

FORMULATION AND EVALUATION OF HERBAL ANTIBACTERIAL GEL CONTAINING ETHANOLIC EXTRACT OF *MIKANIA MICRANTHA* KUNTH LEAVESNINA IRMAYANTI HARAHAP^{1*}, MARLINE NAINGGOLAN², URIP HARAHAP²¹Department of Biological Pharmacy, Faculty of Pharmacy, University of Sumatera Utara, Medan, Indonesia. ²Department of Pharmacology, Faculty of Pharmacy, University of Sumatera Utara, Medan, Indonesia. Email: ninaharahap17@gmail.com

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ABSTRACT**Objective:** This study was to check the effectiveness of *Mikania micrantha* Kunth against the microbial species of *Staphylococcus epidermis*, to observe the zone of inhibition, and to develop a topical gel formulation of *M. micrantha* Kunth for the treatment of acne vulgaris.**Methods:** The extraction was done by maceration method and continues with phytochemical screening and herbal gel formulation (four formulas) using hydroxypropyl methylcellulose as a base. The gel was evaluated for the physical appearance, pH, homogeneity, and antibacterial.**Result:** The ethanolic extract of *M. micrantha* Kunth had a high value of alkaloids, flavonoids, and tannins. All of the formula (F1-F4) showed a good result in physicochemical and antibacterial evaluation.**Conclusion:** *M. micrantha* Kunth can be used to treat the skin diseases, especially acne vulgaris problem.**Keywords:** Acne, Extract, Gel, Herbal, *Mikania micrantha* Kunth, *Staphylococcus epidermis*.© 2018 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>) DOI: <http://dx.doi.org/10.22159/ajpcr.2018.v11i3.22211>**INTRODUCTION**

Acne vulgaris is one of the most common diseases of the skin with a prevalence of 70–85% in adolescents, and in cases of extreme disfigurement, sometimes have severe consequences for the personality development of young people, which is associated with a relatively high prevalence of depression and suicide [1,2]. Many patients fail to improve with the current anti-acne therapy due to the cost of therapy, adverse effects leading to non-compliance, or lack of the therapeutic benefits of current antibiotics, while clinically useful antibiotics are facing major setbacks, including a narrow spectrum of activity, neurotoxicity, nephrotoxicity, ototoxicity, severe damage of liver, bone marrow depression, and sound problem of resistance [3-6].

Consequently, attention has been devoted to safe, new, and/or alternative antimicrobial materials in the field of antimicrobial therapy [7]. Therefore, studies and measures must be taken to reduce these problems such as advocated some strategies include knowing the use of antibiotics, studying the genetic mechanisms of resistance, formulating the new effective solution, and developing new antimicrobials from different sources such as natural product [8]. The most effective drug delivery system for skin diseases is using the topical way. A topical drug delivery system designed to deliver a variety of drugs to the body through diffusion across the skin layers while the effectiveness of topical application mainly depends on its rate and extent of drug release from the base [9].

Formulation for enhancing the effectiveness of extract (*Mikania micrantha* Kunth plant) on human skin using HPMC as gel's base. HPMC is a semisynthetic, inert, viscoelastic polymer which used in many topical formulations, especially in gel [10]. The gel is a topical preparation that is easily applied to the skin and has an attractive physical appearance compared to other topical preparations. Its use is preferred because these supplies gel contains water that is cooling, smoothing, moisturizing, easy usage, and easily penetrate into the skin, thus giving a faster healing effect in accordance with the base used [11,12].

One of the well-known medicinal plants used in the South Tapanuli district in Sumatera Island, Indonesia, *M. micrantha* Kunth (English-American rope; China-Chinese creeper; and Indonesia-Sambung rambut/Siropaspara) [13]. South Tapanuli societies have been believed that sambung rambut leaves can be used as an antimicrobial and skin diseases treatment. Therefore, the present study was conducted to evaluate the antibacterial gel activity of *M. micrantha* Kunth leaves extract using the standard antibacterial methods and to formulate topical gel, while the gel was evaluated for physical appearance, pH, and homogeneity.

