Formulation of Solid Soap from the Ethanol Extract of Batak Onion as Antifungal Candida Albicans

Novita Br Ginting Munthe[1], Iskandar Markus Sembiring[2], Giana Wulandari[3], Rahmad Gurusinga[2], Sri Wulan[1], Ika Nur Saputri[1], Novidawati Boru Situmorang[3], Andayani Boang Manalu[4]
[1]*Faculty of Midwifery, Institut Kesehatan Medistra Lubuk Pakam, Sumatera Utara, Indonesia*
[2]*Faculty of Nursing and Physiotherapy, Institut Kesehatan Medistra Lubuk Pakam, Sumatera Utara, Indonesia*
[3]*Faculty of Pharmacy, Institut Kesehatan Medistra Lubuk Pakam, Sumatera Utara, Indonesia*
[4]*Faculty of Midwifery, Deli Husada Delitua, Sumatera Utara, Indonesia*

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Abstract: Batak onion (Allium chinense) is a secondary metabolite compound that has anti-fungal activity. This study was conducted to determine the antifungal activity of ethanol extract of batak onion solid soap against Candida albicans with a concentration of 15%, 20%, 25%. Candida albicans is a normal flora that can be on the skin, genital tract, upper respiratory tract, and digestive tract including the oral cavity. An infection caused by a fungus is called candidiasis. Batak onion was extracted by diffusion method using 96% ethanol solvent. The diffusion method is used to see the antifungal activity of candida albicans. The negative control that used was Dimethyl sulfoxide (DMSO), while the positive control used was nystatin. Solid soap from batak onion extract showed antifungal activity at a concentration of 25% by inhibiting fungal growth with inhibition zone diameter of 15.35 mm and minimum inhibitory concentration at a concentration of 20% with inhibition zone diameter of 14.67 mm. The higher the concentration of ethanol extracts on the batak onion, so then the higher the diameter of the inhibitory zone in the growth of the fungus candida alibicans. This research proved that the solid soap from ethanol extract of batak onions has antifungal activity against candida albicans.

1 INTRODUCTION

Candida albicans is a major fungal pathogen in human, especially in patients whose immune system was compromised. Candidiasis can take many forms, from mucosal candidiasis to spread disease, often with the involvement of multiple organs, depending on the effect of the underlying host. The defense mechanism of the host against Candida albicans infection is very complex and some researchers have shown an important role for phagocytic cells, cell-mediated immunity and even humoral immune responses in candidiasis resolution (Jahani et al, 2017). Growth pH ranges from 2 - 9, growth temperature ranges from 10 – 35 ^{O}C. Fungus has the potential danger for human or animal health. This organism can produce various types of toxins which called mycotoxins. Vulvar vaginitis candidiasis (VVC) is an infection of the vulva and / or vagina due to uncontrolled growth of the fungus Candida sp, especially Candida albicans. Candidiasis is the most frequent cause of vaginal discharge, its prevalence is 40%, mushrooming of this fungus growth causes burning, pain during urination or having sex, the discharge that comes out is usually thick, white like milk, smell, and accompanied by intense itching in pubic (Enzo Palese, Maurizio Nudo, Grazia Zino, et al., 2018).

Candida albicans causes candidiasis which is a fungal infection with the highest incidence caused by opportunistic infections. Candida albicans causes candidiasis throughout the world with a slight difference in disease variations in each area. Candidiasis species are more common in the tropics while nail candidiasis in cold climates. This disease can affect all ages, especially babies and parents. 5-7 Infections caused by Candida can be acute, subacute or chronic in the entire human body. Candida albicans is a monomorphic yeast and yeast likeorganism that grows well at temperatures of 25-30 ^{O}C and 35-37 ^{O}C (Mutiawati, 2016).

According to the research (Dian et al, 2017) stated that mango leaf extract at a concentration of 1000 ppm indicates the antifungal activity of candida

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albicans. Antifungal activity obtained was 8.12 mm. Using ethanol extract of white tea showed that at a concentration of 22% (w / v) the inhibition zone diameter was found to be 11.50 mm (Widyasanti et al, 2016). In research that uses manjakani gel extract, water extract and methanol extract manjakani gel are tested at a concentration of 5.0 mg / disc capable of producing inhibition zones against Candida albicans respectively 16 and 18 mm (Lohith Kunyeit, Nawneet K. Kurrey, K. A. Anu-Appaiah, Reeta P. Rao., 2019).

