

Effect of *Aloe Vera* Extract in Inhibit of *Candida albicans* on Cured Acrylic Resin Plates

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ABSTRACT

Introduction: Removable dentures are either whole or partial. Fixed dentures are firmly affixed to the patient's teeth. Dentures reduce functional problems caused by tooth loss, but many individuals don't realize how crucial cleaning them is. Long-term denture use can hinder the tongue and saliva's cleaning of the dental mucosa. Thus, *Candida albicans* cling better to denture bases and primary agent in candidiasis oral. Aloe vera leaves contain six antimicrobial compounds that prevent the growth of various fungi, bacteria, and viruses, including *Candida albicans* and *Staphylococcus pyogen*. **Objective:** Knowing the effect of aloe vera extract (*Aloe vera*) with a concentration. **Methods:** The research method is True Experimental Laboratory, which uses a research design in post-test-only control groups. The *Kruskal-Wallis* test was used to analyze and interpret the research data results, and the *Mann-Whitney U* test was used as a follow-up analysis. **Results:** The normality test results showed a *p-value* of 0.033 in the control group of aquades smaller than 0.05. This proves that the control equates are generally not distributed because the *p-value* is smaller than 0.05 (*p-value* < 0. The *p-value* > 0.05 was obtained in the control group, proving that the control group is normally distributed. In the homogeneity test, a *p-value* of 0.000, smaller than 0.05, is obtained. This proves that the test data results in the control and treatment groups are not homogeneous. **Conclusion:** inhibits the development of *Candida albicans* in heat-cured acrylic resin.

Keywords: *Aloe vera*, *Candida albicans*, heat cured acrylic, resin plate

ABSTRAK

Pendahuluan: Gigi tiruan lepasan ada yang utuh atau sebagian. Gigi palsu cekat dipasang dengan kuat pada gigi pasien. Gigi palsu mengurangi masalah fungsional yang disebabkan oleh kehilangan gigi, namun banyak orang tidak menyadari betapa pentingnya membersihkan gigi palsu. Penggunaan gigi palsu dalam jangka panjang dapat menghambat pembersihan mukosa gigi oleh lidah dan air liur. Dengan demikian, *Candida albicans* melekat lebih baik pada basis gigi tiruan sebagai pemicu oral candidiasis. Daun lidah buaya mengandung enam senyawa antimikroba yang mencegah pertumbuhan berbagai jamur, bakteri, dan virus, termasuk *Candida albicans* dan *Staphylococcus pyogen*. **Tujuan:** Mengetahui pengaruh pemberian ekstrak lidah buaya (*Aloe vera*) terhadap konsentrasi Bahan dan Metode: penelitian adalah Uji Experimental Laboratory dengan menggunakan desain penelitian post-test only control groups. Uji *Kruskal-Wallis* digunakan untuk menganalisis dan menginterpretasikan hasil data penelitian, dan uji *Mann-Whitney U* digunakan sebagai analisis lanjutan. **Hasil:** Hasil uji normalitas menunjukkan *p-value* sebesar 0,033 pada kelompok kontrol aquades lebih kecil dari 0,05. Hal ini membuktikan bahwa persamaan kontrol secara umum tidak terdistribusi karena *p-value* lebih kecil dari 0,05 (*p-value* < 0. Didapatkan *p-value* > 0,05 pada kelompok kontrol, membuktikan bahwa kelompok kontrol berdistribusi normal. uji homogenitas diperoleh *p-value* 0,000 lebih kecil dari 0,05 Hal ini membuktikan hasil data uji pada kelompok kontrol dan perlakuan tidak homogen. **Kesimpulan:** menghambat perkembangan *Candida albicans* pada resin akrilik heat cured.

Kata Kunci : Lidah buaya, *Candida albicans*, pelat resin akrilik heat cured

1. Introduction

Dentition is integral to the decomposition of food, and the loss of teeth can precipitate a cascade of anatomical, physiological, and functional alterations in the masticatory system, often culminating in psychological distress. This deleterious progression invariably elevates the demand for dentures, which ameliorate speech and mastication deficits and support facial musculature.

