

EDUCATION AND DENTAL - ORAL HEALTH EXAMINATIONS FOR PREGNANT WOMEN AT THE KAMPUNG SAWAH HEALTH CENTER, CIPUTAT, SOUTH TANGERANG

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ABSTRACT

Oral health of the pregnant mother affects the condition of the baby it contains. Pregnant women who suffer from periodontal infection are at risk of giving birth to babies with low birth weight and are premature. Early pregnancy usually pregnant women experience lethargy, nausea and sometimes until vomiting. The aim of this community service activity is to gain knowledge about the importance of maintaining dental and oral health in pregnant women as well as increasing public knowledge and awareness about procedures for proper and correct brushing of teeth in the Kampung Sawah Community Health Center area, Ciputat, South Tangerang. This research used the counseling method and used questionnaires on 35 pregnant women, aged 20 - 35 years. The initial outreach activity was carried out by explaining and distributing brochures about the symptoms of caries, causes of caries, tips for preventing caries, simulating the correct way to brush teeth, holding a question-and-answer session regarding dental and oral health problems in pregnant women. The conclusion of this paper is that dental and oral health checks must be carried out regularly, both when you feel sick and when there are no complaints.

Keywords: Health, pregnant women, teeth and mouth

1. INTRODUCTION

Health for human including pregnant woman is the most important part of human life, physically and spiritually healthy and related each other.¹ To achieve optimal dental and oral health in toddlers and pregnant women, regular care must be carried out. Treatment can be started by paying attention to food consumption, cleaning plaque and food residue by brushing teeth regularly and correctly, cleaning tartar, filling cavities and extracting teeth that can no longer be maintained. The oral health of pregnant women affects the condition of the baby they are carrying.^{2,3}

It is very common for pregnant women to experience teeth and mouth problems during pregnancy, including hypersalivation (excessive saliva), cavities, gum bleeding, gingivitis (inflammation of the gums). Dental and oral problems in pregnant women often occur, this tends to be ignored, both by sufferers and by doctors or midwives. If dental and oral problems are not felt to be a nuisance, pregnant women usually do not complain to the doctor or midwife who is examining their pregnancy. Prospective mothers tend to care more about the health of their fetus and the pregnancy itself, thereby neglecting dental and oral health. Measuring dental and oral hygiene is an effort to determine the state of a person's dental and oral hygiene.⁴

Generally, an index is used to measure oral and dental hygiene. Index is a number that shows the clinical condition obtained during an examination, by measuring the area of the tooth surface covered by plaque or calculus, thus the number obtained is based on an objective assessment. To measure dental and oral hygiene, an index known as the Oral Hygiene Index Simplified (OHI-S) can be used. This figure is obtained by adding up the Debris Index (DI) and Calculus Index (CI).⁵

During pregnancy, pregnant women will experience physical changes, hormonal and behavioral changes occur in pregnant women. These things also affect the condition of their teeth and mouth. During pregnancy, expectant mothers often experience complaints about their teeth and mouth.⁶

The aim of this community service activity is to gain knowledge about the importance of maintaining dental and oral health in pregnant women as well as increasing public knowledge and awareness about procedures for proper and correct brushing of teeth in the Kampung Sawah Community Health Center area, Ciputat, South Tangerang.

2. METHODS

This research used the counseling method and used questionnaires on 35 pregnant women, aged 20 - 35 years in the Kampung Sawah Community Health Center area, Ciputat, South Tangerang.

3. RESEARCH RESULT

Counseling on caries prevention and simulations on how to brush teeth properly and correctly for pregnant women at the Kampung Sawah Health Center, Ciputat, South Tangerang. The initial outreach activity was carried out by explaining and distributing brochures about the symptoms of caries, causes of caries, tips for preventing caries, simulating the correct way to brush teeth, holding a question-and-answer session regarding dental and oral health problems in pregnant women, and then ending with the distribution of tooth brushes and toothpaste.

4. DISCUSSION

Pregnancy causes hormonal changes which have an impact on the dental and oral health of pregnant women from the first to third trimester. This condition affects the dental and oral hygiene of pregnant women. According to the Indonesian Ministry of Health (1995), the symptoms that appear in the trimester of pregnancy are: ⁴

Trimester I (pregnancy period zero to three months)

During this period, pregnant women usually feel lethargic, nauseous, and sometimes even vomit. This feeling of nausea and vomiting causes an increase in acidity in the mouth. Coupled with an increase in plaque due to laziness in maintaining dental hygiene, tooth decay can quickly occur. During pregnancy there are changes in maintaining oral hygiene which can be caused by feelings of nausea and vomiting, feeling afraid when brushing your teeth because of bleeding in the gums or the mother being too tired from pregnancy, which causes pregnant women to be lazy about brushing their teeth. This situation will automatically increase the buildup of plaque, thus worsening the level of dental and oral hygiene of pregnant women.

Trimester II (pregnancy period three to six months)

During pregnancy, women sometimes still feel the same as during the first trimester of pregnancy. Apart from that, this period is usually the time when hormonal changes occur which can cause abnormalities in the oral cavity, including inflammation of the gums, their color being reddish and bleeding easily, especially when brushing your teeth; lumps appear on the gums (between the two teeth), especially those facing the cheeks. In this situation, the color of the gums becomes purplish red to bluish red, bleeds easily and the teeth feel loose, and can enlarge until they cover the teeth.

