



LIQUID SMOKE SUBMERSIVE EFFECTIVENESS OF ACRYLIC PLATE TO THE GROWTH OF *CANDIDA ALBICANS*

Moch. Haldi Tri Hutama¹, Windriyatna Windriyatna², Dwi Ngestiningsih³, RR Mahayu Dewi Ariani³, Tyas Prihatiningsih^{2*}

¹Undergraduate Program, Department of Dentistry, Faculty of Medicine, Diponegoro University, Semarang, Indonesia

²Department of Dentistry, Faculty of Medicine, Diponegoro University, Semarang, Indonesia

³Department of Medical Biology and Biochemistry, Faculty of Medicine, Diponegoro University, Semarang, Indonesia

* Corresponding Author : E-mail : tyasprihatingsih@gmail.com

ABSTRACT

Background: Acrylic denture was an alternative to replace a lost tooth, and surrounding tissues have the part of the acrylic plate, which was frequently a place of *Candida albicans* proliferation. The liquid smoke has a chemical compound of phenol which produced antimicrobial and could hamper or destroy *Candida albicans*. **Objectives:** To identify the acrylic plate's effectiveness, soaking into liquid smoke to the growth of *Candida albicans*. **Methods:** This research was categorized into experimental research which exerted post-test control group research design. The total sample in this research was 25 samples, four treatment groups, and one control group. This treatment covered acrylic plate soaking into liquid smoke in specific concentration level 1%, 2%, 4%, and 6% to obstruct the growth of *Candida albicans*. Moreover, the statistic test was conducted through Kruskal-Wallis and continued to Post-Hoc test through Mann-Whitney theory. **Findings:** This research showed a significant difference between the amount of *Candida albicans* on the control group and liquid smoke group in concentrations 1%, 2%, 4%, and p value = 0,005). Further, based on the Post-Hoc test result of Mann-Whitney, it referred significant difference between concentrations 1%, 2%, 4%, and 6% within sterile aquades (p-value = 0,008). **Conclusions:** The liquid smoke shared effective concentration which functioned to hamper *Candida albicans* on the acrylic plate. The concentration level of 6% was the most effective concentration to interfere *Candida albicans* on the acrylic plate. Furthermore, it was not found any significant difference between resistibility of liquid smoke to *Candida albicans* on an acrylic plate with concentration level of 1%-6% which could be the most effective way to obstruct *Candida albicans* on acrylic plate.

Keywords : Acrylic plate, Liquid smoke, *Candida albicans*

INTRODUCTION

The possibility of tooth loss was a common thing due to the increasing age of human being. This condition creates an opportunity to improve individual needs to utilize a denture.¹ Denture could replace the edentulous region, provide support to surrounding tissues, and bring back aesthetic, function, convenience, and health disturbance. The denture was referred to as a tooth prosthesis consisting of many parts; one was the base plate. The base plate on the denture structure has a mucosal contact and a prosthetic tooth.²

Initially, the base plate of denture was formed by volcanic material which has been found in 1837. Furthermore, in 1907, it was introduced to the metal material, and then in 1937, the material of the base plate on denture was commonly made from acrylic resin.³ Based on the reaction setting, denture base was classified into light polymerization acrylic resin (light-curing), polymerization acrylic resin (auto curing), and heat polymerization acrylic resin

(heat cured). Heat cured was a polymerization substance derived from heat application.⁴ This material has superiorities, among other classification, such as easy fabrication, aesthetics, economical, easy repair, simple tools, and low toxicity.⁴ However, the denture may cause a disturbance to the normal oral flora in various ways, most frequently *Candida albicans*. *Candida albicans* could grow on the surface of denture, which then impacted to penetration and infected to soft tissues. Moreover, *Candida albicans* could release endotoxin, which could cause impairment on oral mucosa and impact to denture stomatitis. The application of antimicrobial substance may avert this pathogenic growth.³

The liquid smoke could be utilized as an antimicrobial substance taken from natural resources in Indonesia.⁵ This liquid smoke was made by condensing the smoke from coconut shell burning, which was composed of part, as cellulose, hemicellulose, lignin which has in pyrolysis and



produced several types of compound.⁶ One of the compounds contained within liquid smoke, named phenol, could obstruct or destroy bacteria and several kinds of fungus.^{7,8}

Based on those backgrounds, this paper aims to investigate the effectiveness of acrylic plate soaking into liquid smoke to the growth of *Candida albicans*.

METHODS

This experimental research which exerted post-test control group research design and employed 25 samples. This treatment was performed by soaking acrylic plate into liquid smoke with concentration of 1%, 2%, 4%, 6%, and control group to hamper the growth of *Candida albicans*.

