ISSN XXXX-XXXX (Online) | XXXX-XXXX (Print) | Vol. 1, No. 1, November (2022), pp.19-26

Published by: IARN Institute

International Journal of Nursing and Midwifery Research

Journal homepage: https://journals.iarn.or.id/index.php/ners/index

Comparison of the effects of green betel leaf (piper betle) and red betel leaf (piper crocatum) extracts on the growth of staphylococcus aureus bacteria

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Article Info

Article history:

Received Nov 02, 2222
Revised Nov 16, 2022
Accepted Nov 30, 2022

Keywords:

Antibacterial activity;
Essential oils;
Fractions;
Gram positive bacteria;
Piper betle;
Staphylococcus aureus.

ABSTRACT

Betel leaf is well known in Indonesia as a therapeutic herbal. Betel leaf extract contains phenol, euganol and chavicol which can inhibit the growth of bacteria such as Staphylococcus aureus. Phenol can denature the cell protein of bacteria, euganol as bacteriostatic, and chavicol has a bactericidal effect five times more than other phenol derivatives. Red Betel leaf also has some good effect on our body. Research on the effect of red betel leaf is not as much as the effect of betel leaf extract. Because two kinds of piper leaf have some effect as antibacterial, so the purpose of this study is to know the comparison of the antibacterial potency of ethanol extract of red betel vine (Piper crocatum) and beter leaf extract toward the growth of Staphylococcus Aureus. This research use diffusion disk method and with concentration 250 mg/ml, 500mg/ml, 750mg/ml, and 1000mg/ml. The result from this research is that the effect of betel leaf extract at concentrations of 250mg/ml and 500mg/ml is lower than the effect of red betel leaf extract, but at high concentrations of 750mg/ml and 1000mg/ml the effect of betel leaf extract is higher than red betel leaf extract.

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1. INTRODUCTION

Indonesia is a country that has many kinds of plants. From the past until now, many people use traditional plants as alternative medicines from drugs containing chemicals. The habit of consuming traditional medicines is one of the reasons that more and more scientists are developing their use. Traditional medicine as a method to overcome existing health problems. Especially now in the field of antibiotic treatment there are many bacteria that are resistant to antibiotic drugs, one of the reasons is the use of not according to the dosage recommended by the doctor so that it can change the activity of these bacteria.

One of the plants most often used as a medicinal ingredient is the betel plant. This betel plant, especially the leaves, is highly trusted as a traditional medicine by the community. People believe that the betel plant can treat toothache, bad breath, coughing and hoarseness, leucorrhoea, hemorrhoids, itching, and is used as a mouthwash.

Betel leaf can treat various diseases above because betel leaf is also a natural plant that has an antibacterial effect. The antibacterial effect of betel leaves is produced by some of the ingredients in the leaves, namely astri oil which contains several phenolic compounds such as kavikol, cavibetol, karvakol, and eugenol.

Betel leaves have many types, based on the color of the leaves, there are green betel leaves, red betel leaves, and black betel leaves. Based on the name that is commonly used, there are Javanese betel leaves, clove betel leaves, and banda betel leaves. The benefits of all types of betel leaf are generally the same, it can be used as an antibacterial. But what is often used today in society is green betel leaf, because this green betel is easier to find around us.

RESEARCH METHOD

This research is an experimental study using the bacterial disc diffusion test method to compare the effects of green betel leaf extract and red betel leaf on the growth of Staphylococcus aureus bacteria.

This research is an experimental study using the bacterial disc diffusion test method to compare the effects of green betel leaf extract and red betel leaf on the growth of Staphylococcus aureus bacteria.

Data from the research on the effect of betel leaf extract on Staphylococcus aureus were analyzed using the SPSS 16.0 program to see if there was a significant difference in the effectiveness of each test disc containing a negative control, various concentrations of green betel leaf extract and positive control in inhibiting the growth of Staphylococcus aureus .

Data analysis in this study used a numerical comparative hypothesis test for more than two unpaired groups so that the statistical test used was One Way Anova if the data distribution was normal and the data variance test was normal. To determine which concentration has significance, a Post Hoc analysis is performed using the Mann-Whitney test. If the ANOVA test results show that there are significant differences between each test disc, multiple comparison calculations are needed to see which test discs have the difference. mean with other test discs.