Third trimester (six to nine months of pregnancy)

Swelling of the gums above reaches its peak in the seventh and eighth months. Pregnancy can affect dental and oral health. This situation occurs because: ¹⁰ There is an increase in levels of the hormones estrogen and progesterone during pregnancy, which is associated with an increase in the amount of plaque attached to the surface of the teeth. Oral hygiene tends to be neglected due to nausea and vomiting in the morning (morning sickness), especially during early pregnancy. Even though pregnant women experience various disorders, pregnant women are still obliged to maintain the health of their teeth and mouth. So that pregnant women avoid dental and oral diseases during pregnancy, it is recommended to do the following: Brush your teeth properly, correctly and regularly.^{3,7}

pregnant women can experience premature delivery, low birth weight baby, pre-eclampsia, gingival tissue ulcerations, pregnancy granuloma, gingivitis, pregnancy tumors (epulis gravidarum), loose teeth, mouth dryness, and dental erosions.^{8,9}

To maintain oral and dental hygiene, pregnant women are also advised to use toothbrush aids such as tongue brushes, interdental toothbrushes, mouthwash, toothpaste containing fluorine and dental floss. The use of

mouthwash is recommended for pregnant women according to the indications.⁹ The use of mouthwash must be under the supervision and instructions of a dentist so that it does not cause side effects, such as tooth staining and disruption of the balance of the normal flora of the oral cavity. Consume nutritious and balanced foods.^{5,6}

A pregnant mother is strongly encouraged to consume balanced nutritious food in accordance with the guiding principles of balanced nutrition or nutritional adequacy rates, so that she has good immune system and can protect her fetus so that it can grow and develop healthily and perfectly. Avoid sweet and sticky foods.^{5,6,9} Nutrition during pregnancy is very important for general health and oral health for both the mother and the baby. Baby's tooth development during pregnancy starts at the 5th and 6th weeks.¹⁰

Education for pregnant women at the Kampung Sawah Community Health Center, Ciputat, South Tangerang regarding how to maintain healthy teeth and mouth from before pregnancy, during pregnancy and maintaining healthy teeth and mouth in children as well as how to brush their teeth properly and correctly. It is carried out using visual media in the form of leaflets and models of teeth and toothbrushes and the indicator of success is that pregnant women can understand the importance of maintaining healthy teeth and mouth during pregnancy and also maintaining healthy teeth and mouth in children.

The conclusion of this paper is that dental and oral health checks must be carried out regularly, both when you feel sick and when there are no complaints. In fact, ideally, a dental and oral health examination should be carried out if someone is planning or expecting a pregnancy, so that when she becomes pregnant her dental and oral health is in good condition. If a pregnant woman experiences complaints about her teeth and mouth, dental examination and treatment must be done as soon as possible in order to prevent more serious dental and oral disease.





Figures 1. dental and oral education and counseling program (A-C), leaflet of dental and oral education (D)

5. REFERENCES

- Maulid, G A. 2008. Manajemen Kesehatan Gigi Pada Kehamilan, (online). Tersedia di: http://www.slideshare.net/guest27352_10a/manajemen_kesehatan_gigi_pada_kehamilan. Vol.132:875-880. Diakses: 1 Februari 2016.
- Sriyono, N. 2009. *Pencegahan Penyakit Gigi dan Mulut Guna Meningkatkan Kualitas Hidup*. Yogyakarta: Universitas Gajah Mada.
- Kementerian Kesehatan (Kemenkes) RI., 2012. *Pedoman Pemeliharaan Kesehatan Gigi Dan Mulut Ibu Hamil Dan Anak Balita Bagi Tenaga Kesehatan Di Fasilitas Pelayanan Kesehatan*. Jakarta.
- Saputra, S. 2013. Perubahan Hormonal Ibu Hamil Pengaruhi Kesehatan Gigi dan Mulut, *Dental & Dental*.: 16. Yogyakarta: Netras Media Utama.
- Putri, M.H. E. Herijulianti, Nurjanah, N, 2011. *Ilmu Pencegahan Penyakit Jaringan Keras dan Jaringan Pendukung Gigi*. Jakarta: EGC.
- Kementerian Kesehatan (Kemenkes) RI., 2013. *Pokok – Pokok Hasil Riset Kesehatan Dasar - Riskesdas 2013 Provinsi Bali*. Jakarta: Badan Litbangkes Kemenkes RI.
- Sani, 2015, *Kesehatan Gigi dan Mulut pada Ibu Hamil*, (online), available: <https://www.scribd.com/doc/258271545/Kesehatan-Gigi-Dan-Mulut-Pada-Ibu-Hamil>. Diakses 1 Februari 2023
- Soegyanto AI, Larasati RN, Wimardhani YS, Özen B. 2020. Mother's knowledge and behaviour towards oral health during pregnancy. *Pesqui Bras Odontopediatria Clín Integr.*; 20:e5647.
- Azofeifa A, Yeung LF, Alverson CJ, Beltrán-Aguilar E. Dental caries and periodontal disease among U.S. pregnant women and nonpregnant women of reproductive age, National Health and Nutrition Examination Survey, 1999-2004. *J Public Health Dent*. 2016;76(4):320-9.

ORAL HEALTH COUNSELING FOR ELDERLY PATIENTS AT KERANGAN HEALTH CENTER, SOUTH TANGERANG

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ABSTRACT

The elderly population increases every year and leads to several problems, especially health problems, because physical conditions have decreased every year. Elderly patients have limitations in carrying out activities including paying attention to and taking care of their oral health. The purpose of this study was to explain the importance of education for the elderly in maintaining oral health. This research method is Simple Random Sampling by using questionnaires and interviews with 37 elderly people, at Keranggan health center, South Tangerang. The results of the study obtained data in the form of the elderly age 60 - 67 years, the elderly work varied in the form of, traders, retirees, and no work. The drugs that are consumed routinely are antihypertension drugs, diabetes drugs, gout drugs, stomach acid drugs and pain relievers. The conclusions obtained from this study, there is still a lack of knowledge of the elderly in Keranggan health center, South Tangerang regarding the importance of maintaining oral and dental health.

