

## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

The skin is the outermost part of the body, functioning to cover almost the entire external surface. Due to its position as the outermost layer, the skin is easily exposed to external stimuli, making it prone to various issues<sup>1</sup>. One of the most common skin problems is acne. Acne can occur in both men and women<sup>2</sup>. Generally, acne have been experienced by more than 80% of the population aged 12-44 years. However, acne mostly occur during puberty, around the ages of 8-9 years, due to a drastic increase in androgen hormone production, which lead to an increase in keratin sebum secretion. Based on records from the Indonesian Aesthetic Dermatology Research, the percentage of acne vulgaris cases was 60% in 2006, 80% in 2007, and 90% in 2009<sup>3</sup>.

The Prophet Muhammad (peace be upon him) said:

قَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ " إِنَّ اللَّهَ أَنْزَلَ الدَّاءَ وَالذَّوَاءَ وَجَعَلَ لِكُلِّ دَاءٍ دَوَاءً فَتَدَاوُوا وَلَا تَدَاوُوا بِحَرَامٍ " (رواه أبو داود)

Meaning: "Indeed, Allah has sent down disease and its cure and has made for every disease a remedy, so seek treatment, but do not seek treatment with what is unlawful." (Narrated by Abu Darda).<sup>4</sup>

The hadist above explained that if Allah SWT sent down a disease, He also provided its cure. Acne is a mild disease that, if left untreated, may cause

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<sup>1</sup> Yuni Arista N. Kumesan, Paulina Vy Yamlean, And Hamidah S. Supriati, (2013) "Formulasi Dan Uji Aktivitas Gel Antijerawat Ekstrak Umbi Bakung (*Crinum Asiaticum L.*) Terhadap Bakteri *Staphylococcus Aureus* Secara In Vitro," *Pharmacon* 2, No. 2, <https://ejournal.unsrat.ac.id/index.php/pharmacon/article/download/1552/1245>.

<sup>2</sup> Ofirnia C. Kindangen, (2018) "Formulasi Gel Antijerawat Ekstrak Etanol Daun Kemangi (*Ocimum Basilicum L.*) Dan Uji Aktivitasnya Terhadap Bakteri *Staphylococcus Aureus* Secara In Vitro," *Pharmacon* 7, No. 3, <https://doi.org/10.35799/pha.7.2018.20505>.

<sup>3</sup> Nur Sifatullah and Zulkarnain, (2021) "Jerawat (*Acne vulgaris*): Review Penyakit Infeksi Pada Kulit," *Prosiding Biologi Achieving the Sustainable Development Goals with Biodiversity in Confronting Climate Change* 7, no. 1: 19–23, <https://doi.org/10.24252/psb.v7i1.22212>.

<sup>4</sup> MUI NO.13 Tahun 2021, "Hukum Vaksinasi Covid-19 Saat Berpuasa," *Fatwa Tentang Hukum Vaksinasi Covid-19 Saat Berpuasa*, 2021, [https://covid19.patikab.go.id/v4/download/Fatwa\\_MUI\\_No\\_13\\_Tahun\\_2021\\_Hukum\\_Vaksinasi\\_Covid-19\\_Saat\\_Berpuasa.pdf](https://covid19.patikab.go.id/v4/download/Fatwa_MUI_No_13_Tahun_2021_Hukum_Vaksinasi_Covid-19_Saat_Berpuasa.pdf).

discomfort. Acne or *acne vulgaris* is a disorder of the pilosebaceous layer, causing blockages or accumulations of keratin, one of which is caused by the bacterium *Staphylococcus aureus*. Acne treatment is usually done using chemical drugs such as sulphur, benzoyl peroxide, azelaic acid, or antibiotics like tetracycline, erythromycin, and clindamycin. However, the long-term use of chemical drugs increases antibiotic resistance and caused skin irritation. Therefore, research on halal natural ingredients is need as a safer antibacterial alternative with minimal side effects<sup>5</sup>.

Natural ingredients that can be used as anti-acne agents included bilimbi wuluh (*Averrhoa bilimbi* L.) and lime juice (*Citrus aurantifolia* S.). Research by Rahmiati, A. (2017) stated that bilimbi fruit had antibacterial activity against *Staphylococcus aureus*, as evidenced by the clear zone around the well containing bilimbi wuluh extract (*Averrhoa bilimbi* L.). At a minimum concentration of 10%, the average inhibition zone was 21.5 mm, while at a maximum concentration of 40%, the average inhibition zone was 34.0 mm. The antibacterial activity of bilimbi wuluh (*Averrhoa bilimbi* L.) was due to its active compounds such as flavonoids, alkaloids, tannins, and saponins.<sup>6</sup>

