Chapter 1

Introduction

1.1 Background

The first line of defense against environmental and pathogenic dangers is the human skin. It is extensively populated by a flora of viruses, bacteria, and fungi that normally typically cooperate with the immune system and the skin's physiology to promote skin health and equilibrium (Brown & Horswill, 2020). *Staphylococcus aureus* is an opportunistic pathogen that commonly inhabits the human skin (Kwiecinski & Horswill, 2020). According to research conducted in a dermatological wound ambulance in Germany, 10–40% of the general population had *S. aureus* colonization (Dissemond et al., 2004). It can cause skin and soft tissue infections, which is the most frequent clinical manifestation of *S. aureus* (Dayan et al., 2016). Treatments usually involve the usage of antibiotics. However, antibiotic resistance is growing quickly. As a result, the efficacy of the antibiotics now in use decreases. According to the Centers for Disease Control and Prevention, at least two million Americans contract antibiotic-resistant germs each year, and around 23,000 of them pass away. In Indonesia, despite the limited data on antibiotic resistance prevalence, it is believed that this problem is increasing (WHO, 2022). Antibiotic resistance poses a danger to world health, according to a fact sheet that the World Health Organization produced in 2016. It can impact everyone, regardless of age or country. Therefore, the need for novel, natural antibacterial substances as an alternative that can reduce the need for antibiotics is rising to combat the emergence of resistance (Hughes & & Karlen, 2014).

The need to combat microbial resistance has led researchers to extract and discover novel bioactive compounds from plants (Khameneh, 2016), especially because around 50% of today's medications and nutraceuticals are made of natural products or their derivatives (Chavan et al., 2018). The bioactive chemicals produced by medicinal plants are nearly limitless, and many methods have been used to utilize them as antibacterial agents. *Laportea decumana*, a native herbaceous Papua plant of the *Urticaceae* family, is known as "*Daun Gatal*" and has become a traditional medicine in

Papua due to its various medical benefits, which include relieving pain bruising, headaches, stomachaches, stiffness, and muscular and joint discomfort (WHO, 2009; Oloyede & Ayanbadejo, 2014; Simaremare et al., 2018). In addition, it can be used as an analgesic or painkiller, an anti-inflammatory, an abortifacient, an antibiotic, and a laxative (Oloyede & Oyelola, 2013; Oloyede & Ayanbadejo, 2014; Simaremare et al., 2018). Dysentery and diarrhea are among the gastrointestinal issues that *Daun Gatal* can address (Oloyede & Oyelola, 2013; Oloyede & Ayanbadejo, 2014). Several studies have been conducted on the antimicrobial properties of *Daun Gatal* ethanol extract against common pathogenic bacteria such as *S. aureus*, *E. coli*, and *S. typhi*, it was found that *Daun Gatal* successfully inhibits the growth of the three pathogenic bacteria (Pertiwi, 2019; Simaremare, Ruban, & Runtuboi, 2018). Despite this, the antimicrobial activity of *Daun Gatal* has not been extensively studied and the outcome of different solvents for *Daun Gatal* extraction is still unknown. Moreover, medicinal plants such as *Daun Gatal* have the potential to be formulated in the form of skin products such as ointment to target skin infections.

Therefore, this study aims to explore the antimicrobial properties of *Daun Gatal* (*Laportea decumana*) methanol extract against skin infection-causing bacteria, specifically *Staphylococcus aureus*, as well as evaluate the ability of the extract to prevent the bacterial invasion of the skin and decrease pro-inflammatory genes by co-culturing the human keratinocyte cell line (HaCaT) with *S. aureus*.

1.2 Objective

The objectives of this study are:

- Assess the antimicrobial activity of *L. decumana* methanol extract towards skin infection-causing pathogens such as *Staphylococcus aureus*.
- Explore the ability of *L. decumana* methanol extract to prevent bacterial invasion toward HaCaT keratinocytes cells.

- Evaluate the potential anti-inflammatory properties of *L. decumana* methanol extract in decreasing pro-inflammatory genes upregulated during bacterial infection of HaCaT cells.

1.3 Hypothesis

This study hypothesizes that *L. decumana* methanol extract will inhibit the growth of *Staphylococcus aureus* and prevent cellular invasion. Also, *L. decumana* methanol extract will decrease inflammatory gene expression of infected HaCaT cells.