Keywords: health, elderly, teeth, and mouth

1. INTRODUCTION

Poor oral health among elderly will cause non-communicable diseases which lead to increase mortality, decrease health-related quality of life (HRQoL), and increase healthcare expenses. In recent years, the program of Desa Siaga has also been promoted, which aims to empower villages, make communities or villages independent in overcoming health problems in their respective villages, and increase community participation in the health sector. In the Keranggan Community Health Center area, all villages/sub-districts including Siaga Village/District.¹

Implementation of community participation and empowerment activities at the Keranggan Community Health Center can be realized in the form of Community-Resourced Health Efforts (UKBM) whose activities include monitoring and coaching health center for toddlers in 22 sub-districts/villages, 4 health centers for the elderly, and 2 health centers for PTM. There is also cross-sectoral collaboration with the Women's Empowerment, Child Protection, Population Control and Family Planning Service (DP3AP2KB) for infant, teenage and elderly.¹

The results of the Posyandu strata data collection in the Keranggan Community Health Center working area in 2022 showed that there were no Pratama health center (0%), Madya health center (36%), Purnama health center (64%), and no Mandiri health center (0%). The active health center reached 100% and the activeness of toddler cadres reached 100%. All cadres have been trained and regularly carry out coordination meetings and coaching. Even though there are no Independent Health Center Strata in each sub-district, none are still Pratama Health Center.¹

Geriatrics is a health service for the elderly (elderly) and treats conditions and diseases related to the aging process.² Base on the Law of the Republic of Indonesia No. 13 of 1998, the elderly is someone who has reached the age of 60 years and over.³ Hawari in 2001 stated that the elderly is a condition characterized by a person's failure to maintain a balance against physiological stress conditions. This failure is related to a decrease in the ability to live and an increase in individual sensitivity. The characteristics of geriatric patients are multipathology, decreased physiologic reserve, atypical symptoms, and signs of disease, decreased functional status, and malnutrition.⁴

The World Health Organization (WHO) divides the life cycle of the elderly into four groups, namely middle age (middle age) age group 45 to 59 years, elderly (elderly) aged 60-74 years, elderly (old) aged 60-75 and 90. years, veryold age more than 90 years.³ According to Solomon et al, The "13 i" which consists of Immobility (immobilization), Instability (instability and falls), Intellectual Impairment (intellectual disorders such as dementia and delirium), Incontinence (urinary and pelvic incontinence), Isolation (depression), Impotence (impotence), Immuno-deficiency (decreased immunity), Infection (infection), Inanition (malnutrition), Impaction (constipation), Insomnia (sleep disorders), Iatrogenic disorder (iatrogenic disorder) and Impairment of hearing, vision and smell (hearing disorders, sight and smell).³

The aim of the community service activity is to determine the knowledge and awareness geriatric people about procedures for proper and correct brushing of teeth in the Keranggan Community Health Center area, Ciputat, South Tangerang.

2. METHODS

This research method uses Simple Random Sampling by using questionnaires and interviews with 36 elderly people, at Keranggan Health Center, South Tangerang. The subject of the study obtained data in the form of the elderly age 60 -67 years. Each questionnaire's validity and reliability were tested on 30 respondents by online administration. After validation test of the questionnaire, a few questions were modified based on participants' feedback, and afterward, the survey was distributed at the day of counseling.

3. RESEARCH AND DISCUSSION

Counseling on caries prevention, simulations technique to brush teeth and maintain dentures properly and correctly was performed at the Keranggan Community Health Center, South Tangerang. The initial outreach activity was done by explaining and distributing brochures about the symptoms of caries, causes of caries, tips for preventing caries, simulating the correct way to brush teeth and dentures, holding a question-and-answer session regarding dental and oral health problems, and finished with the distribution of toothbrushes and toothpaste. The participants can understand how to maintain healthy teeth and mouths and understand how to brush teeth and maintain the dentures properly and correctly. Table 1 shows sociodemographic characteristics and daily oral health practice of geriatric patients.

Table 1. The Sociodemographic Characteristics and Daily Oral Health Practice of Elderly

	n	%
Age Mean \pm SD (years)	64.4 \pm 8.6	
Gender	11	30.5
Male	25	69.5
Female		
Educational Background		
Elementary School	7	19.4
Yunior High School	18	50
Senior High School	10	27.8
Bachelor	1	2.8
Xerostomia		
Yes	9	32.2
No	27	67.7
Frequency of brushing teeth in a day		
Never	2	5.6
Once/day	31	86.1
More than once/day	3	8.3
The use of toothpaste containing fluoride		
Yes	31	86.1
No	5	13.9
The use of dentures		
Yes	3	8.3
No	33	91.7
Do you remove your dentures overnight?		
Yes	3	8.3
No	33	91.7
Frequency of cleaning the dentures		
Never	3	8.3
Once/day	30	83.3

More than once/day	3	8.3
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Only 3 participants (8.3%) have complained of xerostomia and wear dentures, while majority of them know frequency of tooth brushing using fluoride toothpaste and clean their dentures. All of the participants agree and satisfied with oral counseling about technique to maintain oral health and dentures.

4. CONCLUSION

Oral health is an important component for maintaining overall health and linked to general health and health-related quality of life.¹ As age increase, every individual will experience a decline in body function due to aging. The aging process is usually characterized by impaired patient mobility.^{5,6} The limited mobility of geriatric patients is one factor in the lack of awareness in maintaining oral health, resulting in health problems in the oral cavity. Dental and oral health problems can occur both in the teeth and the oral mucosa. Dental conditions in geriatric patients that can be found include carious teeth, loose teeth, and tooth loss.^{2,6}

The condition of dry mouth (xerostomia) is also often found in geriatrics. Xerostomia in geriatrics occurs due to atrophy of the salivary glands which causes a decrease in saliva production and changes in its composition. Changes due to the aging process result in a reduction in the rate of saliva flow so that the oral cavity tends to become dry.^{2,6} Maintaining a healthy oral cavity is one of the important efforts to maintain a healthy lifestyle. If the oral cavity is neglected and not treated properly, various diseases in the oral cavity will arise. Therefore, dental, and oral health problems among geriatrics are related to general health and will affect an individual's quality of life.⁸

