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FORMULATION OF MOUTH MOUTH FROM ETHANOL EXTRACT OF CARROT (Daucus carota L.) TUBES AS AN ANTIFUNGAL AGAINST THE GROWTH OF Candida albicans

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ABSTRACT

One of the causes of canker sores and bad breath is the presence of fungus in the oral cavity. This can be overcome by gargling using mouthwash. Research has been carried out on the formulation of mouthwash preparations from ethanol extract of carrot (Daucus carota L.) tubers as an antifungal against the growth of Candida albicans. ***Objectives:*** *The aim of this study was to see the antifungal activity of carrot tuber extract mouthwash preparations.* ***Methods:*** *This research is a type of laboratory experimental research using the paper disc diffusion method on agar media to see the antifungal activity of carrot root extract mouthwash preparations. Carrot tuber extract mouthwash was made into four formulas, namely F0 (preparation without extract), F1 (5% carrot extract), F2 (15% carrot extract) and F3 (30% carrot extract). Evaluation of mouthwash preparations includes examination of organoleptic, pH, viscosity and stability.* ***Results:*** *indicate that mouthwash preparations can provide antifungal activity against the growth of Candida albicans. The diameter of the inhibition zone obtained at concentrations of 5% (2.9 mm), 15% (3.9 mm) and 30% (5.3 mm). All mouthwash formulations have a weak category of inhibitory power. The results of organoleptic evaluation, pH, viscosity and stability of mouthwash preparations gave good results, were stable and fulfilled the requirements for mouthwash preparations.* ***Conclusion*** *is that the ethanol extract of carrot root can be formulated into mouthwash and has weak antifungal activity.*

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1. INTRODUCTION

Currently, the most common cases in society are fungal infections. Fungus is an infectious disease that is closely related to habits and the level of personal hygiene. Therefore, densely populated environments with poor sanitation and low socioeconomic levels can also spur the

development of fungal infections (1). One of the fungal species that often causes various types of infections is Candida albicans.

Diseases caused by Candida albicans can be divided into mucous membrane candidiasis, cutaneous candidiasis, systemic candidiasis and id reactions (Candidid). In oral candidiasis, the red mucosa is covered with white patches. These white patches are usually asymptomatic, but may also be accompanied by a burning sensation (2).

Oral mucous membrane candidiasis and other forms of mucocutaneous candidiasis are usually treated with ketoconazole and show a good response (3), but ketoconazole has several side effects from its use, including irritation, itching (4) nausea and vomiting (5) so it is necessary to consider alternative therapies in candidiasis. One alternative that can be used is to utilize plants that contain lots of active compounds that can act as antifungals, considering that the use of traditional medicines is considered safer than synthetic antifungal drugs because they have relatively smaller side effects and some even have no side effects if used appropriately (6).

One of the traditional plants that can be used for antifungal treatment is carrot root. Carrot tubers contain bisabolen, tiglic acid and geraniol. Some of the known chemical constituents of carrot tubers are essential oils, beta-carotene, essential oils, amino acids, pectin, natural sugars, glutanions, Vitamin B1 and Vitamin C. Leaves, fruit and carrot tubers contain saponins (7). Jupriadi's research (2011) states that the antifungal properties of carrot root compounds are Flavonoids (8).

Putri's research (2016) states that carrot root juice can provide antifungal activity against Candida albicans at a concentration of 25% with a MIC of 9.3 mm (9). Ummu's research (2019), states that the ethanol extract of carrot tubers contains Flavonoid and Saponin compounds which have antifungal activity against the fungus Candida albicans at a concentration of 5% w/v with a MIC of 19.8 mm in the strong inhibition zone category (10).

One way to overcome problems in the oral cavity in the form of dental caries and candidiasis is to use mouthwash. Based on the research above, the authors wanted to formulate carrot root ethanol extract as an antifungal against the growth of Candida albicans into mouthwash preparations.

2. RESEARCH METHODE

This type of research is an experimental research involving sampling, sample preparation, sample processing, extract preparation, mouthwash preparation preparation, and evaluation of mouthwash preparations.

The sample used in this study was carrot root extract (Daucus carota L.). The sample preparation process includes cleaning the carrot tubers from dirt, washing, peeling, weighing, slicing, and drying them into fine powder.

Furthermore, carrot root extract was prepared by maceration method. Carrot tuber simplicia powder was soaked in 70% ethanol for several days, then filtered to produce filtrate and residue. The filtrate was evaporated using a rotary evaporator to obtain a thick extract which was weighed and stored in a desiccator.