Firstly, this experiment needs *Candida albicans* proliferation, as many as one ose was put into 100 ml of Sabouraud Dextrose Broth (SDB) media. Secondly, the acrylic plate sterilized would be inserted into SDB media and then incubated on shaker rotary for 24 hours in 37 °C. Five samples were soaked into liquid smoke for 8 hours with each concentration group. Five samples were submerged into aquades as the control group. Thirdly, each sample that has been soaked would be rinsed within sterile aquades and put into a reaction tube containing 10 ml sterile aquades and stored in vortex mixer to separate *Candida albicans* within an acrylic plate. The result of *Candida albicans* drop was continued to dilution session up to 10⁻³. The product from each dilution would be put into Sabouraud Dextrose Agar (SDA) as much as 1 ml and incubated in the incubator for 24 hours at temperature 37 °C. Next, the researchers conducted a quantitative analysis of *Candida albicans* number through the method of standard plate count in this following formula:

$$\text{Fungus amount} = \frac{\text{amount of fungus colony} \times \frac{1}{\text{Dilution factor}}}{\text{Volume}}$$

Finally, this research exerted the normality test of Shapiro Wilk, since the amount of sample were < 50 subjects. The collected data have abnormal distribution. Therefore, it needed a non-parametric test of Kruskal-Wallis which aimed to analyze the difference among groups, and then continued to Post-Hoc test of Mann-Whitney with p<0.05 referred to as significant value.

FINDINGS

Table 1 shows the average, standard deviation, median, maximum, minimum, and normality test value.

Table 1. The average and normality test value of fungus colony amount in the acrylic plate with several concentrations by exerting theory of Shapiro-Wilk test

Group	Mean ± SD	Median (min-max)	Shapiro-Wilk
Sterile	1024 ± 645,93	640 (520 – 1900)	0,088
Liquid smoke 1%	52 ± 46,04	70 (0 – 110)	0,437
Liquid smoke 2%	30 ± 61,64	0 (0 – 140)	0,001
Liquid smoke 4%	8 ± 13,04	0 (0 – 30)	0,021
Liquid smoke 6%	4 ± 5,48	0 (0 – 10)	0,006

*SD = Standard Deviation

Kruskal-Wallis non-parametric test was calculated to identify whether the liquid smoke within each concentration could effectively obstruct the growth of *Candida albicans* in acrylic late.

Table 2. Non-parametric test by exerting Kruskal-Wallis

Group	Median (min-max)	P-Value
Sterile	640	
Aquades	(520 – 1900)	
Liquid smoke 1%	70 (0 – 110)	
Liquid smoke 2%	0 (0 – 140)	<0,005 *
Liquid smoke 4%	0 (0 – 30)	
Liquid smoke 6%	0 (0 – 10)	

The Kruskal-Wallis test result indicates that p-value = 0,005 (p<0,05), referred to as the difference of *Candida albicans* amount in nutrient agar of acrylic plate which was soaked into liquid smoke in several concentration levels. Moreover, the



Kruskal-Wallis test indicated the difference between at least two groups in this research. Next, it was continued to be tested in Post-Hoc through Mann-

Whitney theory to identify the difference among treatments.

Table 3. Post-Hoc test by exerting Mann-Whitney

Group	Liquid Smoke 2%	Liquid Smoke 4%	Liquid Smoke 1%	Sterile Aquades
Liquid smoke 6%	0,811	0,811	0,080	0,008*
Liquid smoke 4%	0,906	–	0,104	0,008*
Liquid smoke 2%	–	–	0,329	0,008*
Liquid smoke 1%	–	–	–	0,008*

Description: *Significant

Mann-Whitney test showed that liquid smoke in 1%-6% concentration was able to hamper the growth of *Candida albicans* in the acrylic plate. This result was derived from table 3, which indicated a significant difference among liquid smoke in a 1%-6% concentration level.

DISCUSSION

The use of denture was a predisposition factor in the development of *Candida albicans* when the denture was not cleaned routinely or maintained overnight in the oral cavity. This form of neglect creates an ideal place for the growth of *Candida albicans*. Another form of denture problems such as loose denture would irritate the mucosa; this condition would enable *Candida albicans* to infiltrate into tissues and then impact infection.⁹ Furthermore, *Candida albicans* could release endotoxin, which caused oral mucosa impairment and impacted denture stomatitis.^{3,9} Generally, the denture could be cleaned up through several ways, as a mechanical way to brush off the denture by using toothpaste or powder and a chemical method to soak the denture into alkaline peroxide and enzyme solution.¹⁰

The research findings derived from acrylic plate soaking into liquid smoke in several levels of concentration and acrylic plate soaking into aquades showed the *Candida albicans* amount in SDA. The acrylic plate submerged into aquades has a considerable amount of *Candida albicans* than the acrylic plate which was soaked into liquid smoke with concentration level 1%, 2%, 4%, and 6%. This finding was in line with the previous research

finding, which discussed the effects of acrylic resin plate soaking into cinnamon extract (*Cinnamomum burmanii*) to the amount of *Candida albicans* blastopores. It demonstrated that the *Cinnamomum burmanii* could affect the growth of *Candida albicans* blastopores amount in acrylic resin plate and increase as the concentration of the cinnamon extract was increasing.¹¹ This research also indicated that the higher concentration level of liquid smoke would determine the substantial possibility of hampering *Candida albicans* in the acrylic plate. However, the threshold of substance toxicity needs to be examined.