Studies have explained that older people do not clean their dentures properly and do not have an adequate oral hygiene due to several factors such as social status, age, educational background, systemic diseases, and smoking. Also lack of information about the maintenance of oral health and periodic recalls play an essential role in above mentioned situation.⁹ Elderly individuals with lower education levels, with lack of family support and inadequate self-care independence, have poor knowledge related to oral care. Elderly with higher education has tendency to search related information about oral problems and preventive measures, such as using dental floss and changing their toothbrush regularly, via various channels.¹⁰

After carrying out several activities in the Dental and Oral Health Education program at the Keranggan Community Health Center, several indicators of success were obtained from the Dental and Oral Health Education program. Collaboration is established and can help with service activities at the health center around the Keranggan Community Health Center. The attitude and habits toward home procedures for oral and denture hygiene resulted in poor prosthesis cleanliness. Obstacles that occur during the dental and oral health education program, the lack of the number of educations,⁸ so that implementation is less than optimal.

The positive impact of implementing dental and oral health education, namely increased knowledge about health for residents around Posyandu and Puskesmas, and improved health for residents around Posyandu and Puskesmas. Relationships are established between students, the community and Puskesmas officials increased knowledge and skills of the Posyandu community in correct tooth brushing, causes, symptoms and steps to prevent caries.

The public was helped and received new information about dental and oral health for the first time. Majority of the participants admitted the knowledge of care about general health but also the dental and oral health.

The conclusions obtained from this study, there is still a lack of knowledge of the elderly in the Keranggan Health Center Community, South Tangerang regarding the importance of maintaining dental and oral health and dentures cleanliness.



Figures 1. The activity of dental health counseling and data collection of the study



Figure 2. Dental and oral health education with participant of elderly patients and health cadres (a,b).The poster used to in promotion of dental and oral health (c)

REFERENCES

- Anonymous. (2018). Laporan Tahunan Puskesmas Keranggan Tahun 2022. (2022). Puskesmas Keranggan, Tangerang Selatan.
- Türkbeyler İH. et al. (2019). What is Geriatrics? Geriatrics or Older Adults Health and Diseases? *Eur J Geriatr Gerontol*, 1(2),51-55
- Aru W. Sudoyo, Bambang Setiyohadi, Idrus Alwi, M. Simadibrata, Siti Setiati. (2006). *Buku Ajar Ilmu Penyakit Dalam*. Jakarta: FKUI.
- Darmojo, Boedhi. (2009). *Buku Ajar Geriatri*. Jakarta: Balai Penerbit FK UI.
- A Dini. (2013). Sindrom Geriatri (Imobilitas, Instabilitas, Gangguan Intelektual, Inkontinensia, Infeksi, Malnutrisi, Gangguan Pendengaran). *Medula Unila*, 1(3), 117-125.
- Muhith A., Siyoto S. (2016). *Pendidikan Keperawatan Gerontik*. Yogyakarta: ANDI.
- Zakirah, S. A. (2017). *Gambaran Tingkat Kebersihan Rongga Mulut Pasien Usia Lanjut Penderita Demensia*. Fakultas Kedokteran Gigi Universitas Hasanuddin.
- Cakan, U., Yuzbasioglu, E., Kurt, H., Kara, H. B., Turunç, R., Akbulut, A., & Aydin, K. C. (2015). Assessment of hygiene habits and attitudes among removable partial denture wearers in a university hospital. *Nigerian journal of clinical practice*, 18(4), 511–515.
- Papadiochou, S., & Polyzois, G. (2018). Hygiene practices in removable prosthodontics: A systematic review. *International journal of dental hygiene*, 16(2), 179–201.
- Cinquanta, L., Varoni, E. M., Barbieri, C., & Sardella, A. (2021). Patient attitude and habits regarding removable denture

home hygiene and correlation with prosthesis cleanliness: A cross-sectional study of elderly Italians. *The Journal of prosthetic dentistry*, 125(5), 772.e1–772.e7.

Wong, F. (2021). First Data in the Process of Validating a Tool to Evaluate Knowledge, Attitude, and Practice of Healthcare Providers in Oral Care of Institutionalized Elderly Residents: Content Validity, Reliability and Pilot Study. *International*



THE EFFECTIVENESS OF BILIMBI JUICE ON THE GROWTH OF CANDIDA ALBICANS ON ACRYLIC RESIN

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Abstract: -

Background: Acrylic resin is the most common material used as a denture base that contacts directly with the oral mucosa. Acrylic resin has a porous surface and surface roughness that allow the attachment and formation of *Candida albicans* colonies that trigger denture stomatitis. Bilimbi (*Averrhoa bilimbi* L.) juice contains saponins, phenols, tannins, alkaloids, flavonoids, and triterpenoids, which have antifungal activity against *Candida albicans*.

Purpose: To determine the effectiveness of bilimbi juice on the growth of *Candida albicans* on heat-cured and cold-cured acrylic resin.

Material and method: Experimental laboratory research with a post-test only control group design. 24 heat-cured and cold-cured acrylic resin samples, sizes 10x10x2 mm were divided into 4 groups. Groups I and II were heat-cured and cold-cured acrylic resins immersed in 100% bilimbi juice. Groups III and IV were heat-cured and cold-cured acrylic resins immersed in Aqua®. Each group was immersed for 48 hours, and then the number of colonies was calculated.

Results: There was a significant difference in the amount of *Candida albicans* in heat-cured and cold-cured acrylic resins immersed in 100% bilimbi juice compared with Aqua® ($p < 0.05$).

Conclusion: Bilimbi juice is effective in decreasing the growth of *Candida albicans* on heat-cured and cold-cured acrylic resins.

