

## EFFECTIVENESS OF WRESAH (*AMOMUM DEALBATUM*) EXTRACT IN INHIBITING THE GROWTH OF *STAPHYLOCOCCUS AUREUS*

Ajeng Dian Pertiwi<sup>1</sup> , Musparlin Halid<sup>2</sup> 

<sup>1</sup>Department of Pharmacy, Politkenik Medica Farma Husada Mataram

<sup>2</sup>Department of Medica Record and Health Information, Politeknik Medica Farma Husada Mataram

### ARTICLE INFO

#### Article history

Submitted : 2023-03-20

Revised : 2023-04-01

Accepted : 2023-04-10

#### Keywords:

Wresah;  
*Amomum dealbatum*;  
Antibacterial

#### Kata Kunci:

Wresah;  
*Amomum dealbatum*;  
Antibakteri

This is an open access  
article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/)  
license:



#### ✉ Corresponding Author:

Ajeng Dian Pertiwi  
Department of Pharmacy, Politeknik Medica Farma Husada Mataram  
Telp. 081237920249  
Email: [addian90@gmail.com](mailto:addian90@gmail.com)

### ABSTRACT

Wresah plant (*Amomum dealbatum*) is one of the typical fruit species from Lombok Island which has a distinctive fragrance and is a member of the ginger-ginger tribe. This study aims to test the ethanol extract of Wresah skin (*Amomum dealbatum*) as an antibacterial (*Staphylococcus aureus*) with concentrations of 15%, 30% and 50%. The research method conducted was laboratory experimental. The antibacterial test of *Staphylococcus aureus* was carried out with five treatment groups and five repetitions, namely positive control (ciprofloxacin), negative control (distilled water), concentrations of 15%, 30% and 50% using well method and then incubated for 24 hours at a temperature of 37°C. The results of the antibacterial test of ethanol extract of Wresah fruit peel showed inhibition of *Staphylococcus aureus* bacteria and at concentrations of 15%, 30%, and 50% which produced the largest diameter of the inhibition zone with an average diameter of 2.0 mm. The Kruskal Wallis test showed a statistically significant difference between the three concentrations tested ( $p < 0.05$ ), which means that Wresah fruit peel extract is able to inhibit the growth of *Staphylococcus aureus* bacteria. In conclusion, the extract of Wresah fruit peel has demonstrated antibacterial properties against *Staphylococcus aureus* and can be used as a natural alternative to conventional antibiotics.

### ABSTRAK

Tanaman wresah (*Amomum dealbatum*) adalah salah satu jenis buah khas dari Pulau Lombok yang memiliki wangi yang khas dan termasuk dalam suku jahe-jahean. Penelitian ini bertujuan untuk menguji ekstrak etanol kulit buah wresah (*Amomum dealbatum*) sebagai antibakteri (*Staphylococcus aureus*) dengan konsentrasi 15%, 30% dan 50%. Metode penelitian yang dilakukan adalah eksperimental laboratorium. Uji antibakteri *Staphylococcus aureus* dilakukan dengan lima kelompok perlakuan dan lima kali pengulangan, yaitu kontrol positif (siprofloksasin), kontrol negatif (akuades), konsentrasi 15%, 30% dan 50% dengan metode sumuran kemudian diinkubasi selama 24 jam pada suhu 37°C. Hasil uji antibakteri ekstrak etanol kulit buah wresah menunjukkan adanya daya hambat terhadap bakteri *Staphylococcus aureus* dan pada konsentrasi 15%, 30%, dan 50% yang menghasilkan diameter zona hambat paling besar dengan diameter rata-rata 2,0 mm. Hasil uji Kruskal Wallis, menunjukkan nilai signifikansi Asymp signifikansi sebesar 0,000 atau  $p < 0,05$  yang berarti ekstrak kulit buah wresah mampu menghambat pertumbuhan bakteri *Staphylococcus aureus*. Dengan demikian, ekstrak kulit buah Wresah dapat digunakan sebagai antibakteri.

