

## Testing the Antibacterial Activity of Tabasco Pepper Leaf Ethanol Extract Grown in Coastal Area on *Staphylococcus aureus* and *Escherichia coli*

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### ABSTRACT

Tabasco pepper (*Capsicum frutescens*) leaf is one of traditional medicines that people believe is able to treat various diseases. In this study, the antibacterial activity of the ethanol extract of tabasco pepper (*Capsicum frutescens*) leaf was tested against *Staphylococcus aureus* and *Escherichia coli* using agar diffusion method. This study is an experimental study using a population variation of gram-positive and gram-negative bacteria. Variations in extract concentrations used were 5%, 10%, 20%, and 30% concentrations as well as positive control (Ciprofloxacin) and negative control (DMSO 10%). The test results showed that the ethanol extract of tabasco pepper (*Capsicum frutescens*) leaf gave antibacterial activity at a concentration of 20% and 30% against *Staphylococcus aureus* and *Escherichia coli* with resistance diameters of 6 mm and 9.4 mm, respectively. The activity equivalence value of tabasco pepper (*Capsicum frutescens*) leaf ethanol extract against Ciprofloxacin was 22.6 mm - 19.5 mm for *Staphylococcus aureus* and 20.4 mm - 22.3 mm for *Escherichia coli*.

### Keywords

Tabasco pepper leaf; Antibacterial; *Escherichia coli*; *Staphylococcus aureus*; Ciprofloxacin

### Introduction

Infectious diseases are one of the main causes of death worldwide, and are generally caused by bacteria [1]. Pathogenic bacteria that can cause infections and abnormalities in the skin, namely *Staphylococcus aureus*, *Escherichia coli*, *Salmonella*, *Shigella*, *Pseudomonas* and *Yersinia enterocolitica*. *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas* sp. are the most common pathogenic bacteria that harm humans [2]. People commonly treat infectious diseases caused by bacteria by using antibiotics [3]. However, it has bad impact. There will be bacterial resistance problems due to excessive and unsupervised use of antibiotics, so that there can be failure in treatment [4].

Antibiotic resistance is a serious problem. Alternative treatments that have the same potency as the antibiotics used previously are needed [5]. Those treatments can be found in medicinal plants or other plants that contain certain substances and are useful in treat diseases [6,7,8,9]. Medicinal plants provide a very important contribution to the several infectious diseases [10,11,12,13].

Indonesia is a country with a very large coastal area and has abundant natural potential, including medicinal plants or other plants that are useful as alternative or traditional medicine for infectious [14,15,16,17,18,19,20,21,22] and metabolic disease such as wound healing in diabetic [23]. One plant that has medicinal benefits and also has high economic value is tabasco pepper (*Capsicum frutescens*L.). Tabasco chili pepper grows both in lowlands with dry and wet climates with an altitude of 1,000 meters above sea level.

Tabasco pepper (*Capsicum frutescens*) contains anti-oxidants and several other nutrients, such as fat, protein, carbohydrates, calcium, phosphorus, iron, vitamins A, B1, B2, C and alkaloid compounds such as capsaicin, oleoresin, flavonoids and essential oils. Those are widely used as ingredients in cooking spices, traditional medicinal ingredients, food industry and poultry feed [2,24]. Tabasco chili pepper also contains capsaicin and dihydrocapsaicin antibacterial compounds. Capsaicin has an antibacterial mechanism by interfering with cell membrane synthesis, while dihydrocapsaicin is selectively active against bacterial cell walls [25,26].

The parts of Tabasco chili pepper plant have not been fully utilized, including the leaves. In general, Indonesian people do not take advantage of Tabasco chili pepper leaves because after people harvest the fruit, while the leaves will be discarded. Even so, there are some people who use tabasco pepper leaves as a traditional treatment to treat stomach spasms. This treatment is natural and at no cost. It is used by pounding a few pieces of tabasco pepper leaves and brew them with warm or hot water for consumption. As an external medicine, tabasco pepper leaves are used to treat infections of the skin, wounds, and diarrhea [27]. There is very little research and literature related to tabasco pepper leaves. Based on the research, Tabasco pepper contains flavonoids, glycones, phenols, and polyphenols as antioxidants. Tabasco pepper leaves have the ability to inhibit the growth of *Staphylococcus aureus* [27].