Keywords: acrylic resin; bilimbi juice; *Candida albicans*.

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INTRODUCTION

A denture is an artificial substitute for missing natural teeth and adjacent tissues. Denture functions are to restore masticatory ability, maintain residual tissues in the mouth, improve jaw relations, improve aesthetics, and improve quality of life. The denture base is the part of a denture that rests on the foundation tissues and to which teeth are attached.¹ Most denture bases are made of acrylic resin because it has many advantages. But acrylic resin also has porosity and surface roughness that need to be considered. This property increases the potential for the accumulation of microorganisms, especially *Candida albicans*. da Silva et al. (2016) evaluate the influences of surface roughness (SR) of denture bases on *Candida albicans* biofilm formation. He stated that reduced surface roughness resulted in decreased *Candida albicans* biofilm accumulation on poly (methyl methacrylate) acrylic resin denture bases.² *Candida albicans* colonies can be found in removable denture users who never remove and clean their dentures. *Candida albicans* is a normal flora that is often found in the oral cavity, digestive tract, and

vagina. As a normal flora, *Candida albicans* can live commensally with the host without harm, but it can become dangerous if the host does not maintain good oral hygiene. The increase in the number of *Candida albicans* colonies occurred due to the closure of the oral mucosa by the denture base, which was accompanied by poor oral hygiene. This increase in colonies triggers denture stomatitis. A literature study conducted by Mawei et al. (2020) showed that there is a relationship between denture hygiene's level and denture stomatitis in full denture users.³

Inflammation and erythema of the oral mucosal areas covered by the denture are characteristics of denture stomatitis. According to epidemiological research, denture stomatitis affects 15% to over 70% of those who wear dentures. The incidence of denture stomatitis is higher among elderly denture users and among women. Poor denture hygiene, wearing dentures all day and night, the accumulation of denture plaque, and bacterial and yeast contamination of the denture surface are etiological factors. Additionally, poor-fitting dentures can increase mucosal trauma. All of these factors seem to make *Candida albicans* more likely to colonize the oral mucosal surfaces and dentures and act as an

opportunistic pathogen.⁴ This increase in *Candida albicans* colonies will interfere with the comfort, health, and quality of the patient's oral cavity, so an effective method of cleaning the acrylic resin denture base is needed.

Lee et al. (2016) investigated the effectiveness of six different denture cleaning techniques. The following six cleaning techniques were examined: mechanical brushing with a toothbrush, chemical soaking in a commercial cleansing tablet solution, combined brushing and chemical soaking in a commercial mouthwash solution, irradiation in an ultraviolet (UV) light box, and chemical soaking in distilled water. Following a single cleaning session, the efficiency of the denture cleaning techniques in lowering *Candida albicans* was assessed. As a result, brushing, soaking in a commercial cleansing tablet solution, or combining both approaches reduces the adherence of *Candida albicans* to denture samples when compared to other methods.⁵ Most commercial cleansing tablet solution are made from chemicals, but nowadays the use of herbal ingredients is widely used by the community, in addition to advances in technology and science regarding chemicals. There are some herbal ingredients that prove to be effective against *Candida albicans*, such as pomegranate (*Punica granatum*) flowers⁶, edamame (*Glycine max* (L.) Merrill)⁷, parsley (*Petroselinum crispum*)⁸, hibiscus flower (*Hibiscus rosa sinensis* L.)⁹, etc.

One of the plants that has long been used by the community as traditional medicine to treat disease is *Averrhoa bilimbi*, or in Indonesia, it is called Belimbing Wuluh. The fruits, flowers, and leaves of the *Averrhoa bilimbi* plant are useful. The fruit is used to make desserts, syrups, and itching paste. Inflammation, mumps, rheumatism, coughing, bleeding gums, tooth ache, good digestive function, minimizing hemorrhoids, and managing obesity are among the conditions it can help with. *Averrhoa bilimbi* is also useful for removing fabric stains, overcoming fishy odors and cleaning and shining brass.¹⁰ Bilimbi is widely used by the community because it is generally safe, affordable, and accessible. Bilimbi contains a variety of phytochemicals, such as saponins, phenols, tannins, alkaloids,

