



Research Article

CREAM FORMULATION AND ANTIBACTERIAL TEST FOR ACNE MEDICATION FROM *Michelia Champaca* L. FLOWER EXTRACT

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Article Received on: 03/03/19 Approved for publication: 12/04/19

DOI: 10.7897/2230-8407.1004127

ABSTRACT

Acne is a problem that often arises in skin health, especially at the age of 14-19 years, although it can occur outside this age. The purpose of this study was to formulate and test the antibacterial acne cream from flower extract of *Michelia champaca* L. Acne drug formulations were divided into two types of formulas, namely type w/o and formula o/w, each of which consisted of 3 formulas. Evaluation of formulas included pH, viscosity and physical stability of the cream. *Staphylococcus aureus* ATC25923 and *Staphylococcus epidermidis* ATC12228 were selected for antibacterial tests. Physical stability testing of creams included color stability, odor and homogeneity which indicated no change during 56 days storage. The pH value decreased during time storage, but the pH value was still acceptable to the skin except for type w/o with a concentration of 12 MIC. The dose viscosity increased with increasing storage time. Using a method for dilution, the effect of bacteria decreased during time storage. Conclusions obtained on pH, viscosity, and antibacterial inhibitory power were based on statistics. The results of the study concluded that preparations with formula F3, formula o/w with a concentration of 7.5%, gave the best results. It is recommended to do further research for this cream formula clinically to patients who have acne problems..

Keywords: Acne cream, formulation, *Michelia champaca*, antibacterial, MIC.

INTRODUCTION

Acne, known as acne vulgaris, is a skin condition that occurs when your hair follicles become plugged with oil and dead skin cells. It often causes whiteheads, blackheads or pimples, and usually appears on the face, forehead, chest, upper back and shoulders¹. Opportunities for acne vulgaris are around 80-100% at a young age, namely ages 14-17 years in women and 16-19 years in men. So that it can be said that acne occurs during puberty. However, acne can occur at a younger age or even older than that age. The cause of acne is still uncertain, but various factors that are considered to cause acne are seasonal factors, race factors, hormonal food (still debated), bacterial infections, and psychological factors^{2,3}.

Cempaka (Indonesian) flower (*Michelia champaca* Linn.) as a traditional medicine can be used to treat diseases caused by microorganisms such as gonorrhoea, leucorrhoea, fever, leprosy, cough, ulcer, abdominal colic, rheumatism, constipation, dysmenorrhoea, bronchitis, wounds, other disorders. Also, this plant possesses numerous pharmacological properties such as antimicrobial, antipyretics, anti-inflammatory, antioxidant, insecticidal, antidiuretic, febrifuge, carminative, antidiabetic, stimulant, antispasmodic, tonic, stomachic, purgative, expectorant, cardiotoxic, digestive, stimulant, diuretic, diaphoretic, antipyretic and astringent⁴. Compounds namely flavonoids, alkaloids, sterols, saponins, triterpenoids, tannins were identified and characterized^{5,6}. Khan *et.al*⁷ mentioned methanol extracts of leaves, seeds, stem, and root barks, stem and root heart-woods of *M. champaca* and the obtained fractions

(petrol, dichloromethane, ethyl acetate, butanol) exhibited a broad spectrum of antibacterial activity. The flowers of *M. champaca* have been shown to contain the flavonoid quercetin and an unidentified flavonoid glycoside besides β -sitosterol, unsaturated aliphatic ketones, and hydrocarbons⁸.

There have been no reports regarding the anti-acne cream of *M. champaca* Linn extracts. Therefore, this study carried out to formulate cream and its antibacterial test for acne medication from Chrysanthemum flower extract. The statistic cream preparation evaluation and anti-bacterial activity against *Staphylococcus aureus* and *Staphylococcus epidermidis* were carried out for 56 days.

MATERIALS AND METHODS

Materials

Plant material: Cempaka flower buds were collected from the Bogor Botanical Gardens, West Java and determined at the Taxonomy Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Padjadjaran. The sample was then cleaned from impurities in both soil and other objects, cut into pieces and dried in the open air without being exposed to sunlight.

Extractions: Dried cempaka was chopped and blended until it became powder, put into the macerator, then soaked with solvent. The 3,000-gram powder was extracted using the maceration method using 70% ethanol as its solvent based on modification method of Kusuma *et.al*⁹. The extract was concentrated using a

rotary evaporator at a temperature of 40-50°C and continued by using a water bath at a temperature of 40-50°C to obtain a dry extract with a constant weight.

Formulation: Three formula of each o/w and w/o type creams as shown in Table 1.

Evaluation of the formula: This test included testing physical properties and microbiological testing.