Tabasco pepper contains saponins, tannins, alkaloids, glycosides, flavonoid and glycones compound steroids [28]. Flavonoid compounds have activity as antibacterial with a mechanism of disrupting the integrity of bacterial cell membranes. Flavonoids are protein coagulator secondary compounds. The high level of saponin activity against fungal toxicity can accelerate the wound healing process [29].

Several studies have shown that tabasco pepper leaves contain compounds that have pharmacological and antioxidant activity, such as flavonoids and tannins. Tabasco pepper leaves have the potential to be developed as an antibacterial [24], and is traditionally used for the treatment of skin infections, dysentery, and diarrhea. It has other properties as antibacterial, anti-inflammatory, antihistamine, and anti-HIV ingredients [30].

In an effort to utilize the leaves that have not been used optimally, in-depth research is needed, especially the use of tabasco pepper leaves as an antibacterial. In the test for the antibacterial activity of the ethanol extract of tabasco pepper leaves, *Escherichia coli* is used because it is a bacteria that causes diarrhea, and *Staphylococcus aureus* is one of the bacteria that causes coughs in humans. These infectious diseases are often experienced by Indonesians.

## Materials and Methods

This type of research is experimental research on tabasco pepper (*Capsicum frutescens*) leaves with Agar Diffusion method. This research was conducted for 1 month. This research was conducted at the Laboratory of Pharmaceutical Microbiology, University of Halu Oleo. The population in this study was tabasco peppers (*Capsicum frutescens*) leaves of Konawe Sulawesi Tenggara. The samples in this study were some of tabasco pepper (*Capsicum frutescens* L.) leaves on *Staphylococcus aureus* and *Escherichia coli* by diffusion agar.

**The tools** used were Erlenmeyer, 250 ml measuring cup, beaker, test tube rack, dropper, water bath, analytical balance, stirring rod, Petri dish, loop needle, tweezers, incubator, autoclave, oven, micropipette, scale ruler, vial and photographic tools.

**The materials** used were tabasco pepper leaves (*Capsicum frutescens*), distilled water, DMSO 10% NaCl, aluminum foil, 96% ethanol, filter paper, agar nutrient, agar media, bacteria culture (*Capsicum frutescens*) and *Escherichia coli*, hand gloves, masks, discs and label.

**Preparation** includes the provision of tools, including sterilizers. Then, the sampling preparation, which was picking the tabasco pepper leaves in the morning at the photosynthesis time, 07.00-10.00 a.m. Then the tabasco pepper leaves are sorted wet to separate impurities or foreign materials. Then, the leaves were under running water. The washed leaves were then aerated so that the moisture content in the leaves was reduced. Then, the tabasco pepper leaves are dried in the sunlight using a black cloth. Next, the leaves were chopped into small pieces.

**Making ethanol extract** of tabasco pepper leaves is done first by preparing the tools and materials used, weighing the sample of 500 grams of tabasco pepper leaves which have been cut into small pieces as much as 500 grams. Then it was put in a maceration container. Then, 96% ethanol solvent was added to the sample and stirred so that all was homogeneous and completely immersed. After that, the sample was covered and coated with plaster so that it is tightly closed. After  $1 \times 24$  hours, the sample was filtered using filter paper. The filtered powder was reconstituted with the same solvent for up to  $3 \times 24$  hours. The extraction result was then rotary vapored until they became thick extract.

**Making a dilution:** dilution of tabasco pepper leaf extract 5%, 10%, 20%, 30% was made by weighing as much as 0.05 grams; 0.1 gram; 0.2 grams; 0.3 grams of tabasco pepper leaf extract, dissolved in 10% DMSO with 10 ml, stirred until homogeneous then put into the vial and labeled.