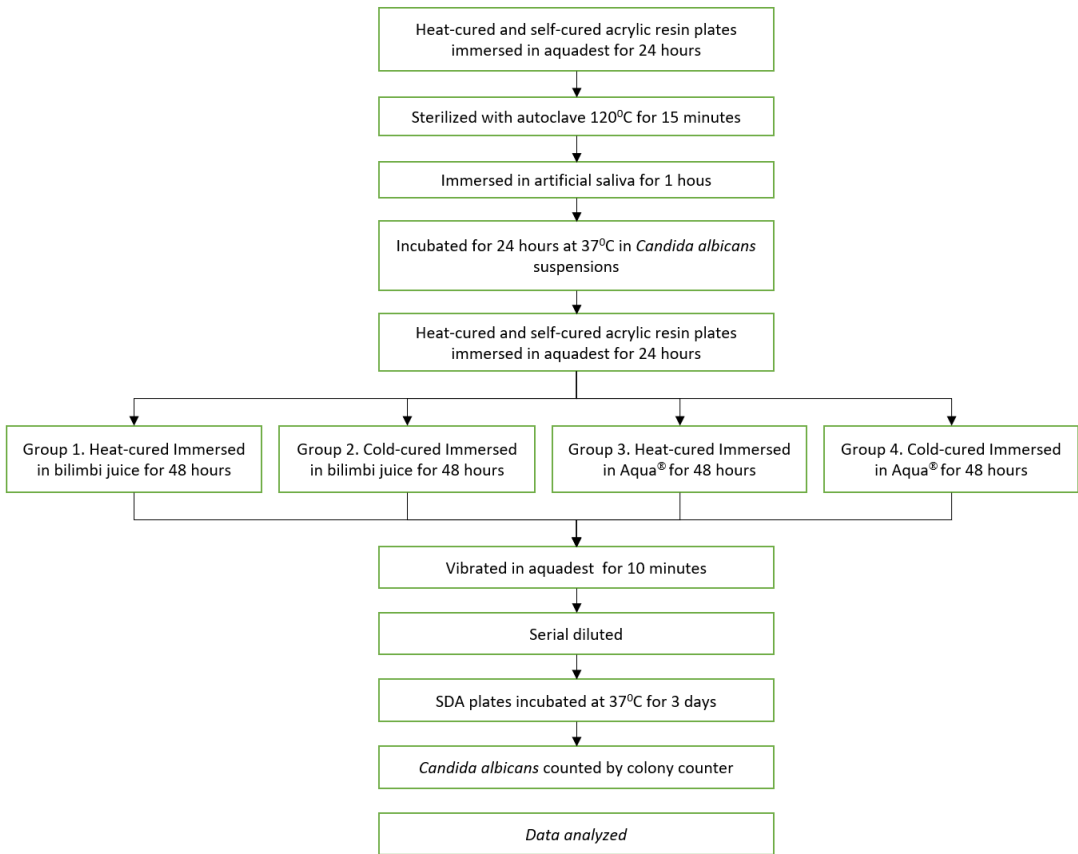
flavonoids, and triterpenoids. A previous study showed bilimbi have fungistatic or antifungal properties. Octaviani (2018) stated that bilimbi juice at 100% concentration can inhibit the growth of *Candida albicans* colonies by 55%.¹¹ However, there are no studies about the effectiveness of bilimbi juice on the growth of *Candida albicans* on acrylic resin. Based on that, we are interested in testing the antifungal effectiveness of bilimbi juice (*Averrhoa bilimbi* L.) on the growth of *Candida albicans* on heat-cured and cold-cured acrylic resin.

METHODS

This study was an experimental laboratory with a post-test only control group design. It was conducted at the Testing and Research Services Laboratory (Qlab), Faculty of Pharmacy, Pancasila University. The materials consisted of: 1) *Candida albicans* colony; 2) fresh bilimbi (*Averrhoa bilimbi* L.) juice with 100% concentration; 3) Aqua® (negative control); 4) heat-cured acrylic resin plates with a size of 10x10x2mm; and 5) cold-cured acrylic resin plates with a size of 10 x 10 x 2 mm. All plates of acrylic resin are the same size and shape. Based on Federer's formula, the sample size obtained is six plates in each group. So, the total size was 24, which was divided into four groups and immersed for 48 hours:

- Group I: treatment group with a heat-cured acrylic plates immersed in 100% bilimbi juice.
- Group II: treatment group with a cold-cured acrylic plates immersed in 100% bilimbi juice.
- Group III: control group of heat-cured acrylic plates immersed in Aqua®.
- Group IV: control group of cold-cured acrylic plates immersed in Aqua®.

The research flow diagram is in Figure 1. Data analysis in this study was carried out with SPSS®, with the data first being tested using Shapiro-Wilk to determine whether the data were normally distributed or not. If the data is normal, the independent t-test is used. If the data is not normal, the Kruskal-Wallis test is used.



RESULTS

The aim of this study was to determine the effectiveness of bilimbi juice on the growth of *Candida albicans* on heat-cured and cold-cured acrylic resin denture bases. The growth of *Candida albicans* on head-cured and cold-cured acrylic resin after being immersed for 48 hours in bilimbi juice is less than that in Aqua® (Figure 1 and 2, Table 1)

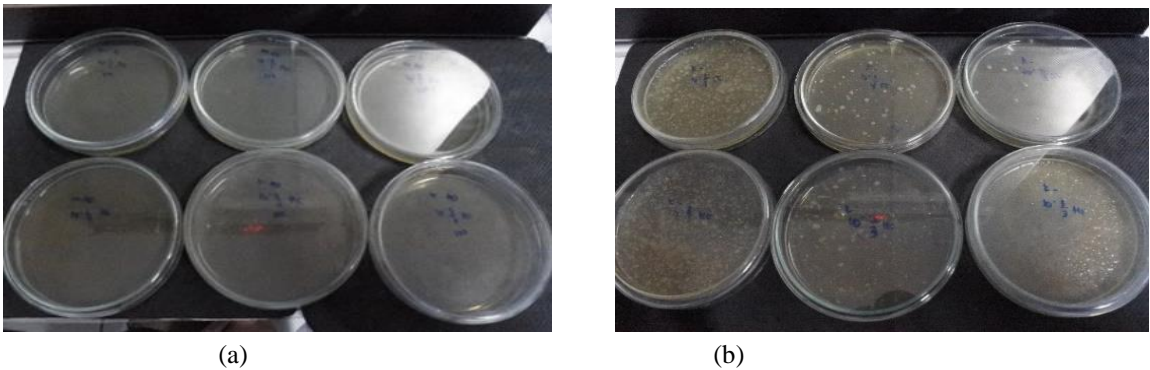


Figure 1. *Candida albicans* on heat-cured acrylic resin after being immersed in (a) bilimbi juice and (b) Aqua®