Testing physical properties: this included testing for color and odor changes, homogeneity, pH, viscosity, and safety testing (irritation),

Microbiological testing: this included testing of MIC determination by means of tube dilution, determination of the inhibitory diameter of the extract by means of discs, and determination of the inhibitory diameter of the extract by cylinder

Statistical methods: Interpretation of results of parts A and B, analyzed statistically.

RESULTS

Table 1: Acne cream formula

Composition	O/W Formula (gram)				W/O	Formula (gram)			
	F1	F2	F3	F4		F5	F6	F7	F8
Cempaka extract	-	4 MIC	8 MIC	12 MIC	-	4 MIC	8 MIC	12 MIC	
Stearic acid	14.20	14.20	14.20	14.20	-	-	-	-	
Glycerin	10 mL	10 mL	10 mL	10 mL	-	-	-	-	
Borax	0.25	0.25	0.25	0.25	-	-	-	-	
Triethanolamine	1.00	1.00	1.00	1.00	-	-	-	-	
Liquid Paraffin.	-	-	-	-	55.00	55.00	55.00	55.00	
Cera alba	-	-	-	-	8.00	8.00	8.00	8.00	
Spermaceti	-	-	-	-	8.00	8.00	8.00	8.00	
Borax	-	-	-	-	0.50	0.50	0.50	0.50	
Aqua dest.	75.00	75.00	75.00	75.00	28.50	28.50	28.50	28.50	

Notes: (o/w) Oil in water, (w/o) Water in oil, F1& F5 Formula control, F2, F3,F4, F6 F7, F8 formula with different Cempaka extract

Table 2.: Organoleptic observations of the Cempaka flower extract preparations

Formula	Colour	Odor	Homogeneity
F1	white	-	Homogeneous
F2	light brown	typical	Homogeneous
F3	brown	typical	Homogeneous
F4	dark brown	typical	Homogeneous
F5	white	-	Homogeneous
F6	light brown	typical	Homogeneous
F7	brown	typical	Homogeneous
F8	dark brown	typical	Homogeneous

Notes: (F1, F5) formula control, (F2, F3,F4) formula O/W with 4, 8, 12 MIC, (F6,F7,F8) formula w/o with 4,8,12 MIC.

Table 3: pH measurement results at a time interval of 56 days

Formula	Storage (days)									
	0	3	7	14	21	28	35	42	49	56
F1	7.50	7.47	7.39	7.30	7.16	7.00	6.84	6.71	6.60	6.45
F2	7.48	7.46	7.32	7.16	6.93	6.81	6.68	6.51	6.43	6.29
F3	7.43	7.41	7.27	7.10	6.87	6.70	6.58	6.41	6.36	6.23
F4	7.40	7.38	7.20	7.00	6.79	6.61	6.43	6.30	6.16	6.05
F5	8.13	8.09	7.98	7.76	7.59	7.48	7.36	7.22	7.06	6.91
F6	7.52	7.50	7.41	7.24	7.10	6.87	6.72	6.53	6.73	6.21
F7	6.94	6.91	6.80	6.67	6.47	6.23	6.16	6.00	5.89	5.73
F8	6.60	6.57	6.48	6.22	6.13	5.91	5.77	5.60	5.42	5.29

Notes: (F1, F5) formula control, (F2, F3,F4) formula O/W with 4, 8, 12 MIC, (F6,F7,F8) formula W/O with 4,8,12 MIC.

Table 4.: Viscosity measurement results (poise) at a time interval of 56 days

Formula	Storage (days)									
	0	3	7	14	21	28	35	42	49	56
F1	56.5	29.0	34.5	55.0	76.5	98.0	121.0	146.0	164.0	181.0
F2	24.0	26.0	31.0	34.0	39.0	44.5	50.0	63.0	71.0	80.0
F3	22.0	23.0	27.0	30.5	34.0	38.0	43.0	52.0	60.0	69.0
F4	20.0	21.5	23.0	26.5	30.0	34.5	39.5	46.0	53.0	61.0
F5	64.0	81.5	93.5	118.0	144.0	180.0	200.0	220.0	240.0	260.0
F6	31.0	38.0	43.0	52.5	58.0	69.0	78.0	89.0	102.0	111.0
F7	25.5	28.0	33.0	36.0	44.0	51.5	59.0	70.0	78.5	90.0
F8	17.0	18.00	22.0	29.0	37.0	45.5	50.0	59.0	69.0	76.0

Notes: (F1, F5) formula control, (F2, F3,F4) formula O/W with 4, 8, 12 MIC, (F6,F7,F8) formula W/O with 4,8,12 MIC.