2.1 Factors Causing Work Accidents

1. Age

Age has a very important influence on the incidence of work accidents. According to Hunter in Arifin (2005) the old age group has a higher tendency to have an accident compared to the young age group. This is because young people have a higher reaction/response speed. And in general, physical capacities such as vision, hearing, and reaction speed will decrease at the age of 30 years or more. In contrast to the opinion above, Gary Dessler in Sukamto (2004) suggests that accidents generally occur most often between the ages of 17 and 29 years, then will decrease after reaching their lowest point in the late 60's and 70's. ILO (Arifin, 2005) concluded that young workers tend to experience more accidents because young workers tend to lack work experience. Oborno in Arifin (2005) mentions several factors that influence the high incidence of work-related accidents in the young age group, among others due to lack of attention, lack of discipline, tend to follow conscience, careless, and in a hurry. Based on the results of research conducted by Kadarwati (2006) that there is a relationship between age and work accidents at the Eyeglass Frame Factory of PT. Luxindo Nusantara Semarang. Based on the results of research conducted by Kadarwati (2006) that there is a relationship between age and work accidents at the Eyeglass Frame Factory of PT. Luxindo Nusantara Semarang. Based on the results of research conducted by Kadarwati (2006) that there is a relationship between age and work accidents at the Eyeglass Frame Factory of PT. Luxindo Nusantara Semarang.

2. Gender

Men and women differ in physical abilities and muscle strength. (Silastuti, 2006)

3. Years of service

Working period is a factor that can affect the occurrence of work-related accidents. Based on various studies, the increase in years of service and skills will be accompanied by a decrease in the number of work-related accidents. Awareness of work-related accidents increases with increasing age and length of work in the workplace concerned (Suma'mur 1989). a. New working period : < 6 years b. Moderate working period: 6 – 10 years c. Long service life: > 10 years

4. Length of Working Hours

According to Suma'mur (1987), people who work well are 40 hours a week, 6-8 hours a day. In some cases the duration of work of more than 10 hours a day results in a decrease in total performance, a decrease in work speed due to fatigue and usually will be followed by an increase in the number of illnesses and accidents.

5. Shift work

Working time is the division of work shifts within 24 hours. Workers are divided into several groups, each of which takes turns and the length of work is in accordance with the 24-hour quotient by the number of work groups. There are two main problems for workers who work in shifts, namely the inability of workers to adapt to the shift system and the inability of workers to adapt to working at night and sleeping during the day (Arifin, 2005). Shifts in working hours in the morning, afternoon and evening can affect the occurrence of an increase in work accidents (Benny and Achmadi, 1991). Based on research conducted by Halinda (2000) there is a relationship between work shifts and work accidents at the Ceramic Company PT. X Cikarang.

6. Noise

Noise is sounds that humans don't want. Noise in the workplace can affect workers because noise can cause feelings of disturbance, communication disorders resulting in misunderstandings, not hearing the signals given, this can result in work-related accidents besides that noise can also cause temporary or permanent hearing loss. Sounds are heard as a stimulus to the ear by vibrations through an elastic medium, and when these sounds are unwanted, they are expressed as noise. There are two things that determine the quality of a sound, namely its frequency and intensity. Frequency is expressed in the number of vibrations per second or called hertz (Hz) and the energy intensity or current per unit area is usually expressed in decibels (db). The human ear is capable of hearing frequencies between 16-20,000 Hz. (Suma'mur, 1996). Measurement is key in minimizing the risks posed by noise. Noise measurement is not much different from noise survey. To be more adequate, noise measurements must be able to identify workers who are exposed to dangerous (non-standard) levels and produce information which will then be used as the basis for determining company regulations related to noise. An example of a company regulation related to noise is reducing noise exposure; ear protector; mandatory zone sign wearing ear protection;

2. RESULTS AND DISCUSSIONS

1. Results

Green Betel Leaf Extract

Image 1. Green betel leaf extract results

The green betel leaves used in this study were obtained from plants owned by residents in the Pondok Timur housing complex, Bekasi. The results of the determinations that have been made state that the plant used is Piper betle linn, coming from the Piperaceae family. From 500 grams of green betel leaves, 58.1 grams of thick extract was obtained.