### INTRODUCTION

An infectious disease is caused by a biological agent, such as a virus, bacterium, or parasite. It can be transmitted from one person to another, either directly or through an intermediary. Broadly speaking, infectious diseases can be transmitted through direct media, i.e. from person to person, for example through the skin surface. The air media is referred to as an airborne disease, an example of a disease that can be transmitted and spread directly or indirectly through the respiratory air. Through the water, the medium is referred to as waterborne disease or water-related disease, an example of a disease transmitted through water. Through the medium of vectors, often referred to as vector-borne

diseases are diseases that are often endemic or epidemic and often pose a danger of death. Generally, this type of infectious disease is also called environment-based disease. This is because the onset of the disease is caused by human interaction with the surroundings that have the potential for disease. Infectious diseases are a major contributing factor to the high morbidity and mortality rates in the world. Infectious disease is a disease factor that is widely suffered in Indonesia and in the world. In addition to viruses, bacteria are also one of the causes of infection (Tun, 2018).

Our bodies are exposed to viruses, parasitic fungi and bacteria all the time. Serious physiological abnormalities or even death are caused by infectious agents that attack the body to the internal organs (I. A. Dewi & Adhi, 2016). In addition to being exposed to pathogenic infections, we are often exposed to infections by excessive levels of the normal flora that can cause disease, such as *Staphylococcus sp*, *Escherichia coli*, *Streptococcus sp*, and others. *Staphylococcus sp* bacteria can cause ulcers, pneumonia, meningitis, urinary tract infections and others (Rizky, 2018).

Epidemiological studies show that infections caused by *Staphylococcus aureus* in the world have increased in the last two decades. Data in the United States and Europe show that *Staphylococcus aureus* is the most common pathogenic bacteria causing infections with a prevalence of 18-30% (Toy et al., 2015). Meanwhile, in Asia and Indonesia, *Staphylococcus aureus* has almost the same incidence of infections (Sundari & Nuryanto, 2016).

*Staphylococcus aureus* is also a bacterium that causes many nosocomial infections in Indonesia. In Jakarta in the other period of 2019-2021 there was an almost fourfold increase in the incidence of *Staphylococcus aureus* infection from 2.5% to 9.4% (Perwira, 2014).

According to research conducted by Nuryah et al. (2019) revealed that there were 23 cases of postoperative wound infection caused by *Staphylococcus aureus* (Nuryah et al., 2019). Not only in Indonesia, in developed countries, such as the United States, there are 20,000 deaths every year due to nosocomial infections (Tandanu, 2020). Worldwide, 10% of hospital inpatients experience new infections during their stay, totaling 1.4 million infections each year (Salim & Soleha, 2017). According to WHO in 55 hospitals in 14 countries around the world, 8.7% of hospital patients suffer from infections during hospitalization (Roni et al., 2019). Whereas in developing countries there are more than 40% of patients with nosocomial infections. The most common bacteria found in cases of infection is *Staphylococcus aureus* (Lutpiatina, 2017).

With the advancement of modern science and technology, traditional medicine in Indonesia has a very large role in public health services in Indonesia, so traditional medicine has the potential to be developed (Dewi et al., 2019). Indonesia is rich in medicinal plants, which are still not optimally utilized for health. Indonesia is known to have the second largest biodiversity in the world after Brazil (Dewa et al., 2019).

Indonesia's tropical forests contain 30,000 species of plants, approximately 9,600 of which are known as medicinal plants. There are so many medicinal plants in Indonesia both in traditional and modern medicine. One of the medicinal plants that has been quite widely used is the Wresah plant (Adiyasa & Meiyanti, 2021). Wresah is one type of flora that also has the ability to treat various diseases. Wresah is a kind of spice substitute for cardamom which has a slightly sour taste and has a Latin or scientific name as *Amomum dealbatum* (Nurcahyati & Ardiyansyah, 2018). Wresah is still classified in the rhizome or ginger-ginger tribe, the benefits of Wresah include being able to eliminate and overcome red eyes, whether it is due to illness or irritation due to pollution. Another advantage or benefit of Wresah is that it can treat dizziness and nearsightedness after childbirth (Lianah et al., 2020).

In addition, infectious diseases have their problems with various risks such as immunocompromised local and systemic status in patients, microbial resistance to antibiotics, and microbial types that sometimes require specific antibiotics that are expensive and prolonged. The main basis for antibiotic selection in the management of a disease is based on the results of secretion culture and cell sensitivity. However, a very important problem in antibiotic therapy is the formation of resistance mechanisms to antibiotics, so it is very necessary to think about utilizing natural materials in their use for antibiotic therapy. Based on several studies, the dominant bacterial colonies found in skin diseases are *Staphylococcus aureus* colonies.