The previous research on the effects of liquid smoke concentration as a disinfectant solution to the decrease of *Candida albicans* has asserted that the higher concentration of liquid smoke would determine the stronger resistibility of *Candida albicans*. This finding has supported the recent researchers that the liquid smoke was effective to hamper the growth of *Candida albicans* in an acrylic plate, since it contained antimicrobial activity.

The liquid smoke contained a substance which could hamper fungus growth, named phenol. Phenol was able to impede fungus due to its ability to break the cell membrane, which affected cell permeability; thus, which could obstruct fungus cells' growth.¹² Besides, phenol was also able to denature cell protein and pucker cell to destroy the fungus cell.¹³

According to this research finding, the liquid smoke contained a substance that was able to obstruct fungus growth in acrylic plate and it was



considered safe use, then, it could be used as a disinfectant on the denture. This research could be improved on the sample size; it was restricted on acrylic plate in square shape and did not use the real denture. This restriction was due to the difficulty of sampling. However, this research restriction would not affect the validity of the research.

CONCLUSIONS

The liquid smoke in several concentration levels effectively obstructs the growth of *Candida albicans* in the acrylic plate. The concentration of 6% was the most effective concentration level, which could hamper *Candida albicans* in the acrylic plate. Moreover, there was no significant difference between the resistibility of liquid smoke and *Candida albicans* growth in the acrylic plate with a concentration level of 1%-6%. Further research should analyze another contributing effect on acrylic plate soaking into liquid smoke, such as durability, colour changes, and plate's odour.

REFERENCE

1. Sofya Pocut Aya, Rahmayani Liana FF. Tingkat Kebersihan Gigi Tiruan Sebagian Lepas Resin Akrilik Ditinjau dari Frekuensi dan Metode Pembersihan. *J Syah Kuala Dent Soc.* 2016;1(1):91-5.
2. Fatchur RE. Efektivitas Ekstrak Daun Dewa (*Gynura pseudochina* (Lour.) DC) terhadap Pertumbuhan *Candida albicans* pada Plat Dasar Gigi Tiruan Resin Akrilik. *Kedokt Gigi Unissula.* 2010;48(123):1-13.
3. Endang W. Pengaruh Ekstrak *Graptophyllum Pictum* terhadap Pertumbuhan *Candida albicans* pada Plat Gigi Tiruan Resin Akrilik. *Indones J Dent.* 2008;15(3):187-91.
4. Sundari Iin, Sofya Pocut Aya HM. Studi Kekuatan Fleksural antara Resin Akrilik Heat Cured dan Termoplastik Nilon Setelah Direndam dalam Minuman Kopi Uleekareng (*Coffea robusta*). *J Syah Kuala Dent Soc.* 2016;1(1):51-8.
5. Imaniar AC, Vidyahayati IL, Wibisono G, Ciptaningtyas VR, Pulpa G. Pengaruh Pemberian Asap Cair pada Berbagai Konsentrasi terhadap Pertumbuhan *Enterococcus faecalis* Penyebab Gangren Pulpa. *J Kedokt Diponegoro.* 2018;7(2):424-32.
6. Sari TI, K AA, Rahmawati. Proses Pembuatan Asap Cair (Liquid Smoke) dari Limbah Industri. *J Tek Kim.* 2009;16(2):44-7.
7. Pangestu E, Iman S, Suprianto. The Use of Coconut Shell Liquid Smoke for Controlling *Phytophthora* Sp. Causing Cocoa Fruit Rot Disease In Vitro. *J Perkeb Lahan Trop.* 2014;4(2):39-44.
8. Budijanto S, Hasbullah R, Prabawati S, Zuraida I. Identifikasi dan Uji Keamanan Asap Cair Tempurung Kelapa untuk Produk Pangan. *J Penelit Pascapanen Pertan.* 2008;5(1):32-40.
9. Williams D, Lewis M. Pathogenesis and Treatment of Oral Candidosis. *J Oral Microbiol.* 2011;1(30):1-11.
10. Garg R. Denture Hygiene , Different Strategies. *Journal Webmed Cent.* 2010;1(10):1-10.
11. Dama C, Soelioangan S, Tumewu E. Pengaruh Perendaman Plat Resin Akrilik dalam Ekstrak Kayu Manis (*Cinnamomum burmannii*) terhadap Jumlah Blastospora *Candida albicans*. *J e-GiGi.* 2013;1(2):1-5.
12. Christopher W, Natalia D, Rahmayanti S. Uji Aktivitas Antijamur Ekstrak Etanol Umbi Bawang Dayak (*Eleutherine americana* (Aubl.) Merr. Ex K. Heyne.) terhadap *Trichophyton mentagrophytes* secara In Vitro. *J Kesehatan Andalas.* 2017;6(3):685-9.
13. Shafwan S Pulungan A. Aktivitas Antijamur Ekstrak Etanol Daun Kunyit (*Curcuma longa*) terhadap Jamur *Candida albicans*. *J Biol Kesehatan.* 2017;3(2):120-4.