Effect of Green Betel Leaf Extract on Staphylococcus aureus

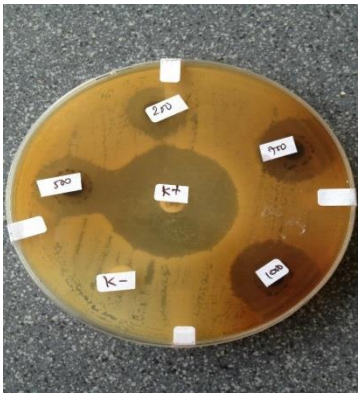


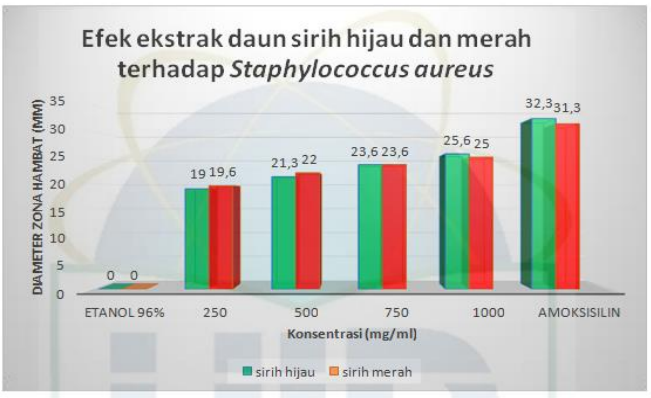
Figure 2. Effect of green extract on s.aures

At a concentration of red betel leaf extract of 250 mg/ml, Staphylococcus aureus was inhibited by growth with an average diameter of 19.6 mm with a standard deviation of 0.57 mm. At a concentration of red betel leaf extract of 500 mg/ml, Staphylococcus aureus was inhibited by the growth of Staphylococcus aureus bacteria with an average diameter of 22 mm with a standard deviation of 1.73 mm. At a concentration of 750 mg/ml of red betel leaf extract, Staphylococcus aureus was inhibited by the growth of Staphylococcus aureus bacteria with an average diameter of 23.6 mm with a standard deviation of 1.52 mm. At a concentration of red betel leaf extract of 1000 mg/ml, Staphylococcus aureus was inhibited by the growth of Staphylococcus aureus bacteria with an average diameter of 25 mm and a standard deviation of 1.73 mm. While observing the growth of Staphylococcus aureus bacteria tested using amoxicillin as a positive control, inhibition of Staphylococcus aureus growth was found with an average diameter of 31.2 mm with a standard deviation of 0.04 mm. As in green betel leaves, in red betel leaves in the lowest concentration, namely 250 mg/ml, it can inhibit the growth of Staphylococcus aureus bacteria and is included in the category of strong inhibition. The greater the concentration, the stronger the effect of inhibiting the growth of Staphylococcus aureus bacteria. in red betel leaves in the lowest concentration, namely 250 mg/ml, it can inhibit the growth of Staphylococcus aureus bacteria and is included in the category of strong inhibition. The greater the concentration, the stronger the effect of inhibiting the growth of Staphylococcus aureus bacteria. in red betel leaves in the lowest concentration, namely 250 mg/ml, it can inhibit the growth of Staphylococcus aureus bacteria and is included in the category of strong inhibition. The greater the concentration, the stronger the effect of inhibiting the growth of Staphylococcus aureus bacteria.

red betel data with concentration 25%		
	STANDARD DEVIATION	AVERAGE
20	0.57735	19.66667
19		
20		

red betel concentrate 50%		
21	1.732051	22
21		
24		
red betel concentration 75%		
22	1.527525	23.66667
24		
25		
red betel concentration 100%		
23	1.732051	25
26		
26		
red betel positive control		
30	1.154701	31.33333
32		

Data Normality for Red Sirih



2. Discussion

Based on the results of this study, green betel leaf extract proved to be more potent than red betel leaf extract in inhibiting the growth of Staphylococcus Aures bacteria. The results of this study are in accordance with research conducted by Seila Inaytullah (2012) which also proved that green betel leaf extract with 96% ethanol solvent using the disk diffusion method can inhibit the growth of Staphylococcus aureus bacteria with strong effectiveness.

