



## In Vitro Antimicrobial Activity of Bawang Batak Bulbs (Allium Chinense G. Don) Against Methicillin-Resistant Staphylococcus Aureus

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**Abstract.** Introduction: Staphylococcus aureus infection can cause pyoderma. These days there is a shift in Staphylococcus aureus sensitivity to antibiotics that is marked by the existence of Methicillin-Resistant Staphylococcus aureus, so alternative therapy that is herbal medicine might be needed. There are a lot of medicinal plants in Indonesia, but until today the usage is still minimum. One of the plant genus that is already being used is allium that had been known to have antimicrobial activity. The genus allium that is consumed a lot by Indonesians especially people of North Sumatra is *bawang batak* (*Allium chinense* G. Don.). This study is conducted to assess the antimicrobial activity of bawang batak bulbs in several concentrations to MRSA. Methods: This research is an experimental research with agar diffusion method. The extracts were divided into six groups: extracts in concentration level of 6.25%, 12.5%, 25%, 50%, 100% and a negative control (DMSO). The sample size is four per group with total sample of 24. Results: The results showed that the inhibition of bacterial growth occurred at the concentration levels of 50% and 100% with inhibition zone diameters of 8.695 mm and 10.545 mm respectively. Extracts with concentration levels of 25%, 12.5% and 6.25% did not show any inhibition. Conclusion: *Bawang batak* bulbs extract can be used to inhibit the growth of MRSA.

**Keywords:** MRSA, pioderma, Allium chinense G. Don

**Abstrak.** Pendahuluan: Infeksi Staphylococcus aureus dapat menyebabkan pioderma. Hari-hari ini ada pergeseran sensitivitas Staphylococcus aureus ke antibiotik yang ditandai dengan keberadaan Methicillin-Resistant Staphylococcus aureus, sehingga terapi alternatif yang mungkin diperlukan obat herbal. Ada banyak tanaman obat di Indonesia, tetapi hingga saat

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ini penggunaannya masih minim. Salah satu genus tanaman yang telah digunakan adalah *allium* yang telah diketahui memiliki aktivitas antimikroba. Genus *allium* yang banyak dikonsumsi oleh orang Indonesia terutama orang Sumatera Utara adalah bawang (Allium chinense G. Don). Penelitian ini dilakukan untuk menilai aktivitas antimikroba umbi bawang dalam beberapa konsentrasi untuk MRSA. Metode: Penelitian ini merupakan penelitian eksperimental dengan metode difusi agar. Ekstrak dibagi menjadi enam kelompok: ekstrak dalam tingkat konsentrasi 6,25%, 12,5%, 25%, 50%, 100% dan kontrol negatif (DMSO). Ukuran sampel adalah empat per kelompok dengan jumlah sampel 24. Hasil: Hasil penelitian menunjukkan bahwa penghambatan pertumbuhan bakteri terjadi pada tingkat konsentrasi 50% dan 100% dengan diameter zona penghambatan 8,695 mm dan 10,545 mm masing-masing. Ekstrak dengan kadar konsentrasi 25%, 12,5% dan 6,25% tidak menunjukkan adanya hambatan. Kesimpulan: Ekstrak bawang bawang dapat digunakan untuk menghambat pertumbuhan MRSA.

**Kata kunci:** MRSA, pioderma, Allium chinense G. Don

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## 1. Introduction

Methicillin-resistant Staphylococcus aureus (MRSA) is a multi-resistant Staphylococcus aureus, although methicillin-resistant actually means resistant to the  $\beta$ -lactam antibiotic [1]. MRSA chromosomal resistance is caused by an inadequate dose of antimicrobial or antibiotic exposure, so the bacteria will produce Penicillin Binding Proteins (PBP 2a) that interfere with the antibiotic affinity of the actual PBP. An antibiotic reaction with a PBP can actually inhibit peptidoglycan synthesis and bacterial cell wall formation, resulting in bacterial lysis. In contrast, an antimicrobial reaction with PBP 2a does not produce this effect [2]. There are two types of MRSA, healthcare-associated methicillin-resistant S. aureus (HA-MRSA) and community-acquired methicillin-resistant S. aureus (CA-MRSA). The most common infections caused by MRSA are skin and soft tissue infections, the clinical picture is similar to pyoderma caused by methicillin-sensitive Staphylococcus aureus (MSSA) [3].

Pyoderma is an infection of the epidermis, just below the stratum corneum or in the hair follicle, by pathogenic bacteria often accompanied by purulent secretions. Clinical manifestations of pyoderma vary, ranging from superficial pyoderma to invasive soft-tissue infections, depending on the anatomical site of the infection and the host factor. Clinical manifestations of skin infections may include bullous impetigo and non-bullous impetigo, infection of the hair follicle and surrounding tissues in the form of folliculitis, furunculosis and carbuncles, whereas soft tissue infections are cellulitis [4]. There are only four antibiotics recognized by the FDA for the treatment of pyoderma induced by MRSA, vancomycin, linezolid, daptomycin and tigecycline [5].