Until now there has been no research report on the potential of this plant in inhibiting bacterial growth, so researchers are interested in conducting research aimed at determining the inhibition of Wresah fruit peel extract against the growth of *Staphylococcus aureus* bacteria. The purpose of the study was to determine the effectiveness of Wresah fruit peel extract (*Amomum dealbatum*) in inhibiting *Staphylococcus aureus* bacteria.

## MATERIALS AND METHOD

This research is an experimental study used to see the effect of Wresah fruit peel extract (*Amomum dealbatum*) in inhibiting the growth of *Staphylococcus aureus* bacteria. This research was conducted at the Biology Laboratory, Politeknik Medica Farma Husada Mataram from March to November 2022. The sample used in this study was the ripe fruit peel of Wresah (*Amomum dealbatum*), as much as 250 grams which had been dried. The total sample size used in the study was 25 Petri dishes containing *Staphylococcus aureus* bacteria. The 25 petri dishes were divided into 5 test groups, each test group consisting of 5 petri dishes. The instruments in this study are:

- a. Tools. The tools used in this research are autoclave, blender, rotary evaporator, incubator, digital scale, micropipette, ruler, triangle, bunsen lamp, funnel, filter paper, test tube, gloves, mask and tissue.
- b. Material. The materials used in this study were Wresah fruit peel (*Amomum dealbatum*), *Staphylococcus aureus*, NA media, MHA (Muller Hinton Agar), 96% ethanol solution, distilled water and aluminum foil.

## Work Procedure

### Sampling

Wresah fruit peel samples were collected in East Lombok Regency. Wresah fruit peels taken were 3 months old. The skins were then collected and wet sorted. Wresah fruit skins are washed with running water so that the dirt attached to the Wresah fruit skin is lifted until clean and then drained. After drying for several days in an open place that is not exposed to direct sunlight, it is then sorted dry and mashed using a blender. Wresah fruit peel powder is stored in a closed container.

### Extract Preparation

The extract of Wresah fruit peel (*Amomum dealbatum*) was made by maceration method which was carried out by weighing 250 grams of Wresah fruit peel simplisia powder then put in a container and given 96% ethanol. Maceration was carried out for 3 days in a room protected from direct sunlight while stirring repeatedly, then the extract obtained was filtered and stored in a closed container.

### Antibacterial Test of Wresah Fruit Peel Extract

- a. Sterilization of tools and materials
  - 1) Wash tools and materials to be used
  - 2) Wrap and sterilize equipment such as glassware, petri dishes, test tubes, Erlenmeyer, volume pipettes by using an oven at 175° C for 2 hours.
- b. Prepare test microorganisms

The test microorganism that will be carried out in this study is *staphylococcus aureus*. To multiply the population of organisms, pure cultures of *staphylococcus aureus* bacteria are taken aseptically using an ose needle and then scratched zik-zak and then incubated for 24 hours.

- c. Preparation of *Staphylococcus aureus* 0.5 Mc Farlan suspension

In one ose tip, *staphylococcus aureus* colonies from clinical culture were suspended in sterile 0.95 NaCl (5 ml) and compared with 0.5 Mc farlan turbidity standard until the same.

- d. Preparation of MHA (Mueller Hinton Agar) media

Weighted 20 grams of MHA media using an analytical balance. Put into an erlenmeyer flask then dissolved with 150 ml of distilled water until homogeneous. Stirred and heated on a hot plate while stirring until the media dissolved well. Covered the media with cotton, then sterilized with an autoclave at a temperature of 121° C for 15 minutes. Poured media after

sterilization into sterile petri dishes with a thickness of 4 mm, waited until the media solidified before use.