Table 5: Observation of inhibitory diameter (mm) of formula against *S.aureus* bacteria

Formula	Storage (days)				
	0	7	14	28	46
F1	-	-	-	-	-
F2	12.28±0.08	12.20±0.05	12.13±0.06	12.03±0.08	11.93±0.08
F3	13.13±0.08	13.12±0.03	13.05±0.05	12.97±0.08	12.95±0.05
F4	14.18±0.13	14.13±0.03	14.07±0.03	13.98±0.06	13.95±0.05
F5	-	-	-	-	-
F6	11.37±0.06	11.32±0.03	11.27±0.06	11.18±0.03	11.18±0.03
F7	12.27±0.12	12.25±0.05	12.22±0.08	12.18±0.03	12.17±0.03
F8	13.60±0.05	13.60±0.05	13.55±0.05	13.52±0.03	13.47±0.03
P	14.75±0.05	14.77±0.03	14.72±0.03	14.73±0.06	14.75±0.09

Notes: (F1, F5) formula control, (F2, F3,F4) formula o/w with 4, 8, 12 MIC, (F6,F7,F8) formula w/o with 4,8,12 MIC. (P) innovator products

Table 6: Observation of inhibitory diameter (mm) of formula against *S.epidermidis* bacteria

Formula	Storage (days)				
	0	7	14	28	46
F1	-	-	-	-	-
F2	12.15±0.05	12.13±0.06	12.10±0.05	12.07±0.06	12.02±0.10
F3	13.00±0.05	12.95±0.05	12.95±0.05	12.93±0.03	12.90±0.05
F4	13.98±0.03	13.97±0.08	13.93±0.03	13.938±0.06	13.88±0.03
F5	-	-	-	-	-
F6	11.15±0.09	11.10±0.05	11.05±0.05	11.02±0.06	11.01±0.03
F7	12.55±0.05	12.53±0.06	12.50±0.06	12.50±0.06	12.48±0.03
F8	13.47±0.03	13.43±0.03	13.42±0.03	13.40±0.08	13.37±0.03
P	14.42±0.03	14.38±0.063	14.42±0.08	14.42±0.08	14.40±0.05

Notes: (F1, F5) formula control, (F2, F3,F4) formula o/w with 4, 8, 12 MIC, (F6,F7,F8) formula w/o with 4,8,12 MIC. (P) innovator products



Fig.1: Anti-bacterial test image of *S. aureus*, (F1) formula control (F2,F3,F4) Formula with cempaka extract

DISCUSSION

Its plant identification from Taxonomy Laboratory showed that the plant was Cempaka, *Chrysanthemum Flower (Michelia champaca L.)*, Family: Magnoliaceae.

The extracted results obtained a dry extract with a yield of 20.5% w/w and the results of observations of organoleptic *M.champaca* were in the form of dry powder, brown, distinctive smell.

For o/w type cream used stearic acid, borax, glycerin, triethanolamine, and cempaka flower extract variations. In the o/w cream, the presence of stearic acid could cause the cream to become softer so that the viscosity was lower. The type of base that has high viscosity would cause the diffusion coefficient of a drug on the basis to be low so that the drug release from the base would be small¹⁰. A small amount of borax was used to aid in emulsification and preserve products¹¹. Glycerine was used for moisturizer¹² whereas the combination of stearic acid and triethanolamine would form a salt which was triethanolamine stearic which was anionic and produced fine grains so that it would stabilize the type of oil emulsion in water or vanishing cream. In the w/o cream the presence of liquid paraffin as an emollient¹³, Cera alba was the base and emulsifier, spermaceti was used as a stiffening agent and emollient in ointments and creams¹² while borax having a similar function as in the o/w cream.

Physical properties: observation of the physical form of Cempaka flower cream preparations with various concentrations of extracts, including color, odor, and homogeneity of the preparation. This was done visually (organoleptically) with results shown in Table 1.

Table 2 showed that cream preparations of various concentrations of Cempaka flower extract had a homogeneous and distinctive smelling form while the cream color depends on the concentration of the extract. It was found that all cream formulas did not show any change in color, odor, and homogeneity in 56 days of storage.

Table 3 showed pH measurement results at a time interval of 56 days.

By using the analysis of the randomized complete block complete design statistics^{15, 16}, the null hypothesis (Ho) was rejected, because the value of F_{count} was greater than F_{table} with significant $\alpha = 0.005$. This showed a significant difference in the pH value of each formula for 56 days of storage. Each formula showed a decrease in pH values, where all formulas of o/w type, pH decrease were still fulfilling skin pH requirements. With the increase of Cempaka flower extract, the value of pH will be lower (acid). For w/o type formulas, formulas with concentrations of 0.0%, 2.5% and 5.0% decreased extracts still

meet skin pH requirements which were around 5.5 to 10¹⁷. This was due to a decreased water content in the preparation so that the acid concentration increased and the pH decreased. The pH value was constant after 52 days of storage.

