

CHAPTER I

INTRODUCTION

1.1 Background

Oral health is an important aspect for humans in daily life. Generally, overall body health needs to be considered. In addition, dental and oral health can affect the overall health of the body, as stated in the Minister of Health Regulation No. 89 of 2015 concerning dental and oral health efforts. According to the results of the Basic Health Research¹ states that the largest proportion of dental problems in Indonesia is damaged, decayed, or painful teeth at 45.3%. Meanwhile, the majority of oral health issues experienced by the Indonesian population are swollen gums and/or abscesses at 14%. Diseases in the oral cavity, such as sore throat, toothache, and inflammation, usually occur due to infections in the oral cavity. Infectious diseases in the oral cavity are caused by pathogens such as bacteria, viruses, fungi, and protozoa.²

The prevalence of dental and oral health problems in Indonesia remains relatively high. Besides brushing teeth, one way to chemically control oral health is by using mouthwash to maximize oral cleanliness. Mouthwash functions to prevent bad breath. However, these medications have side effects such as allergies, nausea, and in some cases, irritation leading to the development of resistance in fungi caused by certain ingredients like triclosan. Triclosan has a broad antimicrobial spectrum and can reduce plaque. However, the use of mouthwash containing triclosan can pose a risk of dental and, does not show a reduction in bacteria or fungi, or what is commonly referred to as resistance. Given the concerns about bacterial resistance caused by triclosan, the use of triclosan mouthwash is not recommended.³ Then there is a substance called chlorhexidine, which is an antibacterial agent that has a negative effect on the color stability of composite resin restorations or causes temporary sensory changes and leaves brown stains on teeth, restorations, mucous membranes,

¹Riskerdas. 2018. "Proporsi Masalah Gigi di Indonesia".
<https://sehatnegeriku.kemkes.go.id/baca/umum/20210912/3338465/kemenkes-tingkatkan-layanan-kesehatan-gigi-dan-mulut-yang-aman-dari-penularan-covid-19/>, *Sehat Negeriku*.

² Fatihah, Iha Nadia, et al. 2023. "The Effect of Ginger for Garling on Salivary Profile and In-Vivo Antimicrobial Activity." *International Journal Islamic and Complementary Medicine* 2-3.

³ Perala, Bhupathiraju P. 2016. Efficacy of Four Fluoride Mouth Rinses on *Streptococcus mutans* in High Caries Risk Children – A Randomized Controlled Trial. *J Clin Diagn Res*;10(9): ZC56–60.

and tongue that are difficult to clean,⁴ The long-term use of *chlorhexidine* is not recommended because the potential side effects include taste disturbances, burning sensation, discoloration of teeth, restorations, and mucous membranes, as well as increased calculus formation.⁵ Some mouthwashes on the market also use ethanol as a solvent. In high concentrations, ethanol also plays an important role as a preservative and antiseptic agent. However, alcohol-based mouthwashes can become aggressive liquids that damage the tissues of the oral cavity and cause epithelial detachment, mucosal ulceration, gingivitis, petechiae, and white lesions with long-term use.⁶ Long-term use will also lead to the problem of *Candida albicans* resistance to the drug. Therefore, treatment using natural ingredients is needed, which is expected to minimize side effects or serve as an initial step in screening antifungal candidates.⁷ The alternative chosen to address the issue is to use mouthwash based on herbal plant extracts that have antifungal activity, such as peppermint leaves (*Metha piperita* L.) and ginger (*Zingiber officinale* Roscoe Var. *amarum*).

Peppermint (*Metha piperita* L.) contains essential oils that include menthol and menthone, which have antifungal activity. The essential oils in peppermint can act as antifungals against *Candida albicans*. In addition, peppermint leaves also contain phenolic compounds, tannins, flavonoids, menthofuran, and triterpenoids that have the ability to kill fungi and bacteria.⁸ In ginger plants (*Zingiber officinale* Roscoe Var. *amarum*), which are widely distributed in Indonesia and commonly used as medicine, several studies have shown that ginger extracts have broad-spectrum antibacterial activity.⁹ In addition, ginger also has antifungal activity against *Candida albicans*. The active ingredient that acts as an antifungal in ginger is

⁴ Ibrah. 2016 Pengaruh Lama Perendaman Dalam Larutan Chlorhexidine Terhadap Perubahan Warna Resin Akrilik Heat Cured. Jurnal Material Kedokteran Gigi; 5(1); 9

⁵ Istibsyaroh, Lestari S, Nugroho R. 2018. Perubahan Warna Resin Komposit Nanofiller Setelah Perendaman Dalam Minuman Susu Ferementasi. The Indonesian Journal Of Health Science; 10(1);

⁶ Poetry., Pinka. & Prakasa, 2017. Efek Obat Beralkohol Terhadap Jaringan Rongga Mulut. Jurnal Ilmiah dan Teknologi Kedokteran Gigi, 13(1), pp. 4-7.