In the use of the drug fluconazole begins to provide an inhibitory response to the growth of Candida albicans at a concentration of 512 µg/ml. While nystatin can inhibit Candida albicans at a concentration of 350 µg/ml (Paramita, 2016). In previous studies using mango leaf extract, white tea extract, manjakani gel extract, nystatin drug, fluconazole drug and in this study the researchers used batak onion extract which is known to have antimicrobial activity due to its content of alisin and thiosulfate. Batak onions also contain biological compounds such as sulfur compounds, steroidal saponins, nitrogen, flavonoids, amino acids (Jahani, S. Bazi, S. Shahi, Z. Sheykhzade, A., 2017).

The saponin compounds contained in Batak onions have antibacterial, antifungal, antipyretic effects, increase synthetic DNA and protein, and increase immunity. There is also research which states that the steroid compound Allium chinense can prevent cardiac injury due to oxidation substances and has an anti-inflammatory effect because the tubers contain succinic acid. (Lin et al, 2016).

Batak onion is autotetraploid plants with 2n = 32 chromosomes. The height of Plant can reach 50 cm with a narrow leaf shape, bright green that blends with the tuber stems below. The flowers of A.chinense are lavender, long flower stalks, and stamens stick out. The depth of Root can reach 45-50 cm with oval-shaped bulbs 4-5 cm in diameter. The tubers are grayish white to purple wrapped in transparent skin and white tuber flesh which gives a very strong scent of onions. The nutritional composition of the tubers includes carbohydrates 18.3%, total protein 3.1%, and fat 0.12. It was found that there was potential for the onion as a toxic agent against the parasite and showed that the onion has 10 times higher toxic power than garlic. Allicin can totally inhibit RNA synthesis and partially synthesize DNA and microbial proteins (Munthe, N.G, Sembiring, I., & Siregar, W., 2019).

Indonesia is widely known as the second largest biodiversity mega-flashlight after Brazil in the world, which consists of around 7,000 types of plants that have medicinal properties. The genus Allium (onion tribe) has been widely studied because of its potential as an antibacterial and antifungal and food preservative. One of the onion plants that have been widely used by the people of Indonesia, especially the Batak tribe, is the batak onion (amillum chinense). Allium chinense is a medicinal plant and food ingredient that is often found in Asia, especially in East and Southeast Asia. In East Asian countries, especially in China, this plant has been used to treat angina pectoris, cardiac asthma, and antiaggregation, antiplatelet. In an in vitro test, it was found that the sulfur content in Allium Chinense can affect plasma cholesterol levels. In other studies, it was also found that the steroid content in it could prevent heart disorders caused by oxidative stress. Allium Chinense also has antimicrobial activity due to the content of alisin and thiosulfinate in it. The transformation form of the two compounds is also referred to as having quite potent antimicrobial activity. Therefore, Allium Chinense can inhibit many microorganisms, such as bacteria, fungi, viruses, and parasites (Gazzani and Grusak, 2012).

North Sumatra has various types of plants such as fruits, vegetables and in particular has plantations of Allium chinense or onion/chive onions found in the highlands of Berastagi, Sidikalang, Tapanuli and the surrounding area. One of the famous genus of plants that is widely used by the community is Allium. The Allium genus consists of more than 280 species spread throughout the world. Most of the genus Allium is used by the community as a spice in cooking and traditional medicine. Various antimicrobial compounds of the genus Allium have long been known as allicin, diallyl disulfide, ajoene, and 3- (Allyltrisulfanyl) -2-amino-propanoic acid which has been proven to inhibit the growth of microorganisms such as bacteria, fungi, viruses and parasites (Kyung, 2012) .

The aim of this research is to formulate ethanol extracts of batak onions into solid soap preparations that can be used as antifungal and safe to use for the community. Solid bath soap is bath soap that made using alkaline NaOH and is one of the cosmetics and pharmaceutical preparations most often used by the public to clean the body's skin from impurities. Bath soap is the result of the saponification process which involves the hydrolysis of a triglycerol fatty acid with an alkali which produces a byproduct of glycerin (Widyasanti, et al, 2017).

2 RESEARCH METHOD

The research phase includes preparation of ingredients, characterization of simplicia, phytochemical screening and extraction, then the manufacture of solid soap preparations, then testing for antifungal activity using diffusion methods to use disc paper. The parameters observed were the diameter of the inhibitory zone of fungal growth using concentrations of 15%, 20% and 25%. The all of proceses can be seen ini Figure 1.