e. Inhibition test

To determine the effect of ethanol extract of Wresah fruit peel on the growth of *staphylococcus aureus* bacteria using the well method, namely: prepare a clinical suspension of *staphylococcus aureus* with a turbidity of 0.5 Mc farlan. Prepare MHA with a thickness of 4 mm, take a sterile cotton swab, then enter 100 µl of test bacteria into each petri dish, 10 petri dishes are then leveled using a triangle evenly, allowed to dry for 5 minutes. Wells were made using a sterile *blue tip* placed on the surface of the MHA media, each cup made 4 wells. After that, the ethanol extract of Wresah fruit peel as much as 4 µl was included in each well with a concentration of 15%, 30%, and 50%. Given a wide enough distance until the clear zone does not overlap. Incubated at 37° C for 24 hours not upside down so that the ethanol extract of Wresah fruit peel plant does not spill. Observed the inhibition zone around the wells, the inhibition zone formed was measured with a ruler and expressed in millimeters.

Data collection techniques were carried out by conducting tests that have been observed from a physical perspective including organoleptic tests, homogeneity tests and antibacterial inhibition tests. This research data uses qualitative data analysis and quantitative data. Qualitative and quantitative data analysis was carried out by testing antibacterial inhibition. The research data that has been obtained was first tested for normality using the *kalmogorov-smirnov test*. Followed by a parametric test using *oneway anova* with a confidence level of 95% ( $\alpha = 0.05$ ) this anova test is used to determine the mean difference from the source of variation, namely the treatment group and the control group.

## RESEARCH RESULTS

The results in Table 1 show that at a concentration of 15% there is no inhibition zone because the concentration is too small, the smallest inhibition zone at a concentration of 30% with an average inhibition zone of 1 mm. While the largest inhibition zone was at a concentration of 50% with an average inhibition zone of 1.48 mm (Table 2). This means that the higher the concentration of ethanol extract of Wresah fruit peel, the greater the inhibition zone formed.

**Table 1.** Extraction of Wresah Fruit Peel

Simplisia	Weight of simplisia	Extract (gram)	Yield %
Wresah fruit peel	250 grams	4 grams	1,6%

**Table 2.** Wresah (*Amomum dealbatum*) Fruit Peel Extract Against *Staphylococcus aureus*

Treatment	Inhibition Zone Diameter (mm)					Total	Average Test Results	Category of Barriers
	I	II	III	IV	V			
15% Concentration	0	0	0	0	0	0	0	Weak
30% concentration	1	1	1	1	1	1	1	Weak
50% Concentration	1,1	1,3	1,0	2,0	2,0	7,4	1,48	Weak
Positive control (ciprofloxacin)	3,7	5,3	3,7	5,3	3,7	71,5	4,34	Weak
Negative control (distilled water)	0	0	0	0	0	0	0	Weak

### Research Data Analysis

Based on the measurement results of the inhibition zone formed, the *Shapiro Wilk* normality test was carried out to determine whether the data was normally distributed or not.

**Table 3.** Normality Test

Tests of Normality	
	Shapiro-Wilk
	Sig.
Extent of Zone of Inhibition	.002
Concentration	.009

Table 3 shows that the results of the *Shapiro Wilk* normality test of the data obtained a significance value (Sig.) of 0.002 and 0.009 < 0.05 respectively, which means that the data is proven not to be normally distributed, from these results the test is continued to the *Kruskal Wallis* test.

**Table 4.** *Kruskal Wallis* Difference Test

Test Statistics	
Extent of Zone of Inhibition	
Asymp. Sig.	Sig.
	.000

Table 4 shows that the results of the *Kruskal Wallis* test in determining the inhibition zone and from the data obtained a significance value of  $0.000 < p = 0.05$ , which means that the data has a significant value.

**Table 5.** *Post Hoc* Test Results

Multiple Comparisons		
Dependent Variable: Extent of Zone of Inhibition		
(I) Concentration	(J) Concentration	Sig.
50%	15%	.001
	30%	.452

Table 5 shows that the results of the *Post Hoc* test data obtained a significance value (Sig.) between 50% and 15% concentrations of  $0.001 < 0.05$  which means that the data has a significant difference. While, the significance value (Sig.) between 50% and 30% concentrations of  $0.452 > 0.05$  which means that the data is not significant.