Red betel leaf extract has also been shown to inhibit the growth of Staphylococcus aureus bacteria. The results of this study are in accordance with research conducted by Juliantina (2008) which proved that red betel leaf extract could inhibit the growth of Gram positive and negative bacteria and obtained results for the Minimum Inhibitory Concentration (MIC) of red betel ethanol extract against Staphylococcus aureus (Gram positive). tends to be at 25%. Meanwhile, Escherichia coli (Gram negative) tends to be 6.25%. 10 In addition, research conducted by Atingul (2012) proved that red betel leaf extract can inhibit the growth of Staphylococcus Aureus bacteria.

Inside the betel leaf there is an essential oil that functions as an antibacterial. The antibacterial power of green betel leaf essential oil is due to the presence of phenolic compounds and their derivatives which can denature bacterial cell proteins. 21 The main components of essential oil consist of phenol and its derivative compounds. One of these derivative compounds is kavikol which has bactericidal power five times stronger than phenol. The presence of phenolic compounds which are toxic compounds causes the three-dimensional structure of the protein to be disrupted and opens into random structures without any damage to the covalent framework structure (disulfide bonds). 21 This causes the polypeptide chain to be unable to maintain its original shape, causing damage to the cell wall.

The antibacterial effect of red betel leaves is thought to be due to the fact that red betel leaves contain active compounds of flavonoids, alkaloids, tannins, polyphenolic compounds and essential oils. 23 Flavanoids which are lipophilic have the ability to damage microbial cell membranes. Damage to the cell membrane and wall will cause important metabolites in the cell to come out, resulting in cell death. Alkaloids include heterocyclic nitrogenous compounds, which contain a base, nitrogen. The mechanism of action of alkaloids can be related to the ability of alkaloids to interact or attach themselves between DNA. If there is a substance that is between the DNA, it will inhibit the replication of the DNA itself, resulting in disruption of DNA replication which will eventually lead to cell death. Tannins are polyphenolic compounds that are thought to shrink cell walls or cell membranes thereby interfering with cell permeability. As a result of disturbed permeability, cells cannot carry out living activities so that their growth is stunted or even dies.

At concentrations of 250 mg/ml and 500 mg/ml the effect of red betel extract was stronger than green betel extract. At a concentration of 750 mg/ml, the average inhibition zone was the same in green betel and red betel extracts. At a concentration of 1000 mg/ml, green betel was found to be stronger than red betel extract. This is because the red betel leaves do not have saponin and triterpenoid compounds. Saponin and triterpenoid compounds are compounds present in all plants at high concentrations, therefore red betel extract is more potent in inhibiting the growth of Staphylococcus aureus bacteria at low concentrations. 10

Control of ethanol solvent did not show any inhibition zone. This explains that the control used has no effect on the antibacterial test. The control of amoxicillin affects the growth of Staphylococcus aureus bacteria in the category of strong inhibition. Amoxicillin is a broad spectrum antibiotic (can be used for gram-positive and negative bacteria), amoxicillin is also a derivative of penicillin, its mechanism of action is to inhibit bacterial cell wall synthesis.

Based on the description above, it proves that green betel leaf has a role as an antibacterial against Staphylococcus aureus bacteria with strong effectiveness because it contains essential oils with bethel phenol and its derivatives which can inhibit the growth of Staphylococcus aureus bacteria so that they can be used in health products, for example in antiseptic gels for hands.

CONCLUSION

Green betel leaf extract (Piper betle L.) using the disc diffusion method significantly inhibited the growth of Staphylococcus aureus bacteria at a concentration of 500 mg/ml with strong effectiveness. The higher the concentration of green betel leaf extract (Piper betle L.), the stronger it inhibits the growth of Staphylococcus aureus. Red betel leaf extract (Piper crocatum) using the disc diffusion method can significantly inhibit the growth of Staphylococcus aureus bacteria with strong effectiveness at a concentration of 500 mg/ml . The higher the concentration of red betel leaf extract (Piper crocatum), the stronger it is in inhibiting the growth of Staphylococcus aureus bacteria. At concentrations of 250 mg/ml and 500 mg/ml, red betel leaf extract was more potent in inhibiting the growth of Staphylococcus aureus bacteria than green betel leaf extract. At a concentration of 750 mg/ml green betel leaf extract has the same effect as red betel leaf extract. At a concentration of 1000 mg/ml, green betel leaf extract was stronger than red betel leaf extract. Based on statistical tests, there is an average difference between green betel leaf extract and red betel leaf extract, but the difference is not significant, so it can be concluded that the effect of red betel extract is the same as the effect of green betel extract.

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