Organic Chemistry Laboratory Medical Institute of Lubuk Pakam Medistra is used for the screening process of chemical compounds, the Laboratory of Pharmaceutical Preparation Technology Medical Institute of Medical Lubuk Pakam Institute is used for the process of making solid soap preparations, Microbiology Laboratory of Grandmed Lubuk Pakam Hospital is used for the testing process of antifungal activity.

In this study the tools and materials used include: Analytical scales, spatulas, stirring rods, test tubes, tube racks, beaker glass, bunsen, digital cameras, dropper, refrigerators, desiccators, tube clamps, rotary evaporators, blenders, filter paper, onion microscopes batak, 96% ethanol, 2N hydrochloric acid reagent, distilled water, 2N sulfuric acid reagent, mayer reagent, bouchardic reagent, dragendorff reagent, chloral hydrate reagent, liebermann-burchard reagent, sodium chloride, autoclave, beaker glass, bunsen, Laminary Air Flow (LAC), test tubes, test tube racks, erlenmeyers, measuring cups, bedwetting, petri dishes, ose needles, digital cameras, ovens, incubators, gas cookers, refrigerators, pipettes drops, parchment paper, caliper, disc paper, micro pipette, tube clamp, Dimethyl sulfoxide (DMSO), Potato Dextrose Agar (PDA) suspension Mc Mclandland standard 0.5, mushroom candida albicans, sodium chloride, stirring rods, 50 ml beaker glass, bunsen, vaporizer cup, 10 mL and 50 ml measuring cups, soap molds, dropper pipette, tube clamp.

Sample processing began from the Batak onions are cleaned of dirt by washing under running water until clean then drained to dry after it is sliced into small pieces dried in a drying cabinet / in the room (aerated). Batak onions that have dried are blended until they become powder weighed by weight and are called simplicia.

The ethanol extract of batak onion was done by maceration using 96% ethanol. This maceration method was chosen because the method used is simple and the tools used are easy to operate, and do not need intensive supervision. This 96% ethanol solvent was chosen because 96% ethanol can attract secondary metabolites well and is good for antimicrobial testing.

How it works: Samples of batak onions that have dried as much as 500 g are blended to a simplicia powder and then soaked with 96% ethanol. The mixture is stirred strongly until it is homogeneous and then allowed to stand for 5 days in a cool place and protected from sunlight while stirring several times. The results of the maceration are filtered with a flannel cloth, the results of the maceration are filtrate, then accommodated in glass speakers while the pulp is macerated again and continued with the same steps for 2 days. Then the first filtrate and the second filtrate are combined into one container and then concentrated with a rotary evaporator until the ethanol has evaporated and only the aqueous extract is left. Furthermore, the water content is removed by heating it on a water bath (water bath), the temperature is maintained at less than 600 ^{o}C so as not to damage the active ingredient contained in the thick ethanol extract.

Making batak onion extract ethanol test solution as much as 2.5 grams of ethanol extract of the batak onions were weighed and then dissolved with DMSO as much as 10 ml to obtain an extract of 250 mg/ml. Make dilution until the extract is obtained with a concentration of 250 mg/ml, 200 mg/ml, 150 mg/ml.

Making Potato Dextrose Agar (PDA) Media as much as 3 g of PDA powder was weighed, dissolve in 1 liter of distilled water and heat until boiling until all PDA powder dissolves, then sterilize in an autoclave at 121 ^{o}C for 15 minutes.

Solid soap making with weigh the raw materials of olive oil, NaOH, stearic acid, glycerin, aquades. Heat the olive oil with TEA in the beaker glass for 15 minutes at a temperature of 185^{o}C then add other ingredients. After homogeneous, add the onion extract and perfume while stirring until homogeneous. Print the soap in the mold and leave it for 2 days at room temperature / refrigerator. After it has cooled, remove it from the mold and do a test on the fungus.

Antibacterial activity test for solid soap as much as much as 0.1 ml suspension of the fungus Cancida albicans was put into a sterilized petri dish. After that poured PDA media that has been thawed as much as 15 ml with a temperature of 45-50 ^{o}C, then homogenized and allowed to stand until the media solidifies at room temperature. Solid soap is dissolved first with water, then paper discs are soaked into the soap solution. On solid media, paper discs are placed which have been soaked first in a solution of solid soap from ethanol extract of batak onions with

various concentrations of 15%, 20% and 25%. Incubated at 20-250 ºC for 48 hours. Furthermore, the diameter of the inhibition zone around the paper disk was measured using a vernier caliper.

