

# Journal of Dentistry Indonesia

The Official Publication of  
The Faculty of Dentistry, Universitas Indonesia  
in Collaboration with  
Indonesian Dental Association

## Contents of Vol. 28, No.2, December 2021

### Journal of Dentistry Indonesia

Original Article	Pages
doi: 10.14693/jdi.v28i2.1242 Comparison of Surface Roughness and Microhardness of Reinforced Glass Infiltrated Ceramics and Microhybrid Composite <i>Sula Nur Karolina, Ilseer Tazzer, Citra Khidra</i>	131-139
doi: 10.14693/jdi.v28i2.1260 Gender Differences in Academic Productivity within Pediatric Dentistry Departments in Turkey <i>Besim Ayhan Elci, Mihem Karahan</i>	139-143
doi: 10.14693/jdi.v28i2.1266 Association among InCRP Levels, Bone Mineral Density, and Periodontal Parameters in Postmenopausal Women <i>Azhar Rakhinda, Ropinder K. Sharma, Shikha Trewari, Anam Arora</i>	146-152
doi: 10.14693/jdi.v28i2.1267 Antibacterial and Antifungal Efficacy of Pineapple Husk ( <i>Ananas comosus</i> ) on <i>Porphyromonas gingivalis</i> <i>in vitro</i> <i>Alif Gani Saadiah, Billy Lombardo, Amelia Sari Wahyuman</i>	153-157
doi: 10.14693/jdi.v28i2.1270 The Relationship of Facial Measurements with the Mesiodistal Width of the Maxillary Anterior Teeth <i>Nur Shamsy Adh Aziz, Nidha Che Mohd, Tyra Haryani Baharudin, Anwarita Ropah, Teng Wah Lim, Su Keng Tan, Rabana Ahmad</i>	158-162
doi: 10.14693/jdi.v28i2.1276 The Effect of Probiotic Restasis on the Expression of Genes Involved in Candidate Bifidus Bifidus Formation: An <i>In vivo</i> Study <i>Amalia Nur Hafid, Amalia Sari Wahyuman</i>	163-170
doi: 10.14693/jdi.v28i2.1292 Body Posture Evaluation of Dental Specialty Groups and Risk of Developing Musculoskeletal Disorders <i>Fatmeh Zaharingsyahudin, Nurul Hekmahiningsih, Niver Hidayati Nuzul</i>	171-176
doi: 10.14693/jdi.v28i2.1299 Financial Implication of COVID-19: A Story of Malaysian Dental Practitioner <i>Nur Fakhria A Hamid, Azlan Jusuf, Nurul Hani NM Mahmud, Ratu Nur Nabilah Masah</i>	177-184
doi: 10.14693/jdi.v28i2.1298 Effects of Different Finishing Procedures on Surface Roughness of Hybrid CAD/CAM Materials <i>Ender Alan, Ozkan Cakirhan, Devrim Z. Mays, Ayse Begül</i>	185-191
<b>Case Report</b>	
doi: 10.14693/jdi.v28i2.1287 Management of Severe Dento-Alveolar Traumatic Injuries in a 9-Year old Boy: A Case Report <i>Elvir Muzic, Muzammil Khoshdel, Huseinbegovic Sherifovic</i>	192-197
doi: 10.14693/jdi.v28i2.1304 Replacement of Two Failed Inlay-on Restorations with Direct-Bonded Restorations Using a Minimally Invasive Strategy <i>Citra Kusumawati, Zahedi Haryono, Yuzuki Shiwada</i>	198-204

## **Editorial Board**

### **EDITOR IN CHIEF**

[Yuniardini Septorini Wimardhani](#), (SCOPUS ID=56784363100) Department of Oral Medicine, Faculty of Dentistry, Universitas Indonesia, Indonesia, Indonesia

### **CO-EDITOR IN CHIEF**

[Lisa Rinanda Amir](#), (SCOPUS ID = 14048047100) Department of Oral Biology, Faculty of Dentistry Universitas Indonesia, Indonesia

### **EDITORIAL BOARD**

[Anne-Marie Kuijpers-Jagtman](#), (SCOPUS ID = 35237602100) Department of Orthodontics, University Medical Center Groningen, The Netherlands

[Adrian Yap](#), (SCOPUS ID = 7103215953) National University of Singapore, Singapore

[Professor Anak Iamaroon](#), (SCOPUS ID = 6701786341) Faculty of Dentistry, Chiang Mai University, Thailand, Thailand

[Benny Mulyono Soegiharto](#), (SCOPUS ID = 24478917200) Department of Orthodontics, Faculty of Dentistry, Universitas Indonesia, Indonesia

[Budi Kusnoto](#), (SCOPUS ID = 6603330742) Department of Orthodontics, College of Dentistry, University of Illinois at Chicago, United States

[BSM Samadarani Siriwardena](#), (SCOPUS ID = 16246416800) Department of Oral Pathology, Faculty of Dental Sciences, University of Peradeniya, Sri Lanka

