



Activity Test of the Preparation of Dental Passage Gel Extract of Basil Leaf Ethanol (*Ocimum Basilicum L.*) Against *Staphylococcus Aureus*

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ABSTRACT

Based on this, basil leaves are formulated in gel toothpaste preparations that have antibacterial activity. This study aims to determine the antibacterial activity of basil leaf gel toothpaste with various base concentrations, 20%, 40% and 60% and to determine the best concentration of basil leaf extract in gel toothpaste preparations that have antibacterial activity against *Staphylococcus aureus*. Basil leaves were extracted by maceration method using 96% ethanol solvent which was then tested for antibacterial activity using disc diffusion method with *Ciprofloxacin* as a positive control and aquadest as a negative control. The results of antibacterial testing showed that the mouthwash with base concentration did not produce an inhibition zone, 20% had a diameter of 6.68 mm, a concentration of 40% had a diameter of 7.81 mm and 60% had a diameter of 8.77 mm. The greater the concentration, the larger the resulting inhibition zone. In this study, it can be concluded that the gel toothpaste of basil leaf extract (*Ocimum basilicum L.*) which can inhibit the *Staphylococcus aureus* is at a concentration of 60% with a moderate inhibitory response category

INTRODUCTION

Basil leaves (*Ocimum basilicum* L.) are plants that are easily obtained spread almost throughout Indonesia because they can grow wild or be cultivated (Sudarsono *et al.* 2002). Traditionally the basil plant is used as a remedy for stomach pain, a fever remedy, relieving bad breath, and as a vegetable. Basil has a variety of biological and pharmacological effects including essential oil and ethanol extract of basil leaves able to inhibit the growth of bacteria such as *Staphylococcus aureus*, *Escherichia coli*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Bacillus cereus*, *Pseudomonas fluorescens*, *Streptococcus alfa*, and *Bacillus subtilis*, *Mycobacterium tuberculosis*, *Klebsiella*, *Proteus*, *Salmonella typhi*, *Shigella*, *Vibrio cholera*, *Neisseria gonorrhoea* (Sudarsono, 2002).

According to Natasya *et al* 2021 states that the content of compounds contained in the ethanol extract of basil leaves (*Ocimum basilicum* L.) consists of flavonoids and tannins that can provide antibacterial effects against the growth of *Staphylococcus aureus*.

One of the bacteria contained in dental plaque is *Staphylococcus aureus*. *Staphylococcus aureus* contains bacteria that can cause infections in the oral cavity and its surroundings with a percentage of 2.62% (Azadeh *et al.*, 2011).

Mechanical removal of plaque is an effective method, this method is in the form of brushing teeth. To increase its antibacterial effectiveness and ease of use, basil leaf extract needs to be made in gel dosage form as a toothpaste. Made in gel paste preparations with a carbomer base because it has the advantage of good dispersality, the effect is cooling, does not clog pores, is easily washed with water and the drug release process is good and has a very high viscositation of 40,000-60,000 cps at a level of 0.5% with a pH of 7.5 (Allen, 2002). That way, the bacteria that cause dental and oral diseases can be overcome by the use of gel toothpaste preparations. The toothpaste used when brushing serves to reduce plaque formation, strengthen teeth against caries, clean and polish the tooth surface, eliminate or reduce bad breath as well as maintain dental health and maintain dental aesthetics.

The selection of the shape of toothpaste with carbomer content as a *gelling* agent as well as a binding agent in toothpaste preparations is also based on the advantages that are not obtained in the form of paste, namely there is a sensation of coldness (due to evaporation of alcohol with water simultaneously when applied) and has an interesting organoleptic, namely transparent (clear) so that it is more accepted by the public in terms of aesthetics. The use of binders also affects the speed and volume of foam formation, the appearance of toothpaste shape, and the speed of taste release from toothpaste preparations (Petrusso, 2010).

Based on the background and statements above, researchers are interested in researching with the title Test Aof the Inhibitory Power of Basil Leaf Ethanol Extract (*Ocimum basilicum* L.) In the preparation of gel toothpaste against *Staphylococcus aureus*. With variations in the concentration of the active substance, respectively, namely the base, 20%, 40% and 60%.

THEORETICAL REVIEW

Research by Nur Aini Purnamaningsih *et al* (2020) on the Potential of Basil Leaf Extract (*Ocimum basilicum L.*) as an antibacterial against *Staphylococcus aureus* with variations in concentrations of 20%, 40%, 60%, 80%, and 100% against *Staphylococcus aureus* using the well diffusion method. The concentration of basil leaf extract is 100% effective as an antibacterial against *Staphylococcus aureus* bacteria of 12.60 mm.