The mouthwash formulation consists of several ingredients, including ethanol extract of carrot root, glycerin, propylene glycol, Na-saccharin, menthol, 70% ethanol, and distilled water. Various formula variations (F0, F1, F2, F3) were prepared with different proportions of ingredients.

Mouthwash preparations were made by dissolving the ethanol extract of carrot root with propylene glycol in a beaker glass, then adding aquadest and glycerin until dissolved. Menthol, Na-saccharin, and distilled water were also added and stirred until dissolved. The mouthwash preparation solution that has been made is filtered, tightly closed, and stored for evaluation.

Evaluation of mouthwash preparations was carried out through organoleptic observations (taste, shape, color, aroma, clarity), pH measurements, viscosity measurements, and stability tests. Organoleptic evaluation involves observing the physical changes in the preparations after being stored for 6 cycles. pH and viscosity measurements were also carried out before and after the storage cycle.

In addition, preparation of negative control and positive control was carried out for comparison with the tested mouthwash preparations. The tools used in this study were also sterilized before use.

In the next step, the test fungi were inoculated on the slanting agar medium and the seeding medium. Fungal identification was carried out by observing the morphological structure using a microscope.

Finally, the antifungal activity of the mouthwash was tested using test media that had been inoculated with the test fungus.

3. RESULT AND ANALYSIS

Plant Identification Results

The results of plant identification carried out at the Medanense Herbarium (MEDA) at the University of North Sumatra, Medan, showed that it was true that the test material used was Carrot (Daucus carota L.).

Results of Sample Preparation

The results of the sample preparation of worel tubers obtained a fresh sample weight of 4.5 kg, a carrot tuber simplicia weight of 470 gr and a simplicia powder weight of 450 gr. The percentage of depreciation obtained is 8.57%.

Extraction Results of Carrot Tuber Simplicia Powder

Extraction of carrot tuber simplicia yielded an extract weight of 227.28 gr. The yield percentage obtained was 50.51%.

Results of Preliminary Evaluation of Mouthwash Preparations

Table 2. Preliminary Evaluation Results

Keterangan	F0	F1	F2	F3
Bau	Menthol	Menthol	Menthol	Menthol
Rasa	Manis	Manis	Manis sedikit rasa wortel	Manis rasa wortel
Warna	Tidak berwarna	Orange muda	Orange	Orange tua
Bentuk	Cair	Cair	Cair	Cair
Kejernihan	Jernih	Jernih	Jernih	Jernih
pH	7,3	5,6	5,4	5,3
Viskositas	4,55 cSt	5,26 cSt	5,92 cSt	7,57 cSt

Note:
F0 = without extract
F1 = 5% ethanol extract of carrot tubers
F2 = 15% ethanol extract of carrot tubers
F3 = 30% ethanol extract of carrot tubers

Organoleptic Stability Results

Table 3. Results of Organoleptic Stability Examination of Mouthwash Preparations

F	Ket	Siklus					
		1	2	3	4	5	6
0	Bau	Menthol	Menthol	Menthol	Menthol	Menthol	Menthol
	Rasa	Manis	Manis	Manis	Manis	Manis	Manis
	Warna	Tidak Berwarna	Tidak Berwarna	Tidak Berwarna	Tidak Berwarna	Tidak Berwarna	Tidak Berwarna
	Bentuk	Cair	Cair	Cair	Cair	Cair	Cair
	Kejernihan	Jernih	Jernih	Jernih	Jernih	Jernih	Jernih
1	Bau	Menthol	Menthol	Menthol	Menthol	Menthol	Menthol
	Rasa	Manis	Manis	Manis	Manis	Manis	Manis
	Warna	Orange Muda	Orange Muda	Orange Muda	Orange Muda	Orange Muda	Orange Muda
	Bentuk	Cair	Cair	Cair	Cair	Cair	Cair
	Kejernihan	Jernih	Jernih	Jernih	Jernih	Jernih	Jernih
2	Bau	Menthol	Menthol	Menthol	Menthol	Menthol	Menthol
	Rasa	Manis Sedikit Rasa Wortel	Manis Sedikit Rasa Wortel	Manis Sedikit Rasa Wortel	Manis Sedikit Rasa Wortel	Manis Sedikit Rasa Wortel	Manis Sedikit Rasa Wortel
	Warna	Orange	Orange	Orange	Orange	Orange	Orange
	Bentuk	Cair	Cair	Cair	Cair	Cair	Cair
	Kejernihan	Jernih	Jernih	Jernih	Jernih	Jernih	Jernih
3	Bau	Menthol	Menthol	Menthol	Menthol	Menthol	Menthol
	Rasa	Manis Rasa Wortel	Manis Rasa Wortel	Manis Rasa Wortel	Manis Rasa Wortel	Manis Rasa Wortel	Manis Rasa Wortel
	Warna	Orange Tua	Orange Tua	Orange Tua	Orange Tua	Orange Tua	Orange Tua
	Bentuk	Cair	Cair	Cair	Cair	Cair	Cair