⁷ Nurul, Makhfirah; et al 2020. "Pemanfaatan Bahan Alami Sebagai Upaya Penghambat *Candida albicans* Pada Rongga Mulut". Jurnal Jeumpa, 7 (2)

⁸ Patil SR, Godghate AG. 2016; *Mentha piperita* Linn: Phytochemical, antibacterial and dipterian adulticidal approach. Int J Pharm Pharm Sci. 8(3):352-5.

⁹ Gupta SK, dan Sharma A. 2014; Medical properties of *Zingiber officinale* Roscoe-A Review. IOSR J Pharm Biol Sci. 9(5):124-29.

phenolic compounds, especially gingerol, which can inhibit the filament formation process by *Candida albican*.¹⁰ Several in vitro studies report that ginger extract can inhibit the growth of *Candida albicans*. as explained in the Qur'an, Surah Al-Insan, verse 17, which states:

وَيُسْقَوْنَ فِيهَا كَأْسًا كَانَ مِزَاجُهَا زَنْجَبِيلًا ۝ ١٧

"There, they were given a glass of ginger-infused drink."

Surah Al-Insan verse 17 shows a good reward for the inhabitants of paradise, which is a drink mixed with ginger, or what the Quran refers to as "zanjabil." The word "zanjabil" is interpreted in various ways by the commentators. However, based on the majority of the mufassir's opinions, Jauhari concludes that zanjabil is a tropical plant that grows with aromatic roots used to flavor food and beverages.¹¹

Evaluation of antifungal activity research on peppermint in general, which is conducted in vitro on animals, shows that the novelty in mouthwash formulation research is the combination of peppermint and ginger extracts used as a mouthwash that can prevent *Candida albicans*. Additionally, the mouthwash formulation research with a combination of peppermint leaf extract and emprit ginger extract can also be considered an innovation in mouthwash development with alternatives that cause minimal or no side effects at all, thereby assisting pharmacists in the latest innovations in mouthwash. These effects encourage the development of mouthwash made with natural ingredients from the combination of ginger and peppermint plants, based on previous research,¹² that multi-plant extract (extract made from a mixture of two or more plants) in a formulation will have greater antifungal activity compared to single plant extract.

¹⁰ Dewi, S. T., Chairani, S., dan Puspa, S. R. 2023. Perbandingan Jumlah *Candida albicans* Setelah Berkumur Ekstrak Jahe dan Klorheksidin pada Penggunaan Ortodonti Cekat. Cakradonya Den J, 15(2):81-86.

¹¹ Putri, A., Andy, S., Utomo, W. W., & Pemi. 2023. Jahe Dalam Al-Qur'an dan Sains: Analisis Penafsiran M. Quraish Shihab Terhadap Q.S Al-Insan Ayat 17 Dalam Tafsir Al-Misbah. *Al-Wasathiyah: Journal of Islamic Studies*, Volume 2 (2).

¹² Hulwah, D. Z., Bobsaid, J., Ramadhan, M., & Setiawati, Y. 2022. Efektivitas Mouthwash Berbahan Dasar Ekstrak *Camellia sinensis* dan *Metha Piperita* Antibakteri terhadap *Streptococcus mutans*. *Jurnal Kedokteran Meditek*, 28(1) 30-39

1.2 Research Problem

The research problem in this research is:

1. What are the characteristics of mouthwash formulations with a combination of peppermint leaf extract and ginger as antifungals against *Candida albicans*?
2. How effective is the combination of peppermint leaf extract and ginger extract as an antifungal against *Candida albicans* in mouthwash formulation?

1.3 Research Objectives

The objective of this research is:

1. To determine the characteristics of pH, viscosity, and homogeneity in mouthwash with a combination of peppermint leaf extract and ginger as an antifungal against *Candida albicans*.
2. To determine the potential effectiveness of the combination of peppermint leaf extract and ginger extract as an antifungal against *Candida albicans* in mouthwash formulation.

1.4 Benefits of Research

1. Theoretical Benefits

The results of this study can be used as a reference for further research on reproductive physiology, particularly regarding antimicrobials in the *Candida albicans* bacteria in vitro.

2. Practical Benefits

The results of this research are expected to enrich the body of knowledge and broaden the readers' understanding, especially for mouthwash users in combination with ginger and peppermint against fungi in vitro.

1.5 Research Authenticity

Research on the effects of anabolic steroids has been conducted by several researchers, as shown in Table 1 below.