H1: The presence of antibacterial activity of Basil Leaf Ethanol Extract (*Ocimum basilicum L.*) In the preparation of gel toothpaste against *Staphylococcus aureus*.

According to Agatha Maylie Wijatno (2014) about the use of Carbomer as a Gelling Agent in the Toothpaste Formula of Guava Leaf Ethanol Extract (*Psidium guajaval*) in Gel Form using carbomer 940 as a gelling agent with successive concentration variations of 0.5%, 1.0% and 1.5%. After being tested for physical quality, poor results were obtained on the test of ease of removal from the tube and the aroma of gel-shaped guava leaf toothpaste was not preferred. The results show that guava leaf ethanol extract toothpaste has met the criteria of toothpaste which includes physical quality and safety tests.

H2: There is a gelling agent concentration that will be formulated from Basil Leaf Ethanol Extract (*Ocimum basilicum L.*) In the preparation of gel toothpaste against *Staphylococcus aureus*.

According to Natasya *et al* 2021 states that the content of compounds contained in the ethanol extract of basil leaves (*Ocimum basilicum L.*) consists of flavonoids and tannins that can provide antibacterial effects against the growth of *Staphylococcus aureus*.

H3: There are chemical compounds contained in Basil Leaf Ethanol Extract (*Ocimum basilicum L.*) In the preparation of gel toothpaste against *Staphylococcus aureus*.