Kejernihan	Jernih	Jernih	Jernih	Jernih	Jernih	Jernih

Notes:
F0 = without extract,
F1 = 5% ethanol extract of carrot tubers
F2 = 15% ethanol extract of carrot tubers, F3 = 30% ethanol extract of carrot tubers

pH Stability Results

Table 4. Results of pH Stability Examination of Mouthwash Preparations

Formula	Siklus						Rata-rata
	1	2	3	4	5	6	
F0	7,3	7,3	7,3	7,3	7,3	7,3	7,3
F1	5,6	5,6	5,6	5,6	5,6	5,6	5,6
F2	5,4	5,4	5,4	5,4	5,4	5,4	5,4
F3	5,3	5,3	5,3	5,3	5,3	5,3	5,3

Note:
F0 = without extract
F1 = 5% ethanol extract of carrot tubers
F2 = 15% ethanol extract of carrot tubers
F3 = 30% ethanol extract of carrot tubers

Viscosity Stability Results

Table 5. Results of Viscosity Stability Check for Mouthwash

Formula	Siklus (cSt)						Rata-rata
	1	2	3	4	5	6	
F0	13,63	4,74	12,53	8,89	10,57	3,93	9,05
F1	17,22	5,22	16,63	12,76	11,83	6,79	11,74
F2	17,30	5,23	16,68	13,17	12,02	8,50	12,15
F3	17,32	6,32	17,21	13,35	12,33	9,35	12,65

Note:
F0 = without extract
F1 = 5% ethanol extract of carrot tubers
F2 = 15% ethanol extract of carrot tubers
F3 = 30% ethanol extract of carrot tubers

Inhibition Zone Diameter Results

Table 6. Results of measuring the diameter of the inhibition zone for mouthwash preparations

Formula	Diameter Zona Hambat (mm)			Rata-rata
	1	2	3	
F0	0	0	0	0
F1	3	3	2,8	2,9
F2	4,1	3,8	3,8	3,9
F3	5,5	5,3	5,2	5,3

K+	14,5	15,3	14,9	14,9

Note:
F0 = without extract
F1 = 5% ethanol extract of carrot tubers
F2 = 15% ethanol extract of carrot tubers
F3 = 30% ethanol extract of carrot tubers

DISCUSSION

Organoleptic Mouthwash Preparations

The results of the organoleptic examination of the carrot tuber extract mouthwash had a menthol smell, a sweet taste of na-saccharin and a slight carrot taste. The taste of carrots varies based on the concentration of the added carrot extract. The color varies from light orange to dark orange based on the concentration of the added carrot extract. The orange color in the preparation comes from the beta-carotene content of carrots. It is in the form of a liquid solution and the clarity of all dosage concentrations is equally clear.

pH of Mouthwash Preparations

The results of examining the pH of the mouthwash preparations, obtained an average value ranging from 5.3 to 7.3 (Table 4). Where the average pH of F0 = 7.3. F1 = 5.6. F2 = 5.4 and F3 = 5.3. The higher the concentration of the preparation, the more acidic the pH will be. This happens because the carrot extract added to the preparation contains flavonoids which are slightly acidic. The pH value of the resulting mouthwash preparations still meets the standard requirements for a good pH of mouthwash preparations, namely 4.5-7.5 (14).

Viscosity of Mouthwash Preparations

The results of examining the viscosity of mouthwash preparations, obtained an average value ranging from 9.05 to 12.65 cStoke (Table 5). Where the average viscosity value of F0 = 9.05 cStoke, F1 = 11.74 cStoke, F2 = 12.15 cStoke, and F3 = 12.65 cStoke. The viscosity value of the resulting mouthwash preparation is close to that of pure water at 27°C, which is around ± 13.9 cSt. The closer the viscosity level of the preparation is to the viscosity of water, the easier and more comfortable the product is to use for gargling (15).

Stability of Mouthwash Preparations

The results of observing the organoleptic stability of mouthwash preparations showed that all formulations were stable. There was no change in odor, taste, color, shape and clarity of the preparation during 6 cycles of storage.

The results of observing the stability of the pH of mouthwash preparations showed that all formulations were stable. There was no change in the pH of the preparation during 6 storage cycles.