METHODS**Collection of plant material**

The leaves of *M. micrantha* Kunth were obtained from the Sigma Dalan village in Padang Bolak (North Sumatera Province-Indonesia). The authenticated was done by the Indonesian Institute of Sciences, Research Center for Biology.

Preparation of *M. micrantha* Kunth leaves ethanolic extract and gel

Extraction was done by a stratified maceration method using 1000 mg of powdered *M. micrantha* Kunth leaves which were macerated in ethanol solvent for 3 days, then filtered, do it continuously until the filtrate obtained is clear and colorless [14]. For topical gel application (Table 1), gel of ethanolic extract was prepared using simple gel base in four concentrations, i.e., 10%, 12.5%, 15%, and 17.5%.

Phytochemical screening of ethanolic extract

Phytochemical screening carried out on ethanolic includes examining the chemical secondary metabolites of alkaloids, flavonoids, glycosides, tannins, triterpenoids, and steroids [14-16].

Evaluation of gel**Physical appearance**

The physical appearance of the gel was checked visually such as the color, odor, consistency, and greasiness. The observation was conducted for 12 days.

pH determination

The pH of gel was determined using a pH meter.

Homogeneity test

Observation of its homogeneity by applying a certain number of gels on a piece of transparent glass and covered with glass object, then observed. The gel must demonstrate a homogenous and there was no visible presence of grain.

Antibacterial evaluation

The bacterial strain used in the study is *Staphylococcus epidermis* (ATC 12228) which is the main factor of acne vulgaris. The antibacterial gel will be tested using the agar diffusion test. The method of antibacterial was assayed using the standard procedure assay. Antibacterial activity was recorded by measurement of zone of inhibition around each disc in the plate using zone reader. Each assay was performed using triplicate and mean, all the three experiments were taken [10,17]. The standard antibacterial to compare is Bioplacenton®.

Table 1: Formula data for 100 g *M. micrantha* Kunth gel formulation

Ingredients	Quantity			
	F1	F2	F3	F4
<i>M. micrantha</i> Kunth (%)	10	12.50	15	17.50
HPMC (%)	3.50			
Propylene glycol (%)	15			
Methylparaben (%)	0.20			
Ethylparaben (%)	0.05			
Distilled water	q.s			

HPMC: Hydroxylpropyl methylcellulose, *M. micrantha*: *Mikania micrantha*

Table 2: Phytochemical screening result of *M. micrantha* Kunth ethanolic extract

Screening	Ethanol extract
Alkaloids	Positive
Flavonoids	Positive
Glycosides	Negative
Tannins	Positive
Triterpenoid	Negative
Steroids	Negative
Saponins	Negative

M. micrantha: *Mikania micrantha*

Table 3: Summary of physical appearance, pH, and homogeneity of *M. micrantha* Kunth gel

Parameters	Day 0				Day 4			
	F1	F2	F3	F4	F1	F2	F3	F4
Color	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Odor	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable
Greasiness	Non-greasy	Non-greasy	Non-greasy	Non-greasy	Non-greasy	Non-greasy	Non-greasy	Non-greasy
Consistency	Good	Good	Good	Good	Good	Good	Good	Good
pH	6.2	6.2	6.2	6.2	6.2	6.2	6.2	5.9
Homogeneity	Good	Good	Good	Good	Good	Good	Good	Good
Parameters	Day 8				Day 12			
	F1	F2	F3	F4	F1	F2	F3	F4
Color	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Odor	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable
Greasiness	Non-greasy	Non-greasy	Non-greasy	Non-greasy	Non-greasy	Non-greasy	Non-greasy	Non-greasy
Consistency	Good	Good	Good	Good	Good	Good	Good	Good
pH	6.2	6.2	6.2	5.8	6.2	6.2	6.2	5.6
Homogeneity	Good	Good	Good	Good	Good	Good	Good	Good

M. micrantha: *Mikania micrantha*

RESULTS

Phytochemical screening

Screening results of various extract of *M. micrantha* Kunth leaf extract are presented in Table 2.