Table 4 showed the results of measurements of viscosity with an LV type Brookfield tool (in poise). From Table 4 was then analyzed using the analysis of the randomized complete block complete design statistics^{15, 16}, the null hypothesis (H₀) was rejected because the value of F_{count} was greater than F_{table} with significant $\alpha = 0.005$. It meant a significant difference in the viscosity value of each formula for 56 days of storage. In each formula, there was an increase in the value of viscosity during storage time. This was indicated by the increased viscosity of the cream during storage. It might probably due to the reduced water content in the preparation due to evaporation during storage. The greater the concentration of Cempaka flower extract, the more the viscosity decreased because of the water content of the extract.

Safety tests in the form of irritation tests were intended to determine the safety of preparations made during use. Tests were carried out by applying the preparation to be tested on the backs of the volunteers' hands three times a day for three consecutive days. Then observed changes that occurred in the skin. This test was conducted on three volunteers for each formula. It was found of 24 volunteers who used cream preparations, it turned out that none of them had experienced changes in their skin. This showed that all of these formulas did not irritate the skin.

From the results of measurements of the inhibitory diameter area of Cempaka flower extract and formula for *S. aureus* and *S. epidermidis*. it was found that the potential of the o/w type formula was greater than that of the w/o type formula. This was because the active substance or extract was more soluble in water than oil. The use of *S. aureus* and *S. epidermidis* for the test due to the following reasons. *S. aureus* played a role in many mild skin infections, such as acne, it could also cause abscesses and pus in the wound. This bacterium was the most common cause of inflammation and the process of growth in the human skin¹⁸. In acne, *S. aureus* would release fatty acids from lipids and caused tissue irritation. *S. epidermidis*, on the other hand, was a staphylococcus that was not pathogenic, tended not to be hemolytic, and negative coagulation, and did not harm mannitol, It was a normal flora of human skin and respiratory tract and digestive tract.

The results of measuring the inhibitory diameter of the formula against *S. aureus* and *S. epidermidis* are shown in Tables 5 and 6. Based on the literature it was known that the sensitivity of the inhibitory area could be divided into three, namely: the area of the inhibition area of more than 3 mm was a sensitive area, between 2-3 mm was a medium sensitive area and less than 2 mm was a resistant area sensitive. The inhibition area was measured from the edge of the cylinder to the outer boundary of the inhibition area¹⁹ (see Fig. 1). Based on this provision and from tables 5 and 6, the formulas F2, F6 and F7 showed results that were less sensitive to bacteria *S. epidermidis* and *S. aureus* during storage time. Formula F3 showed results that were moderately sensitive for 14 days against *S. epidermidis* bacteria after which the results were less sensitive or resistant. Formula F3 gave moderate sensitive results for 56 days of storage against *S. aureus*. F4 and F8 showed sensitive results for 56 days of storage against both bacterias.

From the results of statistical data processing, using a 2x3x5 factorial design for measuring the diameter of two types of preparations with three concentrations of Cempaka flower on the storage time, obtained the F_{calculated} value greater than F_{table},

with $\alpha = 0.05$, for factor A), factor B (concentration), factor c (time) and interaction of factor A and factor B.

This identified the real difference between the formula type o/w and the type w/o where the formula type o/w was better than type w/o. There was a real difference from variations in concentration, where greater concentrations would provide greater anti-bacterial power. There was an influence of the length of storage time on the anti-bacterial power of the preparation where the longer the storage decreased the anti-bacterial power.

CONCLUSION

Cempaka flower extract cream has a stable shape, color and smell, and homogeneity for 56 days of storage. Of the eight formulas made all of which do not irritate the skin. During storage, the cream of Cempaka flower extract decreases pH but is still within the pH interval of the skin. The viscosity of the formula has increased its viscosity value during storage caused by evaporation of water. From the overall results of the study, it can be concluded that the best preparation to use is a formula with formula F3 which is an o/w formula with 8 MIC equal to an extract concentration of 7.5% w/w.

ACKNOWLEDGMENT

We thank Fachrizal for technical support.

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Cite this article as:

Dolih Gozali and Resmi Mustarichie. Cream formulation and antibacterial test for acne medication from *Michelia Champaca* L. flower extract. Int. Res. J. Pharm. 2019;10(4):73-77 <http://dx.doi.org/10.7897/2230-8407.1004127>

Source of support: Nil, Conflict of interest: None Declared

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