*Bawang bata*k (*Allium chinense* G. Don) are medicinal plants and food crops that are often found in Asia. *Bawang bata*k contains alisin, saponin and flavonoids that have antimicrobial activity [6]. Alisin has a bactericidal effect on MRSA because alisin can inhibit RNA biosynthesis. In addition, alisin also has partial inhibitory activity against DNA and protein synthesis [7]. Flavonoids act as antibacterial by forming complex compounds of proteins outside cells that interfere with the strength of bacterial cell membranes. Saponin is an active substance that can increase membrane permeability. When saponins interact with bacterial cells, the bacteria will be damaged or lysis [8]. *Allium chinense* is believed to inhibit many microorganisms, such as bacteria, fungi, viruses, and parasites [6].

## 2. Methodology

Ethanol extract of *bawang bata*k bulbs are prepared with concentrations of 100%, 50%, 25%, 12.5%, and 6.25% at the Faculty of Pharmacy, University of North Sumatera. The DMSO solution is prepared as a negative control. The antimicrobial activity test was performed by agar diffusion method. MRSA preparations obtained from the collection of Microbiology Laboratory of Faculty of Medicine, University of North Sumatera Utara. The bacterial culture was then diluted with NaCl solution using McFarland method 0.5 (equivalent to 108 CFU / ml). The bacterial solution is then applied to the surface of the Mueller-Hinton Agar (MHA) medium. Then the empty test discs that had been previously soaked for 15 minutes in each stock concentration of *bawang bata*k bulbs extracts were placed on the surface of the agar in the biosafety cabinet. Then the medium was incubated at 37 ° C for 24 hours. The clear zone formed is then measured using a caliper.

## 3. Results

The results of research on antimicrobial effects of *bawang bata*k (*Allium chinense* G. Don) on MRSA are presented in Table 1.

Table 1 Diameter of Inhibitory Zone of MRSA Growth That Was Formed in Experiment with *Bawang Batak* Bulbs (*Allium Chinense* G. Don) Extract

Zone of Inhibition (mm)						
<i>Bawang bata</i> k bulbs extract						DMSO
6.25%	12.5%	25%	50%	100%		
I	-	-	-	8.05	8.175	-
II	-	-	-	8.05	11.055	-
III	-	-	-	9.055	10.6	-
IV	-	-	-	9.625	12.35	-
X $\pm$ SD	-	-	-	8.695 $\pm$ 0.780	10.545 $\pm$ 1.745	-

Table 1 shows that the measurement results at 24 hours after incubation showed that *bawang bata*k bulbs extract inhibited MRSA growth. Inhibition of MRSA growth is seen by the presence of clear zones around the test disk. In all four trials, the inhibition of MRSA growth was initiated in experiments with *bawang bata*k bulbs extracts with concentrations of 50%. Inhibition was also observed in experiments with *bawang bata*k bulbs extract with 100% concentration.

The smallest inhibitory zone diameter of *bawang bata*k extract with concentration of 50% to MRSA was 8.05 mm and the largest inhibitory zone diameter was 9.625 mm. Average inhibitory zone diameter from experiments with *bawang bata*k extract with concentration of 50% was 8.695 mm. The smallest inhibitory zone diameter of *bawang bata*k extract with concentration of 100% to MRSA was 8.175 mm and the largest inhibitory zone diameter was 12.35 mm. Average inhibitory zone diameter from experiments with *bawang bata*k bulbs extract with concentration of 100% was 10.535 mm. Extracts with concentrations of 25%, 12.5% and 6.25% showed no inhibition of MRSA growth. The DMSO used as a negative control of the study did not show any inhibition zone.

The results of this study indicate that the extract of *bawang bata*k bulbs have an antimicrobial effect. This is in line with previous research that has been done [9] Naibaho (2015) at the Bogor Agricultural Institute, which states that *bawang bata*k contains bioactive compounds as antimicrobial agents. This study also corresponds to the theory that all plants of the allium genus have an inhibitory effect on the growth of microorganisms such as bacteria, fungi, viruses and parasites. Plants of the allium genus are also said to inhibit the growth of multi-drug-resistant microorganisms [10].

#### 4. Conclusions

*Bawang bata*k bulbs extract have antimicrobial activity against MRSA. *Bawang bata*k bulbs extract with concentrations of 50% and 100% inhibited the growth of MRSA bacteria with inhibition zone diameters of 8.695 mm and 10.545 mm respectively. *Bawang bata*k bulbs extract with concentrations of 25%, 12.5% and 6.25% did not inhibit the growth of MRSA.

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