Standar formulation for making soap (Chan, 2016):

R/ Olive oil	12,5mL
NaOH 30%	15mL
Stearic Acid	7,5g
Etanol 70%	15 ml
Gliserin	10ml
TEA	10ml
Aquadesh	100 ml

Modified formulation

R/ Oleum citrus	5ml
Batak onion extract	x

Determination of water content in simplicia is done to determine the amount of water contained in the simplicia. The results obtained from the determination of water content, less than 10% is 8.31% and the average was taken as presented in Table 1. Water content that exceeds 10% can be a good medium for microbial growth, the presence of fungi or insects, and encourage damage to the quality of simplicia in accordance with the Materia Medika Indonesian (MMI).

Form:

$$\text{Water content} = \frac{\text{Water of volume (ml)}}{\text{Weight of sampel (g)}} \times 100\% \quad (1)$$

Table 1: Calculation of determination of water content.

Sample	Weight of Sample (g)	Water Volume	Water content (%)
1	5, 25	0,43	8,19
2	5, 25	0,43	8,19
3	5, 25	0,45	8,57
	Average		8,31

Determination of water soluble extract content is done to determine the amount of polar compounds that can be found in a water solvent. The water soluble extract content obtained was 17.61% and the average was taken as presented in Table 2.

Form:

$$\text{Water soluble essence} = \frac{\text{Weight of essence (g)}}{\text{Weight of sampel (g)}} \times \frac{100}{20} \times 100\% \quad (2)$$

Table 2: Calculation of water soluble essence.

Sample	Weight of Sample (g)	Weight of essence (g)	The essence of water soluble (%)
1	5,250	0,191	18,19
2	5,253	0,173	16,46
3	5,253	0,191	18,18
	Average		17,61

Determination of ethanol soluble extract levels is carried out to determine the amount of polar and non-polar compounds that can be found in ethanol solvents.. The content of soluble ethanol extract obtained was 15.61% and the average was taken as presented in Table 3.

Form:

$$\text{Soluble extracts Ethanol} = \frac{\text{Weight of essence (g)}}{\text{Weight of sampel (g)}} \times \frac{100}{20} \times 100\% \quad (3)$$

Table 3: Calculation of soluble essence in ethanol.

mple	Weight of Sampel (g)	Weight of essence (g)	Soluble essence in ethanol (%)
1	5,250	0,176	16,76
2	5,253	0,143	13,61
3	5,250	0,173	16,47
	Average		15,61

Determination of total ash content was carried out to determine the amount of minerals contained in the sample. Total ash content obtained was 5.03% and the average was taken as presented in Table 4.

Form:

$$\text{Total ash content} = \frac{\text{Weight of essence (g)}}{\text{Weight of sampel (g)}} \times \frac{100}{20} \times 100\% \quad (4)$$

Table 4: Calculation of total ash content.

Sample	Weight of Sample (g)	Weight of ash (g)	Total ash content (%)
1	2,100	0,114	5,42
2	2,190	0,106	4,84
3	2,120	0,103	4,85
	Average		5,03

Information : So samples 1,2 and 3 are testing the determination of the characteristics of simplicia to be tested using 3 repetitions, which aims to determine whether the determination of the content contained in the sample is feasible or not used as an antimicrobial.

As much as 2.5 g of ethanol extract of batak onions are carefully weighed with analytical balance. Dissolved with 10 ml DMSO solvent and extract concentration of 250 mg/ml is obtained. Made dilution to obtain extracts with concentrations of 250 mg/ml, 200 mg/ml, 150 mg/ ml and can be seen in the Table 5.
Form:

$$V1 \times C1 = V2 \times C2 \quad (5)$$

Information :
V1 = the volume of extract solution taken (ml)
C1 = concentration of ethanol extract taken (mg/ml)
V2 = the volume of the extract solution made (ml)
C2 = the concentration of ethanol extract made (mg/ml)

Table 5: Calculation of extract concentration .