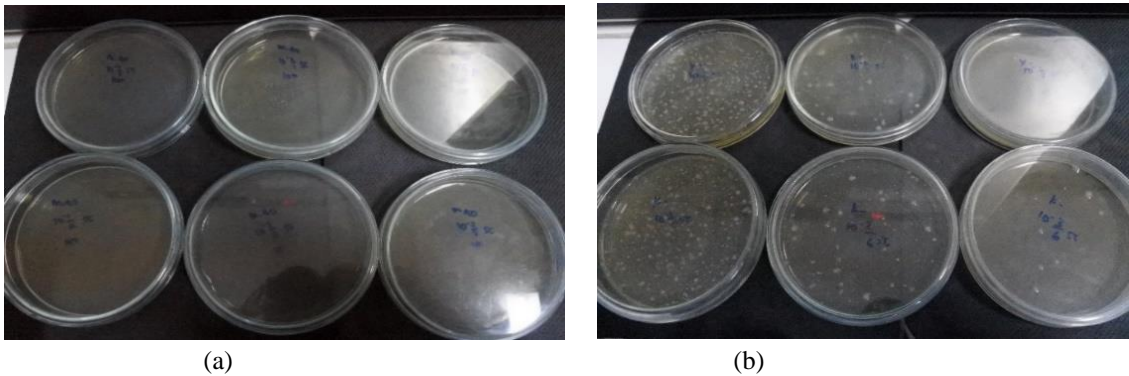


Figure 2. *Candida albicans* on cold-cured acrylic resin after being immersed in (a) bilimbi juice and (b) Aqua®

Table 1. The average of *Candida albicans* colonies and standard deviation

Acrylic resin	Immersion	<i>Candida albicans</i> (CFU/ml)						Average \pm SD
		I	II	III	IV	V	VI	
Heat-cured	Bilimbi juice	29,000	19,000	21,000	19,000	22,000	22,000	22,000.0 \pm 3,687.8
	Aqua®	250,000	270,000	440,000	300,000	400,000	250,000	318,333.3 \pm 81,833.2
Cold-cured	Bilimbi juice	11,000	14,000	16,000	20,000	20,000	14,000	15,833.3 \pm 3,600.9
	Aqua®	520,000	410,000	400,000	320,000	550,000	470,000	445,000.0 \pm 85,029.4

The results were tested for normality using the Shapiro-Wilk test because sample < 30 . The results obtained a significance value of $p > 0.05$, so the data is not normally distributed. The test was then continued with the Mann-Whitney test to find whether a significant difference between all research groups could be observed. The results showed that there was a statistically significant difference ($p < 0.05$) between all study groups (Table 2).

Table 2. Mann-Whitney test result

Comparison of research groups		<i>p value</i>
Heat-cured bilimbi juice	Heat-cured Aqua®	0.004*
Cold-cured bilimbi juice	Cold-cured Aqua®	0.004*
Heat-cured bilimbi juice	Cold-cured bilimbi juice	0.024*
Heat-cured Aqua®	Cold-cured Aqua®	0.03*

* = There were significant differences between all research groups ($p < 0.05$)

DISCUSSION

This study was an experimental laboratory with a post-test only control group design. The aim of this study is to determine the effectiveness of bilimbi juice on the growth of *Candida albicans* on heat-cured and cold-cured acrylic resin denture bases. In this study, Aqua® was used as a control because it is commonly used by people in daily activities and easy to obtain, and some people use Aqua® to immerse their dentures all night. This study used heat-cured and cold-cured acrylic resins because they are still used in dentistry today as denture bases. Heat cured acrylic resin is currently the material of choice because it has good aesthetic quality, is non-toxic, does not irritate tissues, is relatively inexpensive, has no odor or taste, is easy to manufacture, and is easy to clean. The most commonly used acrylic resin is heat-cured, but cold-cured is still widely used for temporary dentures and the repair of broken dentures.

The total size of 24 samples of resin acrylics was divided into four groups, and all samples were immersed for 48 hours.

- Group I: heat-cured acrylic plate immersed in 100% bilimbi juice.
- Group II: cold-cured acrylic plate immersed in 100% bilimbi juice.
- Group III: heat-cured acrylic plates immersed in Aqua®.
- Group IV: cold-cured acrylic plates immersed in Aqua®.

Based on observations, heat-cured and cold-cured acrylic resins immersed in 100% bilimbi juice showed a lower amount of *Candida albicans* colonies, with an average *Candida albicans* colony of 22,000 CFU/ml on heat-cured acrylic resin and 15,833.3 CFU/ml on cold-cured acrylic resin. The statistical results showed that there were significant differences in the amount of *Candida albicans* colonies between heat-cured in bilimbi juice and Aqua® ($p value = 0.004$), cold-cured in bilimbi juice and Aqua® ($p value =$

0.004), heat-cured and cold-cured in bilimbi juice ($p value = 0.024$), and heat-cured and cold-cured in Aqua® ($p value = 0.03$).

A denture is an artificial substitute for missing natural teeth and adjacent tissues. The denture base is the part of a denture that rests on the foundation tissues and to which teeth are attached.¹ The denture base has direct contact with the oral mucosa. Most denture bases are made of acrylic resin, but they also have porosity and surface roughness that increase the potential for the accumulation of microorganisms, especially *Candida albicans*.² Several research studies have suggested that the materials' surface roughness has a significant impact on how well *Candida albicans* adheres to them.¹² The increase in the number of *Candida albicans* colonies occurred due to the closure of the oral mucosa by the denture base, which was accompanied by poor oral hygiene. This increase in colonies triggers denture stomatitis. The most common method of cleaning acrylic resin denture bases is by brushing and immersing them in disinfectant. Most commercial disinfectants are made from chemicals, but nowadays the use of herbal ingredients is widely used by the community, in addition to advances in technology and science regarding chemicals.