A previous study conducted by Fitriana. (2022) stated that lime juice (*Citrus aurantifolia* S.) had good antibacterial activity against *Staphylococcus aureus*, as evidenced by the inhibition zones at different concentrations: 25% (13.3 mm), 50% (14.3 mm), 75% (16.3 mm), and 100% (18.0 mm). The essential oil in lime juice (*Citrus aurantifolia* S.) contained active compounds such as flavonoids, which played a crucial role in inhibiting bacterial growth. Based on previous research, bilimbi fruit (*Averrhoa bilimbi* L.) and lime juice (*Citrus aurantifolia* S.) had

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<sup>5</sup> Erza Genatrika, Isna Nurkhikmah, And Indri Hapsari, (2016) "Formulasi Sediaan Krim Minyak Jintan Hitam (*Nigella Sativa* L.) Sebagai Antijerawat Terhadap Bakteri *Propionibacterium Acnes*," *Pharmacy: Jurnal Farmasi Indonesia (Pharmaceutical Journal Of Indonesia)* 13, No. 02: 192–201.

<sup>6</sup> Asri Rahmiati, Sri Darmawati, and Ana Hidayati Mukaromah, (2017) "Daya Hambat Ekstrak Etanol Buah Belimbing Wuluh (*Averrhoa Bilimbi* L) Terhadap Pertumbuhan *Staphylococcus Aureus* Dan *Staphylococcus Epidermidis* Secara in Vitro," *Prosiding Seminar Nasional & Internasional* 1, no. 1: 669–74.

antibacterial activity. Therefore, the researcher aimed to develop a gel formulation combining both ingredients to make it more accessible for public use.<sup>7</sup>

The innovation in this gel formulation is chosen because hydrogel bases in anti-acne formulations are well-suited for skin with excessive sebaceous gland activity. The advantages of this gel formulation include its ease of washing with water and its oil-free composition<sup>8</sup>. The gel felt light upon application, enhancing user comfort. Additionally, the gel's soft, smooth, and easy-to-spread texture, which did not leave an oily residue on the skin, made it more comfortable for application<sup>9</sup>.

## 1.2 Problem Statement

The problem statement in this study are:

1. What are the quality characteristics of the gel formulation combining bilimbi wuluh extract (*Averrhoa bilimbi* L.) and lime juice (*Citrus aurantifolia* S.) based on organoleptic evaluation, pH, viscosity, homogeneity, and spread ability?
2. How is the antibacterial activity of the gel formulation combining bilimbi wuluh extract (*Averrhoa bilimbi* L.) and lime juice (*Citrus aurantifolia* S.) against *Staphylococcus aureus*?

## 1.3 Research Objectives

The research objectives in this study are:

1. To determine the quality characteristics of the gel formulation combining bilimbi wuluh extract (*Averrhoa bilimbi* L.) and lime juice (*Citrus aurantifolia* S.) based on organoleptic evaluation, pH, viscosity, homogeneity, and spread ability.
2. To determine the antibacterial activity of the gel formulation bilimbi wuluh extract (*Averrhoa bilimbi* L.) and lime juice (*Citrus aurantifolia* S.) against *Staphylococcus aureus*.

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<sup>7</sup> Fitriana Fitriana, Safridha Kemala Putri, and Darmawati Darmawati, (2022) "Kombinasi Ekstrak Jeruk Nipis Dan Madu Dalam Meningkatkan Daya Hambat *Staphylococcus Aureus*," *Jurnal SAGO Gizi Dan Kesehatan* 4, no. 1: 72–80.

<sup>8</sup> Dwi Saryanti Et Al., (2019) "Optimasi Karbopol Dan HPMC Dalam Formulasi Gel Antijerawat Nanopartikel Ekstrak Daun Sirih (*Piper Betle* Linn)," *Jurnal Ilmiah Manuntung* 5, No. 2: 192–99.

<sup>9</sup> Kindangen, (2018) "Formulasi Gel Antijerawat Ekstrak Etanol Daun Kemangi (*Ocimum Basilicum* L.) Dan Uji Aktivitasnya Terhadap Bakteri *Staphylococcus Aureus* Secara In Vitro."

## 1.4 Research Benefits

### 1. Theoretical Benefits

The results of this study could serve as scientific information and references in the formulation of gel preparations combining bilimbi wuluh extract (*Averrhoa bilimbi* L.) and lime juice (*Citrus aurantifolia* S.) against *Staphylococcus aureus*, with appropriate concentrations derived from natural ingredients, and as a reference for future research.

### 2. Practical Benefits

The results of this study were expected to:

1. Provide information and awareness to the public that a combination of bilimbi wuluh (*Averrhoa bilimbi* L.) and lime juice (*Citrus aurantifolia* S.) can be used as an anti-acne treatment.
2. Provide insights for other researchers and the cosmetic industry regarding the gel formulation combining bilimbi wuluh extract (*Averrhoa bilimbi* L.) and lime juice (*Citrus aurantifolia* S.).