Concentration (%)	V1 (ml)	C1 (mg/ml	V2 (ml)	C2 (mg/ml
15	10	150	6	250
20	10	200	8	250
25	2.5 grams of extract in 10 ml of DMSO			

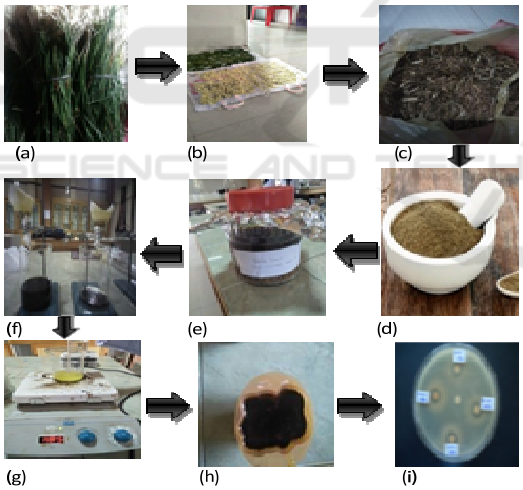

Figure 1: Data Collection Process: (a) Fresh batak onions as much as 10 kg, (b) Cut into small pieces, then dried by aerating for 14 days, (c) Dried simplisia obtained as much as 800 g, (d) 500 g of simplisia onion batak powder, (e) Maceration prosess by using 96 % ethanol for 5 days, (f) Extraction process, (g) The process of making solid soap, (h) The result of solid soap, (i) Solid soap activity test result.

3 RESULTS

The results of macroscopic examination revealed that the onion batak has a slender leaf shape, in terms of 3 to 5, has a length of 45-50 cm. Bulbs have white, grayish white and purplish white with a length of 4-5 cm, smell and crisp texture.

Microscopic examination of the simplicia powder of the onion showed parenchyma, sclerenkim and essential oils and can be seen in Figure 2.

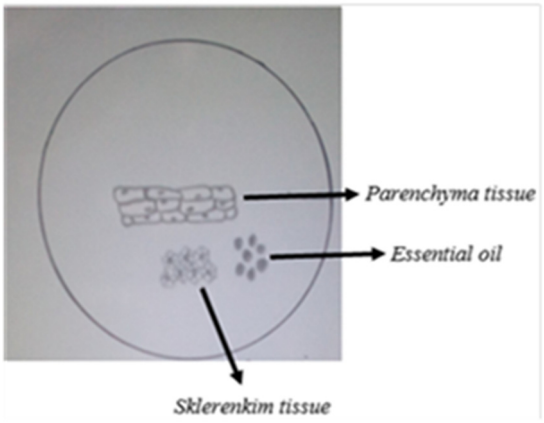

Figure 2: Microscopic examination results

Determination of water content in simplicia is done to determine the amount of water contained in the simplicia. The results obtained from the determination of water content, less than 10% is 8.31%. Moisture content that exceeds 10% can be a good medium for microbial growth, the presence of fungi or insects, and encourage damage to the quality of simplicia in accordance with the Indonesian Medical Materia (MMI) and can be seen in the Table 6.

Table 6: The results of the examination of the characteristics of the simplicia onion batak powder.

No	Parameter	Result (%)	MMI (%)
1.	Water Content	8,31	< 10,00
2.	Water Soluble Content	17,61	>18,00
3.	Ethanol Soluble Content	15,61	>12,50
4.	Total Ash Content	5,03	<6,00

From the examination of phytochemical screening tests it can be seen that classes of chemical compounds against the simplisia powder of batak onions were carried out to obtain information on the groups of secondary metabolites contained therein. The examinations carried out include examination of groups of alkaloid compounds, flavonoids, saponins and steroids / triterpenoids.

On the simplisia powder of onion (Allium chinense) added with 10 ml of hot water, 0.1

magnesium, 1 ml of concentrated hydrochloric acid and 2 ml of amyl alcohol will form red, yellow or orange indicating the presence of flavonoids. The addition of 10 ml of hot water, cooled and then shaken vigorously for 10 seconds in the presence of foam as high as 1 to 10 cm which is stable not less than 10 minutes and not lost with the addition of 2N hydrochloric acid indicates the presence of saponins. The addition of 20 ml of ether is then evaporated in a vaporizer cup and the remaining Lieberman-Buarchard reagent will form purple or red to turn greenish blue indicating the presence of steroids/triterpenoids and can be seen in the Table 7.

Table 7: The results of the chemical compound powder compound simplisia and extracts.