One of the plants that has long been used by the community as traditional medicine to treat disease is *Averrhoa bilimbi*, or in Indonesia, it is called belimbing wuluh.¹⁰ Previous studies showed bilimbi have fungistatic or antifungal properties.¹¹ Bilimbi contains a variety of phytochemicals, such as saponins, phenols, tannins, alkaloids, flavonoids, and triterpenoids.^{13,14} The mechanism of action of saponins as antifungals is by reducing the sterol membrane, resulting in increased permeability, then the cells swell and burst causing the cells to die. The death of these cells results in inhibited growth and development of the fungus.¹⁵ Tannins may have an antibacterial impact by destroying membranes and obstructing metabolic pathways, which could cause the microorganism to perish.¹⁶ Flavonoids damage cell

membranes, inhibiting fungal adherence, fungal growth, *Candida albicans* proliferation, changes in yeast to hyphal forms, and biofilm formation.¹⁷

CONCLUSIONS

Based on the results of this research on the amount of *Candida albicans* on heat-cured and cold-cured acrylic resins after immersion in bilimbi juice, it can be concluded that bilimbi juice is effective in decreasing the growth of *Candida albicans* on heat-cured and cold-cured acrylic resins. What can be done in the next research are:

1. Conduct research with a lower immersion time;
2. Reduce the percentage of bilimbi juice;
3. Conduct research with a pre-test post-test control group design.

REFERENCES

1. Ferro, K. J., Morgano, S. M., Driscoll, C. F., Freilich, M. A., Guckes, A. D., Knoernschild, K. L., ... & Twain, M. (2017). The glossary of prosthodontic terms.
2. da Silva, W. J., Gonçalves, L. M., Viu, F. C., Leal, C. M. B., Barbosa, C. M. R., & Cury, A. A. D. B. (2016). Surface roughness influences *Candida albicans* biofilm formation on denture materials. *Revista Odonto Ciência*, 31(2), 54-58.
3. Mawei, G. T., Wowor, V. N., & Mintjelungan, C. N. (2022). Hubungan Tingkat Kebersihan Gigi Tiruan Penuh dengan Kejadian Denture Stomatitis. *e-GiGi*, 11(1), 20-25.
4. Gendreau, L., & Loewy, Z. G. (2011). Epidemiology and etiology of denture stomatitis. *Journal of Prosthodontics: Implant, Esthetic and Reconstructive Dentistry*, 20(4), 251-260.
5. Lee, H. E., Li, C. Y., Chang, H. W., Yang, Y. H., & Wu, J. H. (2011). Effects of different denture cleaning methods to remove *Candida albicans* from acrylic resin denture based material. *Journal of Dental Sciences*, 6(4), 216-220.
6. Golfeshan, F., Mosaddad, S. A., Alamdarloo, Y., Motamedifar, M., & Dehno, F. H. (2023). Effect of incorporating *Punica granatum* extract in acrylic resins on *Streptococcus mutans* and *Candida albicans*: a preliminary study. *Journal of Herbal Medicine*, 42, 100770.
7. Kristiana, D., Hidayati, L., & Nabil, H. R. (2022). The Effectiveness of Edamame (*Glycine Max* (L.) Merrill) Extract as Acrylic Resin Denture Cleanser on the Number of *Candida Albicans*.
8. Arismunandar, R. N., Nosartika, I., Purnomo, B. N. R., & Antari, A. L. (2021). The Effectivity of Parsley (*Petroselinum crispum*) Extract on The Growth Inhibition of *Candida Albicans*. *Journal of Biomedicine and Translational Research*, 7(3), 123-128.
9. Syaula, Y., Antari, A. L., & Purbaningrum, D. A. (2021). Pengaruh Perendaman Ekstrak Bunga Sepatu (*Hibiscus rosa sinensis* L.) terhadap Pertumbuhan *Candida albicans* pada Plat Resin Akrilik. *e-GiGi*, 9(2), 159-166.
10. Setyawan, H. Y., Sukardi, S., & Nareswari, B. F. (2021, April). The phytochemical potential of *Averrhoa bilimbi*—A review. In *IOP Conference Series: Earth and Environmental Science* (Vol. 733, No. 1, p. 012091). IOP Publishing.
11. Octaviani, M., & Fadila, F. (2018). Uji aktivitas antijamur sari buah belimbing wuluh (*Averrhoa bilimbi* L.) terhadap jamur *candida albicans*. *Jurnal Katalisator*, 3(2), 125-133.
12. da Silva, W. J., Leal, C. M. B., Viu, F. C., Gonçalves, L. M., Barbosa, C. M. R., & Del Bel Cury, A. A. (2015). Influence of surface free energy of denture base and liner materials on *Candida albicans* biofilms. *Journal of Investigative and Clinical Dentistry*, 6(2), 141-146.
13. Nair, M. S., Soren, K., Singh, V., & Boro, B. (2016). Anticancer activity of fruit and leaf extracts of *Averrhoa bilimbi* on mcf-7 human breast cancer cell lines: a preliminary study. *Austin J Pharmacol Ther*, 4(2), 1082.
14. Setyawan, H. Y., Sukardi, S., & Nareswari, B. F. (2021, April). The phytochemical potential of *Averrhoa bilimbi*—A review. In *IOP Conference Series: Earth and Environmental Science* (Vol. 733, No. 1, p. 012091). IOP Publishing.
15. Yulia, R., Chattri, M., Advinda, L., & Handayani, D. (2023). Saponins Compounds as Antifungal Against Plant Pathogens. *Jurnal Serambi Biologi*, 8(2), 162-169.
16. Gizaw, A., Marami, L. M., Teshome, I., Sarba, E. J., Admasu, P., Babele, D. A., ... & Abdisa, K. (2022). Phytochemical screening and in vitro antifungal activity of selected medicinal plants against *candida albicans* and *aspergillus niger* in west shewa zone, Ethiopia. *Advances in Pharmacological and Pharmaceutical Sciences*, 2022(1), 3299146.
17. Putri, H. F. W., Khusmitha, Q. N., Mahardhika, G. P. C., Hidayati, D. Y. N., Raras, T. Y. M., & Norahmawati, E. (2022). Comparison of Phytochemical Content and Antifungal Activity of Bajakah Tampala Stem (*Spatholobus littoralis* Hassk.) Methanol and Ethanol Extracts Against *Candida Albicans*. *Asian Journal of Health Research*, 1(2), 19-24.