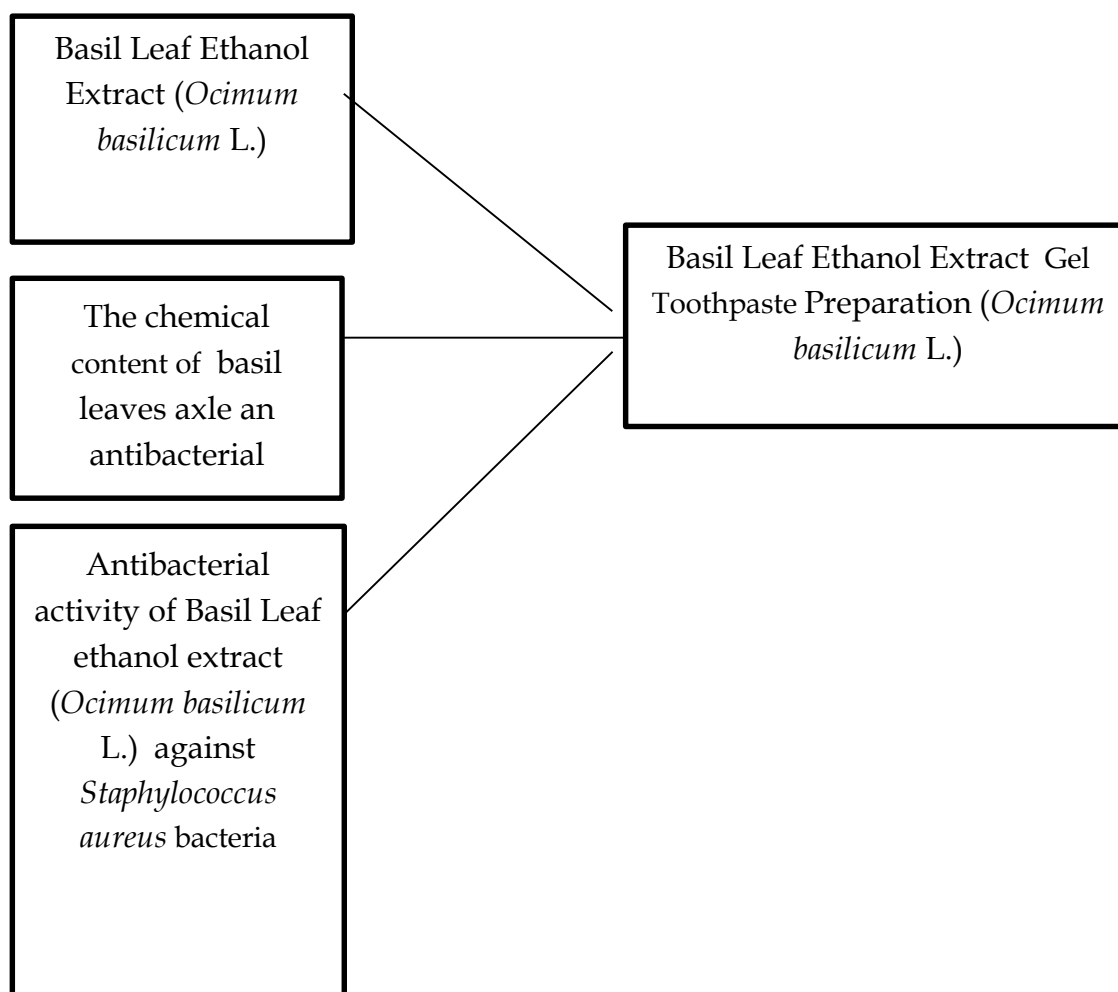


Figure 1. Conceptual Framework Preparation of Dental Passage Gel Extract of Basil Leaf Ethanol (*Ocimum Basilicum* L.) Againts *Staphylococcus Aureus*

After the hypothesis section, if your study is quantitative, please provide the contextual framework here, or your mind maps, if it is qualitative.

METHODOLOGY

The type of research used in this study is a type of laboratory experimental research, which is a test carried out in the laboratory to test and observe the inhibitory activity of basil leaf ethanol extract (*Ocimum basilicum* L.) in gel toothpaste preparations with various concentrations including base, 20%, 40%, 60% against the growth of *Staphylococcus aureus* bacteria.

The ingredients to be used in this study are basil leaf simplicia, 96% ethanol, carbomer, tween 80, triethanolamine, glycerin, sodium benzoate, aquadest, Ciprofloxacin, *Staphylococcus aureus* bacteria, and Hilton Agar Media (MHA).

The data obtained from the antibacterial activity test of gel toothpaste preparations of basil leaf ethanol extract (*Ocimum Basilicum* L.) against

Staphylococcus aureus bacteria were compared with literature and presented in tabular form, as well as narrated descriptively.

RESULTS

The result of making ethanol extract is 96% basil leaves (*Ocimum basilicum* L.) with the maceration method can be seen in the following table:

Table 1. The Result of Making Ethanol Extract 96% Basil Leaves

Simplisia	Simplisia Weight (grams)	Extract Weight (grams)	Amendments (%)
Basil leaves	500	57	11,4

(Source: Primary Data, 2022)

The results of the phytochemical screening test can be seen in the following table:

Table 2. Phytochemical Screening Test of Basil Leaf Viscous Extract

Metabolites Secondary	Result	Information
Flavonoids	A change in the color of the solution to reddish yellow occurs	Positive
Tannins	A change in the color of the solution to blue-black occurs	Positive
Saponins	Foam does not disappear	Positive
Alkaloids	Mayer Reagent : No precipitate formed Dragendrof Reagents : no precipitate formed	Negative

(Source: Primary Data, 2022)

The following is a table of observations of antibacterial activity tests on *Staphylococcus aureus* bacteria after administration of gel toothpaste preparations of basil leaf ethanol extract for 24 hours using the disc diffusion method:

Table 3. Antibacterial Activity Test of Basil Leaf Ethanol Extract Gel Toothpaste Preparation Against *Staphylococcus Aureus* Bacteria

Concentration (%)	Inhibitory Zone Diameter (mm) 3 Replication				Categories of Inhibition Zones
	I	II	III	Average	
Base	0	0	0	0	-
20	7,06	6,42	6,55	6,68	Keep
40	8,28	7,53	7,62	7,81	Keep
60	8,28	8,99	9,04	8,77	Keep
Concentration (%)	2 Replication			Average	Categories of Inhibition Zones
K (+) Ciprofloxacin	23,21	22,20	22,70	22,70	Very powerful
K (-) Aquadest	0	0	0	0	-

(Source: Primary Data, 2022)

DISCUSSION

A gel is a semi-solid system consisting of a suspension made from small inorganic particles or large organic molecules, penetrated by a liquid. In this study, the manufacture of gel toothpaste used a combination of basil leaf ethanol extract as the active substance with carbomer as the gelling agent. Then, according to Natasya *et al* 2021 stated that the content of compounds contained in the ethanol extract of basil leaves (*Ocimum basilicum L.*) consists of flavonoids and tannins that can provide antibacterial effects against the growth of bacteria in the mouth. One of the bacteria that is usually found in the mouth is *Staphylococcus aureus* (Badruttaman *et al*, 2016).