The results of observing the viscosity stability of mouthwash preparations indicated that there was a change in viscosity in all formulation formulations. This instability is due to the rise and fall of the viscosity of the preparation in each cycle that occurs due to the increase and decrease in

temperature during the cycling test at 4°C and 40°C which causes the liquid molecules to move so that the interaction forces between molecules become weak. However, the viscosity values of all formulas are close to those of pure water at 27°C, namely 13.9 cSt (23).

Inhibition Zone Diameter

The results of observing the diameter of the inhibition zone of carrot root ethanol extract mouthwash on the growth of Candida albicans which was carried out through observing 1 x 24 hour incubation period with 3 x repetitions (Table 6), showed that the mouthwash preparation could inhibit the growth of the fungus at a concentration of 5% b /v (2.9 mm), 15% w/v (3.9 mm), and 30% w/v (5.3 mm). According to Davis and Stout the strength of the inhibition zone is categorized as follows: (10).

a) Very strong : > 20 mm
b) Strong: 10-20 mm
c) Medium: 5-10 mm
d) Weak: < 5 mm

So the results of measuring the diameter of the inhibition zone from mouthwash preparations are included in the weak category. This happens because the requirements for mouthwash preparations must be clear, so the mouthwash preparations are filtered to produce preparations that look clear. This causes many active substances from carrot root extract to be filtered, such as flavonoids which have antifungal activity, so that the antifungal activity of mouthwash preparations decreases. This is in line with Umm's research (2019) which stated that the size of the inhibition formed was due to differences in the concentration of carrot extract added to the preparation, where the greater the concentration the more components of the active substance contained therein so that the inhibition formed was also different (10).

Flavonoid and saponin compounds found in carrot tubers can inhibit the growth of Candida albicans. Flavonoids work by interfering with the permeability of fungal cells because they have hydroxyl groups which cause changes in organic components and nutrient transport which results in toxic effects on fungi. Meanwhile, saponins are surfactants in a polar form so that they break down the fatty layer on the cell membrane which causes disruption of the permeability of the cell membrane, this results in the process of diffusion of materials or substances needed by the fungus being disrupted which eventually swells and breaks (10).

In the antifungal activity test for this mouthwash, ketoconazole tablets were used as a positive control. Ketoconazole is efficacious as an antifungal, where it works by inhibiting the synthesis of sterols in the fungal cell membrane and results in an increase in the permeability of the cell wall which makes it susceptible to osmotic pressure (10).

This study was based on Ummu's research (2019), where at the time of making the positive control and concentration of carrot root extract, 1% Na-CMC solution was used to dissolve the test sample so that the results of the antifungal activity test of carrot root ethanol extract at all concentrations were in the inhibition zone category. the strong one. A 1% Na-CMC solution was used to dissolve the ketoconazole positive control because ketoconazole was insoluble in distilled water and formed a precipitate if left for a while, so 1% Na-CMC solution was used to dissolve it (10).

Na-CMC has a function as a thickener, stabilizer, gelling agent, emulsifier, and in some cases can glue the spread of antibiotics. Na-CMC will be dispersed in water, then hydrophilic Na-CMC grains will absorb water and swelling will occur. Water that previously existed outside the granules

and was free to move, cannot move freely anymore resulting in an increase in viscosity. This will cause the particles to be trapped in the system and slow down the deposition process due to the influence of gravity (24).

In the hydrocolloid emulsion system, Na-CMC does not function as an emulsifier but rather as a compound that provides stability. All thickening agents are hydrophilic and dispersed in solutions known as hydrocolloids (25). The addition of 1% Na-CMC solution to carrot extract serves as a thickening agent with the aim of forming a colloidal dispersion system and increasing the viscosity. In the presence of Na-CMC, the suspended particles will be trapped in the system or stay in place and not settle under the influence of gravity (26).

In this study, in preparing the concentration of carrot root ethanol extract in mouthwash preparations did not use 1% Na-CMC solution as a solvent. Concentration of carrot root ethanol extract for mouthwash preparations only uses aquadest as a solvent. This is one of the factors causing the decrease in antifungal activity in mouthwash preparations from ethanol extract of carrot tubers, because aquadest can only dissolve the ethanol extract of carrot tubers but cannot bind the active substances contained therein such as flavonoids and saponins which are substances that have an important role and has antifungal activity.

4. CONCLUSION

Carrot root ethanol extract at concentrations of 5%, 15% and 30% can be formulated into mouthwash preparations. The effective concentration of carrot root ethanol extract which is able to inhibit the growth of Candida albicans in the form of mouthwash is 5% with an inhibition zone diameter of 2.9 mm with a weak inhibition zone category. The best formula for mouthwash is Formula 1 (5%) in terms of color and taste compared to Formula 2 (15%) and Formula 3 (30%).

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