**Table 6.** *Post Hoc* Test Results

Multiple Comparisons		
Dependent Variable: Extent of Zone of Inhibition		
(I) Concentration	(J) Concentration	Sig.
Positive Control	15%	.000
	30%	.000
	50%	.000

Table 6 shows that the results of the *Post Hoc* test data obtained a significance value (Sig.) between the Positive concentration and the Concentration of 15%, 30%, and 50%, which is 0.000

<0.05, which means that the ethanol extract of Wresah fruit peel with a concentration of 15%, 30%, and 50% is able to inhibit the growth of *Staphylococcus aureus* bacteria

## DISCUSSION

The aim of this study was to test the activity of ethanol extract of Wresah fruit peel (*Amomum dealbatum*) against *Staphylococcus aureus* bacteria. This study was conducted at the Biology Laboratory, Politeknik Medica Farma Husada Mataram with three different extract concentrations (15%, 30%, 50%), and ciprofloxacin as the positive control. To ensure the accuracy of the results and minimize errors, the experiment was conducted with five replications. Each treatment group produced a zone of inhibition indicating the presence of inhibition on *Staphylococcus aureus* bacteria, but at a concentration of 15% there was no zone of inhibition because the concentration dose was small. The zone of inhibition is a clear area around the wells that can indicate that there is inhibited bacterial activity. Based on the results of the research that has been done, the ethanol extract test of Wresah fruit peel (*Amomum dealbatum*) is able to inhibit *Staphylococcus aureus* bacteria at concentrations of 13%, 30%, and 50% with a weak inhibition category. The data was then analyzed statistically, the first step was the Kalmogorov-smirnov normality test. Based on this test, the asymp sig value is 0.002 and 0.009 >0.005, which means that the data distribution is not normal. Thus, the test was continued with the *Kruskal wallis* test because the data tested did not meet the requirements for the *Oneway Anova* test where to use this test the data must be from a population or sample of interval or ratio type, the population tested must be normally distributed, the variation or population must be the same and the data groups must have the same sample size. The *Kruskal wallis* test is a non-parametric statistic in an independent group procedure and is used to compare two variables measured from unequal samples. The significance value obtained from the *Kruskal wallis* test (attached) at 0.000 <0.005 means there is a difference between concentrations.

Antibacterial sensitivity test is a method to determine the level of susceptibility of bacteria to antibacterial substances and to determine pure compounds that have antibacterial activity. The bacterial sensitivity test method is a method of how to find out and get natural products that have the potential as antibacterial ingredients and have the ability to inhibit bacterial growth at each concentration. The principle of this method is the inhibition of the growth of microorganisms, namely the zone of inhibition will be seen as a clear area around the well. Furthermore, it is said that the wider the diameter of the inhibition zone formed, the more sensitive the bacteria are.

Based on the results of a study conducted by [Muliasari et al. \(2019\)](#) which states that the active compounds that play a role in inhibiting *Staphylococcus aureus* bacteria are alkaloids ([Muliasari et al., 2019](#)). Alkaloids can interfere with bacteria by poisoning protoplasm, damaging and penetrating cell walls and precipitating proteins ([Wulandari et al., 2021](#)). Alkaloid components can also denature enzymes responsible for spore proliferation. Alkaloid compounds are able to break peptidoglycan bonds when breaking through the cell wall ([Hamrat & Rita, 2021](#)).

This peptidoglycan bond mechanically gives strength to the bacterial cell. The type of bacteria used are gram-negative bacteria with cell walls that have thin or very little peptidoglycan and are between the outer membrane and the inner membrane of the cell wall ([Alam & Singh, 2021](#)). The cell wall of gram-negative bacteria contains phospholipids, lipopolysaccharides, and lipoproteins. After breaking through the cell wall, the compound will cause leakage of cell contents by breaking hydrophobic bonds which results in increased membrane permeability ([Garg et al., 2016](#)). The occurrence of damage to the cell membrane results in pressure inhibiting the activity and biosynthesis of specific enzymes needed in metabolic reactions ([Huong et al., 2015](#)).

## CONCLUSION

Ethanol extract of Wresah fruit peel (*Amomum dealbatum*) has the potential to inhibit the growth of *Staphylococcus aureus* bacteria. Wresah fruit peel extract is able to inhibit the growth of *Staphylococcus aureus* bacteria at concentrations of 15%, 30%, and 50%.