Table 1. Research Authenticity

Research Title	Research Methodology	Variable	Result	Differences in Research
The Effect of Ginger for Garling on Salivary Profile and In-Vivo	Experiment, Experimental Laboratory	Dependent: The study population was female students at UNIDA Gontor Female Campus with	Antimikrobia The antifungal activity of ginger decoction in this study showed no decrease in the number of colonies before and	Dependent: 1) Fungi of the species <i>Candida albicans</i> . 2) Fungi that have been incubated at 37°C for 48

Research Title	Research Methodology	Variable	Result	Differences in Research
Antimicrobial Activity ¹³		inclusion criteria: 1) Respondents who have experienced dental caries and/or mouth sores, 2) Respondents who have experienced problems with swallowing and rinsing, and 3) Respondents who wanted to collect their saliva as samples. Independent: 5 test groups, positive control, negative control, 10% ginger decoction, 20% ginger decoction, 30% ginger decoction. In the treatment 2 times a day for 3 consecutive days.	after treatment. This is because ginger decoction cannot maximally attract active metabolites that play a role in antifungal activity. The antifungal activity of ginger has been extensively studied and its activity was optimal in the form of essential oils compared to the form of aqueous/boiled extracts and organic solvents. The essential oil of ginger was rich in zingiberene, zingerone, and trans-[6]-shogaol which have a strong antifungal activity where the hydrophobic of the essential oil can damage the fungal cell wall	hours. 3) <i>Candida albicans</i> fungi that have been rejuvenated in PDA. Independent: The combination of peppermint extract with ginger extract as an antifungal for <i>Candida albicans</i> .
The Effect of Gargling Mint Leaf Decoction (<i>Metha piperita</i>) on Changes in Salivary pH	Experiment	Dependent: The effectiveness of gargling mint leaf decoction on changes in saliva pH in 26 students Independent: Rinse for 30 minutes with mint leaf decoction and aquadest.	The increase in saliva pH was higher after rinsing with boiled mint leaf water compared to aquades. And in the first group, which gargled with mint leaves, the average pH value before gargling was neutral, and after gargling, the average pH of the saliva changed to alkaline. In the second group, which gargled with aquades, the average pH value before gargling was neutral, and after gargling, the average pH of the	Dependent: 1) Fungi of the species <i>Candida albicans</i> . 2) Fungi that have been incubated at 37°C for 48 hours. 3) <i>Candida albicans</i> fungi that have been rejuvenated in PDA. Independent: The combination of peppermint extract with ginger extract as an antifungal for <i>Candida albicans</i> .

¹³ Fatihah, Iha Nadia, et al. 2023. "The Effect of Ginger for Garling on Salivary Profile and In-Vivo Antimicrobial Activity." International Journal Islamic and Complementary Medicine 2-3.

Research Title	Research Methodology	Variable	Result	Differences in Research
Comparison of <i>Candida albicans</i> Count After Rinsing with Ginger Extract and Chlorhexidine in Fixed Orthodontic Users	Experiment	<p>Dependent: Comparison of the effectiveness of gargling ginger extract and chlorhexidine on the number of <i>Candida albicans</i> in 30 subjects</p> <p>Independent: gargling with 30% ethanol ginger extract and the group gargling with 0.2% chlorhexidine gluconate. The mouthwash was used for 14 days with a frequency of twice daily.</p>	<p>saliva changed to (basa).</p> <p>The use of mouthwash with ginger extract or chlorhexidine can reduce the number of <i>C. albicans</i> colonies compared to before using the mouthwash. Statistical analysis also shows that after rinsing with ginger extract or chlorhexidine, there is a significant decrease in the number of <i>C. albicans</i> colonies on the 7th day. On the 14th day, the decrease in the number of <i>C. albicans</i> colonies is the most pronounced.</p>	<p>Dependent: 1) Fungi of the species <i>Candida albicans</i>. 2) Fungi that have been incubated at 37°C for 48 hours. 3) <i>Candida albicans</i> fungi that have been rejuvenated in PDA.</p> <p>Independent: The combination of peppermint extract with ginger extract as an antifungal for <i>Candida albicans</i>.</p>
The Effectiveness of Mouthwash Based on Camellia sinensis and Mentha piperita Extracts as Antibacterial Agents Against Streptococcus Mutans	Experiment al laboratory	<p>Dependent: The antibacterial effectiveness of mouthwash with a combination of Camellia sinensis and Mentha piperita extracts on Streptococcus mutans.</p> <p>Independent: Measurement of the inhibition zone in the diffusion test. Mouthwash with 5 formulas with concentrations of 20%, 40%, 60%, 80%, 100%, for 35 days.</p>	<p>mouthwash based on a combination of Camellia sinensis and Mentha piperita extracts with a concentration of 100% is the most effective as an antibacterial against Streptococcus mutans. Further research in the form of in vivo studies is needed to determine the actual effectiveness of mouthwash on test subjects.</p>	<p>Dependent: 1) Fungi of the species <i>Candida albicans</i>. 2) Fungi that have been incubated at 37°C for 48 hours. 3) <i>Candida albicans</i> fungi that have been rejuvenated in PDA.</p> <p>Independent: The combination of peppermint extract with ginger extract as an antifungal for <i>Candida albicans</i>.</p>