No	Parameter	Simplisia powder
1	Alkaloid	-
2	Saponin	+
3	Flavonoid	+
4	Steroid/triterpenoid	+

Information :

(+) positive = contains a class of compounds
(-) negative = does not contain a class of compounds

The results of the examination of the antifungal activity test of solid soap from the ethanol extract of batak onions began to inhibit the growth of the fungus Candida albicans at a concentration of 25% with a diameter of inhibitory zone of 15.35 mm. The minimum inhibitory concentration of the fungus Candida albicans at a concentration of 15% with a zone of inhibition zone is 13.14 mm. Thus the solid soap from ethanol extract of the onion can inhibit bacterial growth at a concentration of 25%. It showed that the higher the concentration added to the solid soap preparation, the higher the inhibition zone that is obtained, it can be said that the inhibition zone is getting stronger.

According to (Meidi Y Mangkasa, Johnly A Rorong, and Audy D. Wuntu1, N., 2018), the diameter of a 5-10 mm inhibition zone is categorized as weak and the most effective antifungal inhibition zone against an antifungal test is 14 to 16 mm. According to (Ginting Munthe, N., Sembiring, I., & Siregar, W., 2019), the diameter of the inhibition zone 5 mm is categorized as weak, the diameter of the inhibition zone 14 to 20 is categorized strong and the diameter above 20 is categorized very strong. Solid soap from ethanol extract of batak onions began to inhibit the growth of the fungus Candida albicans at a concentration of 25% with a diameter of inhibitory zone of 15.35 mm. The minimum inhibitory concentration of the fungus Candida albicans at a concentration of 15% with a zone of inhibition zone of 13.14 mm and can be seen in Table 8. The activity of an antimicrobial agent in inhibiting the growth or killing of microorganisms depends on the concentration of the antimicrobial (Meidi Y Mangkasa, Johnly A Rorong, and Audy D. Wuntu, N., 2018).

Table 8: Inhibitory zone of ethanol extract solid soap against the growth of *Candida albicans*.

No	Concentration of Solid Soap Ethanol Extract (%)	Inhibitory Zone Diameter (mm)			Average
		I	II	III	
1.	DMSO	-	-	-	-
2.	Nistatin	15,32	15,34	15,35	15,38
3.	15	13,10	13,15	13,17	13,14
4.	20	14,65	14,67	14,70	14,67
5.	25	15,32	15,35	15,38	15,35

Information : (-) = not inhibit
(%) = concentration % (mg/ml)

Antifungal activity on ethanol extract of Allium chinense solid soap is caused by the presence of chemical compounds that have antifungal activity, namely saponins, flavonoids, and steroids. Phenol/polophenol compounds are the largest group of secondary metabolites that have antifungal activity, have hydroxyl groups attached to aromatic compounds. The location and number of hydroxyl groups in phenol compounds affect the toxicity of microorganisms. The combination of phenol compounds can provide a synergistic effect and increase antifungal reactions better than a single compound.

Phenol compounds at low concentrations can affect enzyme activity, whereas at high concentrations cause denaturation of the protein Saponin belongs to the antifungal group which interferes with permeability of fungal cell membranes. The mechanism of action of saponins as an antifungal is to reduce surface tension resulting in increased cell permeability or leakage and cause intracellular compounds to exit the cell.

Flavonoid is chemical compounds that have potential as antifungals. Flavonoids are a group of phenol compounds that have a tendency to bind to proteins, thus interfering with the process of fungal metabolism, besides flavonoids also function as antifungals by forming complex compounds against extra cellular proteins that interfere with fungal cell membranes.

The mechanism of terpenoids as an antifungal is to react with porin (a transmembrane protein) on the outer membrane of the fungal cell wall, forming a strong polymeric bond, causing damage to the porin. Terpenoid compounds are easily soluble in lipids, this is the nature that causes these compounds to easily penetrate the fungal cell wall (Enzo Palese, Maurizio Nudo, Grazia Zino, et al., 2018).

4 CONCLUSION

The formulation of solid bath soap from ethanol extract of Batak onion has antifungal activity on Candida albicans because it contains secondary metabolites such as Flavonoids, Saponins, and Steroids which have antifungal properties and contain alisin and thiosulfinic compounds which are known to have antimicrobial activity. In this test researchers used various concentrations such as concentrations of 15%, 20% and 25%. At a concentration of 15% shows inhibition zone in fungi is still said to be weak and at concentrations of 20% and 25% inhibition zone can be said to be strong with inhibition zone values of 14.67 mm and 15.35 mm. Then the results obtained by solid soap from ethanol extract of Batak onions can be used as an antifungal Candida albicans.

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