Evaluation of gel

The result of physical appearance, pH, and homogeneity of *M. micrantha* Kunth gel are summarized in Table 3.

Antibacterial evaluation

Antibacterial testing was done by agar diffusion method. The zone of inhibition was summarized in Table 4 and Fig. 1.

DISCUSSION

The phytochemical screening of crude ethanolic extract of powdered *M. micrantha* Kunth leaves recorded very high values for alkaloids, flavonoids, and tannins compounds. The high values that recorded for the plant extract showed that powdered *M. micrantha* Kunth maybe a good source of antimicrobial, especially as antibacterial agent. Four different gel base (F1–F4) were formulated using a different concentration of *M. micrantha* Kunth. From the evaluation of *M. micrantha* Kunth gel showed that all of the formulas had similar physical appearance, pH and homogeneity.

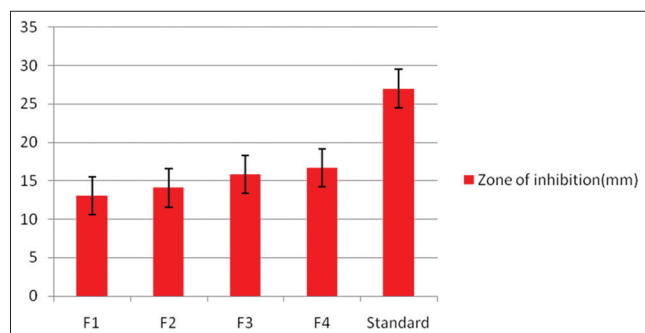
The antibacterial testing method used in this research was the agar diffusion method (Kirby–Bauer) that is by measuring the inhibition zone diameter of bacteria around the paper disc. Inhibitory zone diameter increases with increasing concentration of extract. It can be showed from the zone of inhibition from four formulas in which the F4 is higher, followed by F3, F2, and F1. From the antibacterial assay, the data from the zone of inhibition showed the ethanolic extract of *M. micrantha* Kunth significant activity against *S. epidermis* (ATCC 12228).

Medicinal plants are an important source for the development of new chemotherapeutic agents [18]. Flavonoid and tannin compounds are a class of phenol compounds [19,20], which are known to have antimicrobial activity that is bactericidal but not sporicidal. Phenol compounds act as denaturing agent to membrane plasma of microorganism, which leads to leakage and death of cells [21]. The activity of an antibacterial agent in inhibiting growth or killing bacteria depends on the concentration and type of antimicrobial material. The higher the concentration of the extract, the larger the diameter of the inhibition area is because the more active substances contained in the extract.

Table 4: Antibacterial activity of *M. micrantha* Kunth gel formulation

Name of formula	Culture	Zone of Inhibition in mm*
F1	<i>S. epidermis</i>	13.07 ± 0.2
F2		14.10 ± 0.13
F3		15.83 ± 0.4
F4		16.69 ± 0.1
Bioplacenton®	<i>S. epidermis</i>	26.99 ± 0.15

*Values are given as mean ± SEM for triple measurement. SEM: Standard error of the mean, *M. micrantha*: *Mikania micrantha*, *S. epidermis*: *Staphylococcus epidermis*

**Fig. 1: Graphic of antibacterial effect from *Mikania micrantha* Kunth gel**

CONCLUSIONS

M. micrantha Kunth extract showed a good potential antibacterial agent for *S. epidermis*. The gel of *M. micrantha* Kunth also showed good physicochemical properties which can be concluded that this herbal gel made from *M. micrantha* Kunth can be used to treat the skin diseases, especially acne vulgaris.

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