**1% positive control dilution in 50 ml:** put Ciprofloxacin in a mortar then crushed, weighed 0.5 grams of Ciprofloxacin, then put it in a 10 ml measuring cup, dissolved with DMSO 10% to 50 ml, put into a measuring flask up to 50 ml.

**Making agar media:** weigh 2.8 grams of agar nutrient media, slowly add distilled water to 100 ml (as needed), heat over a water bath until boiling and clear.

**Test bacterial suspension:** take 2 picks of test bacterial isolate by using loop needle and then add 6 ml of NaCl, then vortex until homogeneous.

**Test step**, Testing the diameter of the inhibition zone of tabasco pepper leaf extract against the growth of *Staphylococcus aureus* and *Escherichia coli* bacteria was carried out by taking 5 ml of agar nutrient media into a test tube and adding 1 ml of test bacterial suspension. Agar nutrient media and test bacterial suspension that had been stored in a test tube were then vortexed to make them homogeneous, then put into a sterile petri dish. Disc paper was placed on the agar surface that has condensed and given tabasco pepper leaf extract with a concentration of 5%, 10%, 20%, 30%, positive control (+) and control (-). Then, incubation was performed for 24 hours at 37°C in incubator. Then the bacterial growth was observed and the zone of inhibition was measured using a scaled crossbar for analysis.

## Results

**Table 1.** The antibacterial effectiveness of tabasco pepper leaf extract against *Staphylococcus aureus*

Treatment	Repeated treatment I	Repeated treatment II	Repeated treatment III	Average
30% tabasco pepper leaf extract	13.5	15.5	20.2	16.4
20% tabasco pepper leaf extract	15.2	17	15.7	15.9
10% tabasco pepper leaf extract	10.5	10.7	11	10.7
5% tabasco pepper leaf extract	10.2	10.2	9	9.8
Positive control	29.5	30	29.5	29.6
Negative control	0	0	0	0
Positive control	28	25.5	26.2	26.5

**Table 2.** The test results of the ethanol extract of tabasco pepper leaves (*Capsicum frutescens*) against the inhibition zone for the growth of *Staphylococcus aureus*

Bacteria	Plant parts	Concentration %	Inhibition zone diameter
<i>Staphylococcus aureus</i>	Leaf	5	2,8
		10	3,7
		20	8,9
		30	9,4
	Positive control (+)	3	22,6
	Positive control (-)	-	0
	Positive control (+)	3	19,5

Based on the table of the result of the analysis of inhibition zone measurement, the diameter between the extract of tabasco pepper (*Capsicum frutescens*) and Ciprofloxacin as a positive control against *Staphylococcus Aureus* was clear. The diameter of the inhibition zone in the leaf extract of tabasco pepper (*Capsicum frutescens*) was 2.8 - 9.4 mm and Ciprofloxacin was 19.5 - 22.6mm.

**Table 3.** The antibacterial effectiveness of tabasco pepper leaf extract against *Escherichia coli*

Treatment	Repeated treatment I	Repeated treatment II	Repeated treatment III	Average
30% tabasco pepper leaf extract	15	14.5	13.7	14.4
20% tabasco pepper leaf extract	15	14.2	12.5	13.9
10% tabasco pepper leaf extract	14	13.5	11.5	13
5% tabasco pepper leaf extract	11.7	13.0	11	11.9
Positive control	26.7	27.5	28	37.4
Negative control	0	0	0	0
Positive control	26.2	27.7	34	29.3
Negative control	0	0	0	0

**Table 4.** The result of testing ethanol extract of tabasco pepper (*Capsicum frutescens*) leaves against the inhibition zone of *Escherichia coli* growth

Bacteria	Plant part	Concentration %	Inhibition zone diameter
<i>Escherichia coli</i>	Leaf	5	4.9
		10	6
		20	6.9
		30	7.4
	Positive control (+)	3	20.4
	Positive control (-)	-	0
	Positive control (+)	3	22.3

Based on the results of the analysis of inhibition zone measurements, the diameter between the extract of tabasco pepper leaves (*Capsicum frutescens*) and Ciprofloxacin as a positive control against *Escherichia coli* bacteria was clear. Inhibition zone diameter in tabasco pepper leaf extract (*Capsicum frutescens*) was 4.9 - 7.4 mm and Ciprofloxacin was 20.4 - 22.3 mm.