[Chun Hung Chu](#), (SCOPUS ID= 7404345729) The University of Hong Kong, Hong Kong

[Clive Wright](#), (SCOPUS ID = 55453620500) University of Sydney, Australia

[Cortino Sukotjo](#), (SCOPUS ID = 6508194317) Department of Restorative Dentistry, College of Dentistry, University of Illinois at Chicago, United States

[Diah Ayu Maharani](#), (SCOPUS ID = 32867911000) Department of Preventive and Public Health Dentistry Faculty of Dentistry Universitas Indonesia, Indonesia

[Diana Cassi](#), (SCOPUS ID = 56062239400) Department of Orthodontics University of Modena and Reggio Emilia, Italy

[Erik Idrus](#), (SCOPUS ID = 51763635000) Faculty of Dentistry Universitas Indonesia, Indonesia

[Hamid Nurrohman](#), Hamid Nurrohman, (SCOPUS ID = 52564067000) A.T. Still University-Missouri School of Dentistry & Oral Health, United States

[Izzet Yavuz](#), (SCOPUS ID = 35967243400) Faculty of Dentistry, University of Dicle, Turkey, Turkey

[Kobkan Thongprasom](#), (SCOPUS ID = 6601959811) Department of Oral Medicine, Faculty of Dentistry, Chulalongkorn University, Thailand, Thailand

[Koichi Kawabuchi](#), (SCOPUS ID = 7003523337) Tokyo Medical and Dental University, Japan

[Marco Meleti](#), (SCOPUS ID = 55926088200) Dental School at the University of Parma, Italy

[Masita Mandasari](#), (SCOPUS ID= 57008957900) Department of Oral Medicine, Faculty of Dentistry, Universitas Indonesia

[Nieka Adhara Wahono](#), (SCOPUS ID= 57204112724) Department of Pediatric Dentistry, Faculty of Dentistry, Universitas Indonesia

[Nina Ariani](#), (SCOPUS ID = 55301181500) Department of Prosthodontics, Faculty of Dentistry, Universitas Indonesia

[Pham Anh Vu Thuy](#), (SCOPUS ID = 51562199400) University of Medicine and Pharmacy, Viet Nam

[Bramma Kiswanjaya](#), (SCOPUS ID = 26664624100) Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Universitas Indonesia

# Current Issue: Volume 28, Number 3 (2021) December Articles

---

PDF

Comparison of Surface Roughness and Microhardness of Reinforced Glass Ionomer Cements and Microhybrid Composite

*Seda Nur Karakaş, Hacer Turgut, and Cihan Küden*

<https://doi.org/10.14693/jdi.v28i3.1232>

PDF

Gender Differences in Academic Productivity within Pediatric Dentistry Departments in Turkey

*Basak Kiziltan Eliacik and Meltem Karahan*

<https://doi.org/10.14693/jdi.v28i3.1260>

PDF

Association among hsCRP Levels, Bone Mineral Density, and Periodontal Parameters in Postmenopausal Women

*Aastha Baldodia, Rajinder kumar Sharma, Shikha Tewari, and Aman Arora*

<https://doi.org/10.14693/jdi.v28i3.1266>

PDF

Antibacterial and Antibiofilm Efficacy of Pineapple Hump (*Ananas comosus*) on *Porphyromonas gingivalis* in vitro

*Abdul Gani Soulissa, Billy Lombardo, and Armelia Sari Widyarman*

<https://doi.org/10.14693/jdi.v28i3.1267>

PDF

The Relationship of Facial Measurements with the Mesiodistal Width of the Maxillary Anterior Teeth

*Nur Ilyana Aifa Aziz, Nadia Che Mohd, Izyan Hazwani Baharuddin, Aiemeeza Rajali, Tong Wah Lim, Su Keng Tan, and Rohana Ahmad*

<https://doi.org/10.14693/jdi.v28i3.1270>

PDF

The Effect of Parabiotic Reuterin on the Expression of Genes Involved in *Candida albicans* Biofilm Formation: An Ex vivo Study

*Anastasya Muna Riad and Armelia Sari Widyarman*

<https://doi.org/10.14693/jdi.v28i3.1276>

PDF

Body Posture Evaluation of Dental Specialty Groups and Risk of Developing Musculoskeletal Disorders

*Fatemeh Jahanimoghadam, Naimeh Hasheminejad, and Naser Hashemi-Nejad*

<https://doi.org/10.14693/jdi.v28i3.1292>

PDF

Financial Implication of COVID-19: A Story of Malaysian Dental Practitioner

*Nor Faharina Abdul Hamid, Azlan Jaafar, Nurul Haini Najwa Mohamd Mahmud, and Raja Nur Nabiha Raja Amir Hamzah*

<https://doi.org/10.14693/jdi.v28i3.1293>

PDF

Effects of Different Finishing Procedures on Surface Roughness of Hybrid CAD/CAM Materials