The advantages of gel toothpaste are that it provides a longer cold effect, a lighter texture than paste-shaped toothpaste preparations, and is more moist than pasta preparations (Rosida *et al.*, 2018). This is what underlies the researchers to make the preparation of gel toothpaste basil leaf ethanol extract is made into 4 formulas, each formulation of which has the same composition except basil leaf extract which uses 4 variations in extract concentration, namely the base, 20%, 40% and 60%.

Basil leaf extract gel toothpaste is made with variations in the concentration of the active substance, respectively, namely the base, 20%, 40% and 60%. The manufacture of toothpaste begins with making a base by developing a carbomer with a concentration of 2% into a hot aquadest because the carbomer base can expand well in a hot state after which it is stirred quickly to avoid agglomerates or clumps (Niyaz *et al.*, 2011).

After that, the addition of TEA or Triethanolamine as much as 1% is carried out which is intended to purify and neutralize the pH of Carbomer (mixture 1). Carbomer itself has an acidic pH of about 2.5 - 4.0. So it is necessary to add a neutralizing agent to form a gel mass. One of the neutralizing agents is TEA, because TEA will ionize by the carbomer, producing a negative charge

along the backbone structure of the polymer so as to produce electrostatic repulsion. (Kibbe, 2004). Then sodium saccharin and sodium benzoate are stirred until homogeneous (mixture 2). The addition of sweeteners such as Sodium Saccharin is also needed to improve the taste caused when used, sodium saccharin has water-soluble properties and has a high level of sweetness so that it is only needed in small quantities (Garlen, 1996). Sodium benzoate is also used as a preservative so that the gel toothpaste preparations formed are stable and not damaged during the storage period, and also so that they are not overgrown with bacteria (Rowe, *et al.*, 2009).

After that, mixture 1 and mixture 2 are combined, then tween 80 is added and then homogenized. Tween 80 which serves as a surfactant. Gel toothpaste preparations require surfactants to cause a foam effect. Tween 80 is a widely used surfactant because it has non-toxic properties and is stable to the influence of pH (Zhang, 2009).

Then, the active substance of basil leaf ethanol extract is dissolved in glycerin until homogeneous and then put into the gel base that has been formed. This glycerin functions as a humectant that can prevent the loss of water content in toothpaste or prevent hardening during the storage period (Garlen, 1996). In addition, the addition of aquadest is also needed as a solvent. To be stored for a long time, the addition of preservatives is also very much needed in the formulation of this gel toothpaste.

After that, antibacterial testing of basil leaf extract gel toothpaste was carried out to determine the inhibitory power of basil leaf extract in gel toothpaste preparations against *Staphylococcus aureus* bacteria. The test is carried out using the disc diffusion method. *Staphylococcus aureus* bacterial culture is bred into Nutrient Agar (NA) because it is easily frozen and contains carbohydrates in the form of galactome so that it is not easily decomposed by microorganisms. In this case, beef and peptone extracts contained as the basic ingredients of NA constituents are sources of protein, nitrogen, vitamins and carbohydrates that are needed by microorganisms to grow and develop (Harry, 2013).

Then the bacteria in the incubated NA (*Nutrient Agar*) media were diluted using 0.9% NaCl as much as 10 mL until the turbidity was equivalent to a standard solution of 0.5 Mc Farland (Nuria, 2010). Mcfarland standards for standardization of estimates of the number of bacteria in liquid suspense by comparing the turbidity of test suspenses. In this study, the Mcfarland 0.5 standard was used, where the standard is a standard that is commonly used on a laboratory scale. According to Asrisetya (2019), the standard used for antimikroba susceptibility experiments and bacterial culture experiments at the Clinical Microbiology Laboratory is Standard Mcfarland 0.5 which is equivalent to the estimated number of bacterial suspense which is 1.5×10^8 CFU / ml.

Then *Mueller Hinton Agar* (MHA) media was created for testing antibacterial activity. The reason this medium is used is because, all bacteria can thrive on this medium which is not a differential and selective medium. Pathogenic non-fastidious bacteria can be very easy to grow (Atmojo, 2016). In addition, this media has been designated as a standard medium for antimicrobial sensitivity testing. In previous studies, MHA media plates by diffusion were able

to form an antisemibic diffusion zone that was better than most other plates (Rizki, 2017).

The method used is the disc paper method because it is a method commonly used to test the antimicrobial activity of an antibiotic against pathogenic microorganisms that cause disease. The sensitivity of pathogenic microorganisms to antibiotics can be seen from the size of the clear zones formed (Cappucino & Sherman, 2001). The parameter used is a clear zone, which is a clear area around the paper disc as an indication of the absence or inhibition of the growth of microorganisms due to the excretion of antimicrobial substances by its competitors (Byod, 1995; Atlas and Bartha, 1998).