### Discussions

Based on the results of the data obtained from the test of the antibacterial activity of the ethanol extract of tabasco pepper (*Capsicum frutescens*) against *Staphylococcus aureus* and *Escherichia coli*, there is a difference in results between the tabasco pepper (*Capsicum frutescens*) leaf extract and Ciprofloxacin.

The method used in determining the antibacterial activity is agar diffusion method using disc paper. This method was chosen because it is easy and can save the use of sample during the testing process. The clear zone or zone of inhibition that forms around the disc paper in solid media indicates that the tabasco pepper leaf extract (*Capsicum frutescens*) used has antibacterial potential because it can inhibit bacterial growth.

The diameter of the inhibition zone in the negative control using DMSO 10% was not formed. The negative control function is to determine whether there is a solvent influence on the growth of *Staphylococcus aureus* and *Escherichia coli* bacteria, so that it can be seen that those having the antibacterial activity are not the solvent test substances. The positive control Ciprofloxacin used provided a fairly large diameter of inhibition zone, with a range of 19.5 mm - 22.6 mm each, with a strong category, and could inhibit bacterial growth.

The result of the research on the antibacterial activity of tabasco pepper (*Capsicum frutescens*) leaf extract against *Staphylococcus aureus* bacteria showed that all concentration series formed an inhibition zone in which the inhibition zone at a concentration of 30%: 9.4 mm, a concentration of 20%: 8.9 mm which was in the moderate category, a concentration of 10%: 3.7 mm and at a concentration of 5%: 2.8 mm, which were categorized as weak.

Meanwhile, the test result of the antibacterial activity of the ethanol extract of tabasco pepper (*Capsicum frutescens*) leaves showed that all series of concentrations formed an inhibition zone, in which the inhibition zone of a concentration of 30%: 7.4 mm, a concentration of 20%: 6.9 mm, a concentration of 10%: 6 mm, which was in the moderate category and a concentration of 5%: 4.9 mm, which was in the weak category. This is in accordance with the study of Pan et al. (2009)

which states that the bacterial inhibition zone is classified as three parts, namely strong (10 mm - 20 mm), moderate (5 mm - 10 mm) and weak (less than 5 mm).

In this study, the ethanol extract of tabasco pepper (*Capsicum frutescens*) leaves was shown to have antibacterial activity against *Staphylococcus aureus* and *Escherichia coli*. Thus, the ethanol extract of tabasco pepper (*Capsicum frutescens*) leaves can be used as an alternative to synthetic antibiotics because it effectively inhibits the growth of the tested bacteria. However, research on tabasco pepper (*Capsicum frutescens*) leaf extract is still limited. Therefore, further research on the content of bioactive compounds and antioxidant activity of tabasco pepper (*Capsicum frutescens*) leaf extract is needed.

### Conclusion

Based on the results of the research conducted, it is concluded tabasco pepper (*Capsicum frutescens*) leaf ethanol extract has antibacterial activity against the growth of *Staphylococcus aureus* and *Escherichia coli*, and variation in the concentration of tabasco pepper (*Capsicum frutescens*) leaf ethanol extract effectively inhibits the activity of *Staphylococcus aureus* and *Escherichia coli* and can be shown at extract concentrations of 20% and 30%.

### Limitations and Future Studies

Further research or investigation is needed on the potential of tabasco pepper (*Capsicum frutescens*) leaf as other antimicrobials as well as its content of bioactive compounds and antioxidant activity. In addition, it is necessary to conduct preclinical research on the potential of tabasco pepper leaves extract to determine the optimal dose after passing the pharmacokinetic phase, toxic doses and observations of possible side effects.

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