Dentures are bifurcated into two principal categories: removable and fixed. Removable dentures are subdivided into complete and partial dentures, whereas fixed dentures are securely attached to the patient's remaining teeth.^{1,2}

The primary objective of denture application is to mitigate the functional impairments associated with tooth loss. However, maintaining denture hygiene is frequently underestimated, leading to detrimental effects on oral health. Removable dentures, in particular, are prone to plaque accumulation if not maintained adequately, which can impede the tongue's and saliva's natural cleaning mechanisms due to the mucosa's occlusion beneath the dentures. This can give rise to conditions such as denture stomatitis, an inflammatory response often precipitated by poor dental and oral hygiene. The knowledge and behaviors of denture wearers in maintaining hygiene are critical in preventing such conditions.³

Long-term wear of dentures can obstruct the natural cleaning action of the tongue and saliva, creating a conducive environment for the proliferation of *Candida albicans*, a fungus responsible for candidiasis in 30-60% of cases involving the oral cavity. The dentures must be regularly cleaned using either mechanical or chemical methods. Mechanical cleaning typically involves ultrasonic cleaners, soft toothbrushes, and denture-specific cleaning agents. Chemical cleaning, on the other hand, consists of soaking the dentures in solutions containing disinfectants such as alkaline peroxide, alkaline hypochlorite, acids, enzymes, and other disinfectants.^{4,5}

Recent studies have demonstrated the efficacy of aloe vera sap in inhibiting the growth of *Streptococcus mutans* and *Candida albicans*, with higher concentrations yielding more significant inhibitory effects.⁶ This suggests that aloe vera could be a viable adjunct in denture hygiene, particularly for older people or those with limited dexterity who may benefit from simpler, more effective cleaning methods.⁷ The porous nature of acrylic used in denture bases predisposes them to food particle adherence and subsequent plaque formation, underscoring the necessity of regular and thorough cleaning to prevent oral diseases and maintain overall health. Thus, the importance of denture hygiene extends beyond the mere aesthetics or functionality of the dentures, impacting the wearer's general well-being and quality of life.

2. Material and Methods

This research uses laboratory experimental methods where testing is carried out in the laboratory, and the research design uses post-test-only control design. The sample in this study was a heat-cured acrylic resin plate.

2.1. Acrylic Resin Preparation

The first stage begins with manufacturing specimen pacifier resin acrylic heat cured. The surface of the mold space is smeared with Cold Mold Seal (CMS) using a brush and waiting for it to dry. Next, prepare a porcelain cup filled with a ratio of 23 mg: 10 ml of polymers and monomers. Dimstir the polymer powder little by little while vibrating the saucer until the dough looks like wet sand. The polymer powder is infused until there is no excess monomer. When the dough has reached the dough stage, all dough is taken using a spatula and put into the mold space. Its surface is covered by cellophane plastic. Then, the top cuvette is reattached along with the lid, and light pressing is carried out. The cuvette and the excess dough are re-opened. This is done several times until the cuvette is metal to metal. If there is no more excess acrylic, the cellophane plastic is opened then the screws are installed and the final pressing is carried out with a press. The acrylic cooking stage (curing) is carried out by heating in water approximately 100 ° C for 45 minut Next is to remove the acrylic model from the cuvette (deflecting). Next, part of the specimen is smoothed using sandpaper No. 240, 400, and 1000 until the surface is flat with a size of 10 x 10 x 2 mm or as many as 27 pieces. The finished specimen is immersed in a glass containing 30ml of aqueous at 25°C for 24 hours to remove any remaining monomers.

2.2. Aloe Vera Extract

Aloe vera extraction is obtained by splitting the leaves to take the flesh, which is mixed with water. 25% *Aloe Vera* Extract used 25 g of aloe vera mixed with 75 ml of Aquades to produce 25% aloe vera extract. 50% *Aloe Vera* Extract Used 50 g of aloe vera mixed with 50 ml of Aquadest to have 50% aloe vera extract