Gel toothpaste is made with 4 different extract concentrations i.e. base, 20%, 40%, and 60% coupled with one positive control (Ciprofloxacin antibiotic disc) and one negative control (disc soaked in Aquadest). Antibacterial test testing for gel toothpaste preparations with base concentrations, 20%, 40% and 60% was carried out as many as 3 replications while on positive dicks (Ciprofloxacin) and negativ control (Aquadest) Performed 2 replications. The results of testing the antibacterial activity of basil leaf ethanol extract in gel toothpaste preparations against *Staphylococcus aureus* bacteria, obtained an average inhibitory power diameter with a base concentration of 0 mm which means that at the base concentration it cannot produce inhibitory power in *Staphylococcus aureus* bacteria , a 20% concentration of 6.68 mm which belongs to the medium category, a 40% concentration of 7.81 mm which belongs to the medium category and a 60% concentration of 8.77 mm which belongs to the medium category.

In this study, it was found that the higher the concentration of the extract, the higher the diameter of the inhibitory zone. The results of this study are also in accordance with the results of previous studies, in a study conducted by Pelzcar and Chan (1988) stated that the higher the concentration of the extract, the higher the inhibitory power to bacterial growth. So, in this study the largest inhibitory zone was obtained in ethanol extract gel toothpaste with a concentration of 60%.

There are several factors that affect the diameter of the inhibitory zone of bacterial growth. According to Sumarno (2000), that is the turbidity of the bacterial suspension. If the suspension is less turbid then the diameter of the inhibitory zone will be larger, and vice versa if the suspension is more turbid the diameter of the inhibitory zone will be smaller. In measuring the turbidity of the suspension, a device should be used, namely a nephelometer so that the turbidity of the bacterial suspension is more accurate when compared to the turbidity of *Mc Farland* 0.5. However, in this study macroscopic measurements of turbidity were carried out only visually due to the limitations of the tool. In addition, the thickness of the agar media can also be one of the factors that affect the diameter of the bacterial growth inhibition zone. The effective thickness of the agar is about 4 mm. If it is less than 4 mm diffusion the extract will be faster, while if it is more than 4 mm diffusion the extract will be slow. In this study, no measurements were made on agar media so that it could not be known exactly the thickness of the *Muller Hinton Agar* (MHA) media used.

Basil Leaf gel toothpaste (*Ocimum basilicum L.*) has the potential to be antibacterial because of the content of compounds in basil leaves such as flavonoids, tannins, and saponins (Ardiana, *et al*). Flavonoid compounds act as antibacterials by damaging the bacterial cell membrane in the phospholipid section so as to reduce permeability which results in bacteria being damaged (Nurmashita, 2015). The presence of tannins in the extract can cause disruption of peptidoglycan synthesis so that the formation of bacterial cell walls becomes imperfect. In addition, tannin compounds have the ability to form complex compounds with proteins through hydrogen bonds, causing protein denaturation when the pH approaches isoelectricity. Proteins will be precipitated, enzymes become inactive, metabolism is disrupted which causes damage to bacterial cells (Nurmashita, 2015 and Nuzulia, 2017). Saponins work as antibacterials by disrupting the stability of bacterial cell membranes, which causes important bacterial components such as proteins, nucleic acids and nucleotides to come out so that bacteria become lysis (Alamsyah, 2014).

CONCLUSIONS AND RECOMMENDATIONS

1. The secondary metabolite contained can be basil leaves (*Ocimum basilicum L.*) i.e. flavonoids, tannins and saponins
2. Antibacterial activity of basil leaf ethanol extract (*Ocimum basilicum L.*) in gel toothpaste preparations with a base concentration does not produce an inhibitory zone
3. Antibacterial activity of basil leaf ethanol extract (*Ocimum basilicum L.*) In the preparation of gel toothpaste with a concentration of 20% has an average diameter of 6.68 mm
4. Antibacterial activity of basil leaf ethanol extract (*Ocimum basilicum L.*) in the preparation of gel toothpaste with a concentration of 40% has an average diameter of 7.81 mm
5. The best concentration of antibacterial activity of basil leaf ethanol extract (*Ocimum basilicum L.*) In the preparation of gel toothpaste with a concentration of 60% has an average diameter of 8.77 mm

FURTHER STUDY

For the development of further research results, it is necessary to make different dosage formulas in basil leaf extract as well as test the activity of extracts with consensuali which can inhibit antibacterial activity in the oral cavity.

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