## 1.5 Research Authenticity

**Table 1.** Research Authenticity

Research Title	Research Method	Variables	Results	Research Differences
The Inhibitory Effect of Ethanol Extract from Bilimbi Wuluh ( <i>Averrhoa bilimbi</i> L.) on the Growth of <i>Staphylococcus aureus</i> and <i>Staphylococcus</i>	Laboratory Experimental	<b>Dependent:</b> The inhibitory effect on the growth of <i>Staphylococcus aureus</i> and <i>Staphylococcus epidermidis</i> in vitro.  <b>Independent:</b> Ethanol extract of Bilimbi wuluh	The ethanol extract of bilimbi fruit at concentrations of 10% b/v, 20% b/v, 30% b/v, and 40% b/v exhibited inhibitory effects on <i>Staphylococcus aureus</i> with inhibition zone diameters of 21.6 mm, 27.0 mm, 31.3	<b>Dependent:</b> Formulation and antibacterial activity testing of the gel against <i>Staphylococcus aureus</i> growth.  <b>Independent:</b> The combination and concentration of Bilimbi wuluh extract ( <i>Averrhoa bilimbi</i> L.) and

Research Title	Research Method	Variables	Results	Research Differences
<i>s epidermidis</i> In Vitro <sup>10</sup>		( <i>Averrhoa bilimbi</i> L.).	mm, and 34.0 mm, respectively  For <i>Staphylococcus epidermidis</i> , the inhibition zone diameters were 28.6 mm, 31.6 mm, 36.3 mm, and 39.0 mm, respectively	lime juice ( <i>Citrus aurantifolia</i> ).
Effectiveness Test of Lime Juice (Citrus aurantifolia S.) on the Growth of <i>Staphylococcus aureus</i> In Vitro. <sup>11</sup>	Laboratory Experimental	<b>Dependent:</b> The effectiveness in inhibiting the growth of <i>Staphylococcus aureus</i> . <b>Independent:</b> Lime juice ( <i>Citrus aurantifolia</i> S.).	Lime juice at a 100% concentration demonstrated the potential to inhibit the growth of <i>Staphylococcus aureus</i> , with an average inhibition zone diameter of 14.22 mm	<b>Dependent:</b> Formulation and antibacterial activity testing of the gel against <i>Staphylococcus aureus</i> growth. <b>Independent:</b> The combination and concentration of Bilimbi wuluh extract ( <i>Averrhoa bilimbi</i> L.) and lime juice ( <i>Citrus aurantifolia</i> ).
Combination of Lime Extract and Honey in	Laboratory Experimental	<b>Dependent:</b> The effectiveness in inhibiting	At a 100% concentration, the inhibition zone measured 18.3 mm, at	<b>Dependent:</b> Formulation and antibacterial activity testing of

<sup>10</sup> Asri Rahmiati, Sri Darmawati, and Ana Hidayati Mukaromah. 2017. Daya Hambat Ektrak Etanol Buah Belimbing Wuluh (*Averrhoa Bilimbi* L) Terhadap Pertumbuhan *Staphylococcus Aureus* Dan *Staphylococcus Epidermidis* Secara in Vitro,” *Prosiding Seminar Nasional & Internasional* 1, no. 1: 669–74..”

<sup>11</sup> Sartika W. Lauma, (2015) "Uji Efektifitas Perasan Air Jeruk Nipis (*Citrus Aurantifolia* S) Terhadap Pertumbuhan Bakteri *Staphylococcus aureus* Secara In Vitro,” *PHARMACON* 4, no. 4, <https://doi.org/10.35799/pha.4.2015.10185>.

Research Title	Research Method	Variables	Results	Research Differences
Enhancing the Inhibitory Effect on <i>Staphylococcus aureus</i> <sup>12</sup>		<i>Staphylococcus aureus</i> . <b>Independent:</b> The combination of lime extract and honey.	75% it was 16.6 mm, at 50% it was 13.6 mm, and at 25% it was 11.6 mm.	the gel against <i>Staphylococcus aureus</i> growth. <b>Independent:</b> The combination and concentration of Bilimbi wuluh extract ( <i>Averrhoa bilimbi</i> L.) and lime juice ( <i>Citrus aurantifolia</i> ).



<sup>12</sup> Fitriana Fitriana, Safridha Kemala Putri, and Darmawati Darmawati, (2022) “Kombinasi Ekstrak Jeruk Nipis Dan Madu Dalam Meningkatkan Daya Hambat *Staphylococcus Aureus*,” *Jurnal SAGO Gizi Dan Kesehatan* 4, no. 1: 72–80.