2.3. *Candida albicans* Suspension Preparation

Making Sabouraud Dextrose Agar Media (SDA) Before the specimens are bred, media is made. For mushrooms, use the culture-made media Sabouraud Dextrose Agar (SDA). The agar media used is made by mixing 6.5 grams of Sabouraud Dextrose Agar (SDA) media powder with sterile distilled water, heated until dissolved, then wrapped in aluminum foil and sterilized in an autoclave at 121 ° C for 15 minutes. Dtipour into a Petri dish and leave until cool and hardened. Take one colony to the culture of *Candida albicans* fungus aged 24 hours, then mix it into a test tube containing 0.9% NaCl liquid as much as 10 ml. The mushroom suspension was homogenized with vortex for approximately 15 seconds and then poured into a test tube of 7 ml. Test tube inserted into spectrophotometer

2.4. Inhibition Assay

A total of 27 samples in the form of acrylic plates were inserted into test tubes containing *Candida albicans* suspension following Mc Farland standards (1.5×10⁸ CFU / ml) for 24 hours with a temperature of 37 ° C. Then the samples were immersed in vials divided into three groups with nine samples each. Group 1 was soaked in a 25% Aloe vera extract , and group 2 was soaked in a 50% aloe vera extract. Washing is done for 8 hours, which is assumed to be the soaking of dentures at night rest time. The calculation of the number of colonies of *Candida albicans* is carried out after soaking. The specimen is removed from the vial, then rinsed using Phosphatase Buffered Saline (PBS), after which it is put into 10 ml of 0.9% NaCl and vibrated with vortex for approximately 30 seconds, intending to shed *Candida albicans*. Then, 0.1 ml of the vortex was seeded in Sabouraud Dextrose Agar and incubated for 48 hours at 37. Then, the *Candida albicans* colonies are calculated using the calculation method on the colony counter.

2.5. Statistical Analysis

The effect of aloe vera extract on the inhibitory power of *Candida albicans* was carried out with the *Kruskal Wallis* Test followed by the *Mann-Whitney U* Test with a meaning limit of $p < 0.05$.

3. Result and Discussion

This study aims to determine the effect of aloe vera extract (*aloe vera*) with a concentration of 25% and 50% for *Candida albicans* inhibitors on *heat cured* acrylic resin plates and tests carried out in the laboratory. The results of research conducted at the Microbiology Laboratory of the Faculty of Medicine, Indonesian Muslim University, this study used aloe vera extract (*Aloe vera*). Research was conducted to determine whether there is an inhibitory power that can be done by aloe vera extract (*Aloe vera*) to inhibit the growth of *Candida albicans* on *Heat cured* acrylic resin plates. There were three groups and nine treatments in each group, group one extract (Aloe vera) aloe vera 25%, group two extract (*Aloe vera*) aloe vera 50% and group three Aquades as controls.

Table 1 shows the distribution of mean values in the control and treatment groups. In the aquades control group, an inhibitory value of 327.11 CFU/ml was obtained with a standard deviation of 104.40. Meanwhile, in the 25% concentration treatment group, the average value of inhibition was 269.33 CFU/ml with a standard deviation of 28.05. In addition, in the 50% concentration treatment group, an average inhibitory value of 147.22 CFU/ml was obtained with a standard deviation of 28.47.

Table 1 Adescriptive analysis of the inhibitory power of *Candida albicans* affected by *Aloe vera*

<i>Aloe vera</i> (%)	N	Mean	SD	Data Distribution	Homogeneity
50	9	327.11	104.4	0.033	0.000
25	9	269.33	28.05	0.082	
Aquadest	9	147.22	28.47	0.32	

The p-value of 0.033 in the control group of aquades was lower than 0.05. Indicates the control of aquades is not normally distributed because the p-value is lower than 0.05 ($p\text{-value} < 0.05$). Meanwhile, in the treatment group, a p-value greater than 0.05 ($p\text{-value} > 0.05$) was obtained. Indicates a normally distributed control group. In the homogeneity test, a $p\text{-value}$ of 0.000 is obtained which is lower than 0.05. Showing test results in the control group and inhomogeneous treatment, the Kruskal Wallis test treatment was decided and continued with the Mann-Whitney U test for further tests.

