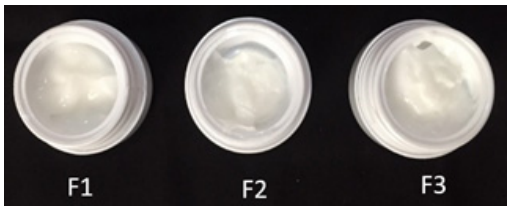

Figure 1: The appearance of the emulgel preparation

Citronella oil gives good results in the antibacterial activity test of Propionibacterium acnes (Figure 2). It can be seen from the figures that show that an increase in the volume of citronella oil causes an increase in the inhibition zone. Based on the results of the antibacterial test of Citronella oil, the diameter at K + is 19.00, 1 µl 7.00 5 µl 9.00 10 µl 11.00, this proves that Citronella oil has antibacterial activity.

The results of measuring the diameter of the emulgel inhibition zone carried out three times of replication. The representative of the outcome, as shown in figure 3 Based on the results of the Citronella oil emulgel test, it was found that the diameter of the positive control inhibition zone was 15.75 mm, formula 1 was 12.80 mm, formula 2 was 11.80 and formula 3 which is 10.40. The second replication results showed that there is a positive control of 15.80 mm, formula 1 is 12.55 mm, formula 2 is 11.40 mm, and formula 3 is 10.20 mm, the third replication results are positive control namely 11.60 mm, formula 1 is 11.60 mm, formula 2 is 12.60 mm and formula 3 is 10.15 mm.

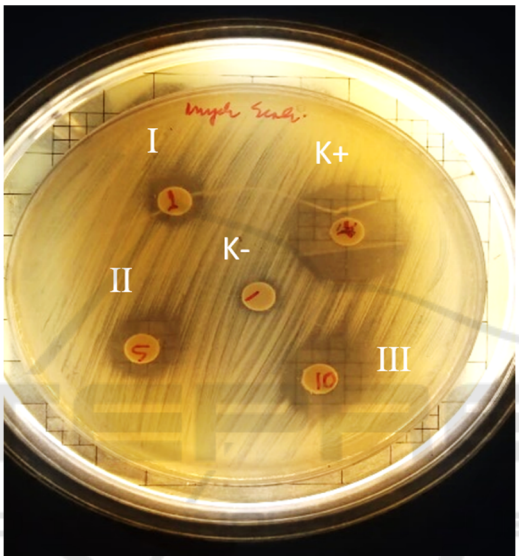

Figure 2: The results of the antibacterial activity test for Citronella oil raw material. K+ was Erythromycin as positive control; K- without Ctronella oil; I, II, and III contained 1µL, 5µL, 10µL Citronella oil, respectively.

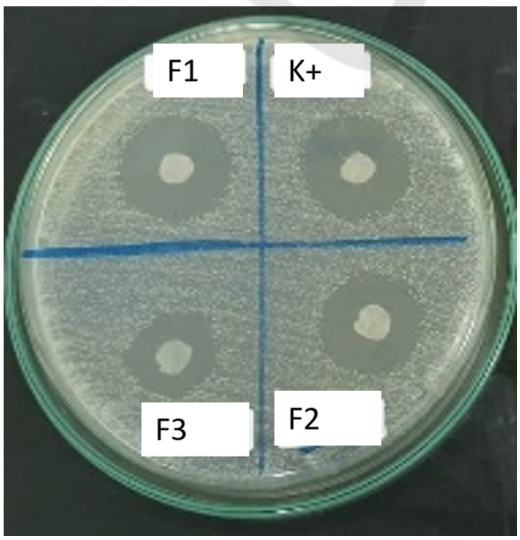

Figure 3: The Results of antibacterial activity amulgel *Citronella oil.* K+ was clindamycin as positive control; K- without Citronella oil; F1, F2, and F3 were formulation 1, 2, and 3, respectively.

Table 2: Measurement results of inhibition zone diameter from *Citronella oil emulgel*

Replication	Inhibition zone diameter (mm)			
	Kontrol +	Formula 1	Formula 2	Formula 3
1	15.75	12.80	11.80	10.40
2	15.80	12.55	11.40	10.20
3	15.60	12.60	11.55	10.15
Average± SD	15.72± 0.10	12.65± 0.13	11.58± 0,20	10.25± 0,13

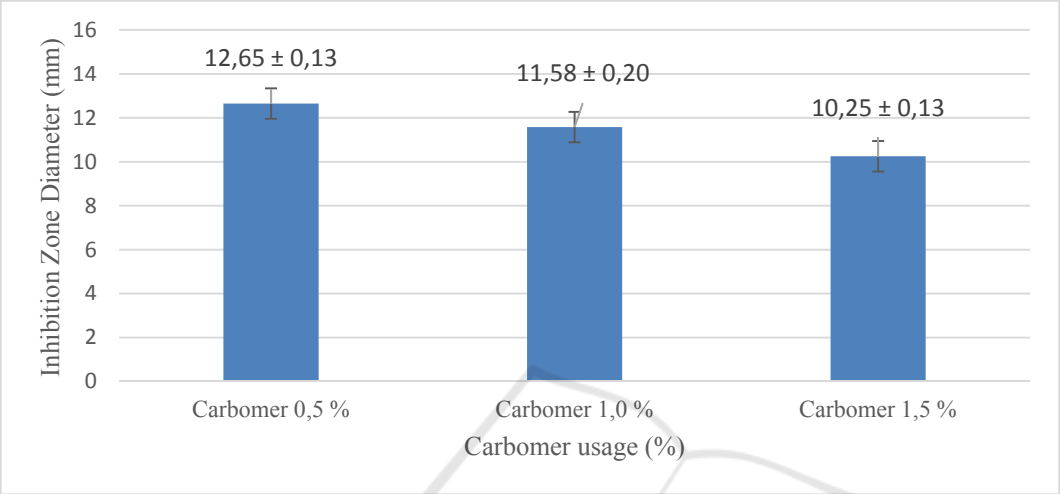

Figure 4: Histogram of inhibition zone diameter from *Citronella oil emulgel*

Anova One-Way Test Results, showed a significance value of 0,000 which means less than 0.05 (p <0.05) so it can be said that there are significant differences between variations in carbomer levels of 0.5%, 1.0%, 1.5 % containing Citronella Oil 2% on the growth of Propionibacterium acnes bacteria in vitro, so it was continued with the Honestly Significant Difference (HSD) test to find out which data were different.

Honestly Significant Difference Test (HSD) (Tukey HSD) shows a significance value of 0,000 which means less than 0.05 (p <0.05 and the results obtained between formula 1 and formula 2 there is a significant difference (p = 0,000) between formula 1 and formula 3 there is a significant difference (p = 0,000) between formula 2 and formula 3 there is a significant difference (p = 0,000) so it can be concluded that there is a significant difference between variations in carbomer levels of 0.5%, 1.0%, 1.5% containing Citronella Oil (Cymbopogon nardus L.) 2% on Propionibacterium acnes bacterial growth in vitro due to the increase in carbomer levels resulting in a decrease in inhibition zone diameter.

4 CONCLUSION

Based on the results of this study it can be concluded that the effect of variations of emulgel with a carbomer base of 0.5%, 1.0%, and 1.5% containing Citronella Oil 2% on the inhibition of Propionibacterium acnes bacteria there is a significant difference which means the higher levels of carbomer can significantly reduce the diameter of the inhibition zone

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