## REFERENCES

Adiyasa, M. R., & Meiyanti, M. (2021). Pemanfaatan obat tradisional di Indonesia: distribusi dan faktor demografis yang berpengaruh. *Jurnal Biomedika Dan Kesehatan*, 4(3), 130–

138. <https://doi.org/10.18051/jbiomedkes.2021.v4.130-138>
- Alam, A., & Singh, V. (2021). Composition and pharmacological activity of essential oils from two imported *Amomum subulatum* fruit samples. *Journal of Taibah University Medical Sciences*, 16(2), 231–239. <https://doi.org/10.1016/j.jtumed.2020.10.007>
- Dewa, I., Rayna, A., Wikananda, N., Agus Hendrayana, M., Januartha, K., & Pinatih, P. (2019). Efek Antibakteri Ekstrak Ethanol Kulit Batang Tanaman Cempaka Kuning (*M. Champaca* L.) Terhadap Pertumbuhan *Staphylococcus Aureus*. *Jurnal Medika*, 8(5), 2597–8012. <https://ojs.unud.ac.id/index.php/eum/article/view/50026>
- Dewi, I. A., & Adhi, K. T. (2016). Pengaruh Konsumsi Protein Dan Seng Serta Riwayat Penyakit Infeksi Terhadap Kejadian Pendek Pada Anak Balita Umur 24-59 Bulan Di Wilayah Kerja Puskesmas Nusa Penida Iii. *Gizi Indonesia*, 3(1), 36–46. <https://doi.org/10.36457/gizindo.v37i2.161>
- Dewi, R. S., Illahi, S. F. N., Aryani, F., Pratiwi, E., & Agustini, T. T. (2019). Persepsi Masyarakat Mengenai Obat Tradisional di Kelurahan Simpang Baru Kecamatan Tampan Kota Pekanbaru. *Jurnal Penelitian Farmasi Indonesia*, 8(2), 75–79. <https://doi.org/10.51887/jpfi.v8i2.782>
- Garg, G., Sharma, S., Dua, A., & Mahajan, R. (2016). Antibacterial potential of polyphenol rich methanol extract of *Cardamom* (*Amomum subulatum*). *Journal of Innovative Biology*, 3(1), 271–275. [https://www.researchgate.net/publication/292985609\\_Antibacterial\\_potential\\_of\\_polyphenol\\_rich\\_methanol\\_extract\\_of\\_Cardamom\\_Amomum\\_subulatum](https://www.researchgate.net/publication/292985609_Antibacterial_potential_of_polyphenol_rich_methanol_extract_of_Cardamom_Amomum_subulatum)
- Hamrat, M. U., & Rita, R. N. D. (2021). Studi Komposisi Jenis Tanaman Dan Sistem Pengelolaan Agroforestri D]Di Areal Hutan Rakyat Dusun Praba, Desa Batu Mekar, Kecamatan Lingsar, Kabupaten Lombok Barat, Provinsi Nusa Tenggara Barat. *Jurnal Silva Samalas: Journal of Forestry and Plant Science*, 5(1), 12–19. <https://e-journal.undikma.ac.id/index.php/jss/article/view/4857>
- Huong, L. T., Dai, D. N., Thang, T. D., Bach, T. T., & Ogunwande, I. A. (2015). Volatile constituents of *Amomum maximum* Roxb and *Amomum microcarpum* C. F. Liang & D. Fang: two Zingiberaceae grown in Vietnam. 29(15), 1469–1472. <https://doi.org/10.1080/14786419.2014.1003064>
- Lianah, Krisantini, & Wegener, M. (2020). Evaluation and identification of the native Zingiberaceae specie in Mijen, Central Java, Indonesia. *IOP Conference Series: Earth and Environmental Science*, 457(1), 012025. <https://doi.org/10.1088/1755-1315/457/1/012025>
- Lutpiatina, L. (2017). Cemarannya *Staphylococcus Aureus* dan *Pseudomonas aerogenosa* Pada Stetoskop Di Rumah Sakit. *Jurnal Teknologi Laboratorium*, 6(2), 61. <https://doi.org/10.29238/teknolabjournal.v6i2.94>
- Muliasari, H., Dwi Ananto, A., & Ihsan, M. (2019). Analisis Kandungan Nutrisi Buah Rengga (*Amomum dealbatum* Roxb). *Jurnal Agrotek Ummat*, 6(2), 71. <https://doi.org/10.31764/agrotek.v6i2.1218>
- Nurchayati, N., & Ardiyansyah, F. (2018). Kajian Etnobotani Tanaman Famili Zingiberaceae Pada Masyarakat Suku Using Kabupaten Banyuwangi. *Biosense*, 1(1), 24–35. <https://ejournal.unibabwi.ac.id/index.php/BIOSENSE/article/view/337>
- Nuryah, A., Yuniarti, N., & Puspitasari, I. (2019). Prevalensi dan Evaluasi Kesesuaian Penggunaan Antibiotik pada Pasien dengan Infeksi Methicillin Resistant *Staphylococcus Aureus* di RSUP Dr. Soeradji Tirtonegoro Klaten. *Majalah Farmaseutik*, 15(2), 123. <https://doi.org/10.22146/farmaseutik.v15i2.47911>
- Perwira, R. I. (2014). Sistem Pakar Untuk Mendiagnosa Penyakit Infeksi Tbc Paru. *Telematika*, 9(2). <https://doi.org/10.31315/telematika.v9i2.285>