Table 2. Kruskal Wallis Analysis of the effect of *Aloe vera* on the inhibitory power of *Candida albicans*

<i>Aloe vera</i>	N	Mean	Std. Dev	P-Value ^A
Aquades	9	327,11	104,40	0,000*
25%	9	269,33	28,05	
50%	9	147,22	28,47	

Table 2 shows the results of the Kruskal Wallis test in the aquades and treatment control groups. The smallest average value of inhibitory power occurred in the treatment of aloe vera extract with a 50% concentration of 147.22 CFU / ml while the largest average value of inhibitory power occurred in the positive control group of 327.11 CFU / ml. The results of the Kruskal Wallis test obtained a p-value of 0.000 which is lower than 0.05 ($p\text{-value} < 0.05$). Shows treatment and control that have a significant effect on inhibition. To see the most significant treatment results, further tests were carried out on the treatment given using the Mann-Whitney U test.

Table 3. Mann-Whitney follow-up test Comparative inhibitory power of *Candida albicans*

<i>Aloe vera</i> (%)	Mean	Post Hoc		
		Aquades	25%	50%
Aquades	327,11	-	0,596	0,000*
25%	269,33	-	-	0,000*
50%	147,22	-	-	-

Table 3 results of comparison between control group and treatment group. A $p\text{-value}$ of 0.596 is greater than 0.05 in the ratio of aquades and 25% concentration. Shows no significant difference between aquades with a concentration of 25%. Meanwhile, in the comparison between aquades with a concentration of 50%, a $p\text{-value}$ of 0.000 is obtained which is smaller than 0.05. Shows there is a significant difference between aquades and 50% concentration treatment.

The comparison results between the 25% concentration treatment and the average of 269.33 CFU/ml and the 50% concentration treatment with an average of 147.22 CFU/ml obtained the average difference in inhibitory power of 122.11 CFU/ml. A $p\text{-value}$ of 0.000 is obtained which is lower than 0.05 ($p\text{-value} < 0.05$). It showed a significant difference between the 25% and 50% treatment groups on inhibition. These results showed that the 50% concentration treatment group was significantly better than the 25% group because it was able to inhibit the growth power of bacteria. This is supported by Wijaya and Masfufatun who said that *Aloe vera* has several ingredients that can function as antimicrobials and inhibit the growth of several fungi, and can inhibit the growth of fungi, one of which is *Candida albicans*.⁸

The same results in the research of Sofya, Rahmawati & Putri. *Aloe vera extract* has an effect on the growth of *Candida albicans* on the denture base of Heat cured acrylic resin. *Aloe vera extract* (*Aloe vera*) concentration of 75% showed the number of colonies growing as much as 182.11 CFU/ml, *aloe vera extract* (*Aloe vera*) concentration of 100% average colony count of 104.22 CFU/ml, and aquades group average colony count of 278.22 CFU/ml. The colonies of *Candida albicans* decreased with increasing concentration of *aloe vera extract*.⁽⁶⁾ Results that are not in line with Adim's research which said based on the results of the Post Hoc Tukey HSD Test obtained results between 25% are significant, while at a concentration of 50% insignificant results were obtained, in reducing the number of *Candida albicans* colonies.⁹

Furthermore, herbal ingredients of *aloe vera extract* showed that concentrations of 25% and 50%, resulting in an average value of 269.33 CFU/ml for a concentration of 25% and an average value of 147.22 CFU/ml for a concentration of 50%, the average value produced by the aquades control group was 327.11 CFU/ml on the growth of *Candida albicans* fungi, showing *Aloe vera* has strong antifungal power so it can be used as a removable denture cleaner Heat cured acrylic resin.

4. Conclusion

Aloe vera with a concentration of 25% and 50% is effective in inhibiting the growth of *Candida albicans* in Heat cured acrylic resin. There was a significant comparison of *Aloe vera* concentrations of 25% and 50% and control Aquades in inhibiting the growth of *Candida albicans*.

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Authors Contribution

Contribution	Mallobassang ATB	Amiruddin M	Asmah N	Hatta M
Concepts or ideas	√	√	√	√
Design	√	√	√	√
Definition of intellectual content	√			
Literature search	√	√	√	√
Experimental studies	√			
Data acquisition	√	√		√
Data analysis	√	√		√
Statistical analysis	√		√	√
Manuscript preparation	√		√	√
Manuscript editing	√	√		
Manuscript review	√	√		



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