- Rizky, R. (2018). Sistem Pakar Untuk Mendeteksi Penyakit Infeksi Saluran Pernafasan dengan Metode Dempster Shafer di Kabupaten Pandeglang Provinsi Banten. *Prosiding SISFOTEK*, September, 4–5. <https://seminar.iaii.or.id/index.php/SISFOTEK/article/view/50/40>
- Roni, A., Maesaroh, M., & Marliani, L. (2019). Aktivitas Antibakteri Biji, Kulit dan Daun Pepaya (*Carica Papaya L.*) terhadap Bakteri *Escherichia Coli* dan *Staphylococcus Aureus*. *Kartika : Jurnal Ilmiah Farmasi*, 6(1), 29. <https://doi.org/10.26874/kjif.v6i1.134>
- Salim, H. H. U., & Soleha, T. U. (2017). Pengaruh Aktivitas Antimikroba Ekstrak Bawang Putih (*Allium sativum*) Terhadap Bakteri Gram Positif (*Staphylococcus aureus*) dan Gram Negatif (*Escherichia coli*) Secara In Vitro. *Medula*, 7(5), 66–70. <https://joke.kedokteran.unila.ac.id/index.php/medula/article/view/1836>
- Sundari, E., & Nuryanto. (2016). Hubungan Asupan Protein, Seng, Zat Besi, Dan Riwayat Penyakit Infeksi Dengan Z-Score Tb/U Pada Balita. *Jurnal Of Nutrition College*, 5(4), 520–529. <https://ejournal3.undip.ac.id/index.php/jnc/article/view/16468>
- Tandanu, E. (2020). Efektivitas Antibakteri Ekstrak Rimpang Jahe Merah (*Zingiber officinale var rubrum*) Terhadap Pertumbuhan Bakteri *Staphylococcus aureus* Secara In Vitro. *PRIMER (Prima Medical Journal)*, 3(1), 44–49. <http://jurnal.unprimdn.ac.id/index.php/PRIMER/article/download/1118/7>
- Toy, T. S. S., Lampus, B. S., & Hutagalung, B. S. P. (2015). Uji Daya Hambat Ekstrak Rumput Laut *Gracilaria Sp* Terhadap Pertumbuhan Bakteri *Staphylococcus Aureus*. *E-GIGI*, 3(1). <https://doi.org/10.35790/eg.3.1.2015.6600>
- Tun, M. (2018). Faktor Resiko Penyakit Infeksi Menular Seksual (IMS). *Jurnal Kesehatan*, 9(3), 419. <https://doi.org/10.26630/jk.v9i3.1109>
- Wulandari, I., Iskandar, B. S., Parikesit, P., Hudoso, T., Iskandar, J., Megantara, E. N., Gunawan, E. F., & Shanida, S. S. (2021). Ethnoecological study on the utilization of plants in Ciletuh-Palabuhanratu Geopark, Sukabumi, West Java, Indonesia. *Biodiversitas Journal of Biological Diversity*, 22(2), 659–672. <https://doi.org/10.13057/biodiv/d220218>