*Ender Akan, Ozlem Colgecen, Ibrahim Talha Meşe, and Bora Bağış*

<https://doi.org/10.14693/jdi.v28i3.1298>

## Case Reports

---

PDF

Management of Severe Dento-Alveolar Traumatic Injuries in a 9-Year old Boy: A Case Report

*Elnaz Mousavi, Masoomeh Khoshdel, and Hamidreza Sharifiyan*

<https://doi.org/10.14693/jdi.v28i3.1257>

PDF

Replacement of Two Failed Indirect Restorations with Direct Bonded Restorations Using Minimally Invasive Strategy

*Citra Kusumasari, Takashi Hatayama, and Yasushi Shimada*

<https://doi.org/10.14693/jdi.v28i3.1304>

12-31-2021

## Antibacterial and Antibiofilm Efficacy of Pineapple Hump (*Ananas comosus*) on *Porphyromonas gingivalis* in vitro

Abdul Gani Soulissa

*Department of Periodontic, Faculty of Dentistry Trisakti University, Jakarta, Indonesia,*  
abdulsoulisa@yahoo.co.id

Billy Lombardo

*Undergraduate Program, Faculty of Dentistry Trisakti University, Jakarta, Indonesia,*  
billylombardo.bl@gmail.com

Armelia Sari Widyarman

*Department of Microbiology, Faculty of Dentistry Trisakti University, Jakarta, Indonesia,*  
armeliasari@trisakti.ac.id

Follow this and additional works at: <https://scholarhub.ui.ac.id/jdi>



Part of the [Dental Hygiene Commons](#), [Dental Materials Commons](#), [Endodontics and Endodontology Commons](#), [Health Economics Commons](#), [Oral and Maxillofacial Surgery Commons](#), [Oral Biology and Oral Pathology Commons](#), [Orthodontics and Orthodontology Commons](#), [Pediatric Dentistry and Pedodontics Commons](#), and the [Periodontics and Periodontology Commons](#)

---

### Recommended Citation

Soulissa, A. G., Lombardo, B., & Widyarman, A. Antibacterial and Antibiofilm Efficacy of Pineapple Hump (*Ananas comosus*) on *Porphyromonas gingivalis* in vitro. *J Dent Indones.* 2021;28(3): 153-157

This Article is brought to you for free and open access by the Faculty of Dentistry at UI Scholars Hub. It has been accepted for inclusion in *Journal of Dentistry Indonesia* by an authorized editor of UI Scholars Hub.

---

## Antibacterial and Antibiofilm Efficacy of Pineapple Hump (*Ananas comosus*) on *Porphyromonas gingivalis* in vitro

### Cover Page Footnote

The authors would like to thank Faculty of Dentistry, Trisakti University for their invaluable support for this research. Authors would like to thank MiCORE laboratory at Trisakti University for their support for this study.

## ORIGINAL ARTICLE

# Antibacterial and Antibiofilm Efficacy of Pineapple Hump (*Ananas comosus*) on *Porphyromonas gingivalis* in vitro

Abdul Gani Souliissa<sup>1</sup>, Billy Lombardo<sup>2</sup>, Armelia Sari Widyarman<sup>3</sup>

<sup>1</sup>Department of Periodontic, Faculty of Dentistry Trisakti University, Jakarta, Indonesia

<sup>2</sup>Undergraduate Program, Faculty of Dentistry Trisakti University, Jakarta, Indonesia

<sup>3</sup>Department of Microbiology, Faculty of Dentistry Trisakti University, Jakarta, Indonesia

Correspondence e-mail to: armeliasari@trisakti.ac.id

## ABSTRACT

**Background:** Periodontal disease is one of the most prevalent oral health problems in Indonesia that affects supporting tissues of the teeth. *Porphyromonas gingivalis* plays an important role in the pathogenesis of periodontal disease. Alternative therapy with natural plant extracts, including pineapple (*Ananas comosus*) hump extract may inhibit the growth of bacteria that cause periodontal disease. **Objective:** To determine the effect of pineapple hump extract on bacterial growth and adhesion of *Porphyromonas gingivalis* biofilms. **Method:** The bacterial inhibition test was performed by the agar well diffusion method, and biofilm density measurements were made using the biofilm assay method. **Results:** Pineapple hump extract can inhibit bacterial growth optimally at a concentration of 100%, with an average zone of inhibition of 7.3 mm. The extract at a 50% concentration can eradicate the biofilms in a 6 h incubation time with an average OD of 0.124. The Shapiro-Wilk method confirmed a normal distribution of the data. Both one-way ANOVA and post hoc test showed a significant difference between the inhibitory ability of pineapple hump extract and between concentrations to restrict formation of *Porphyromonas gingivalis* biofilms. **Conclusion:** Pineapple hump extract was able to inhibit bacterial growth and eradicate the adhesion of *Porphyromonas gingivalis* biofilms in vitro.

**Key words:** periodontal disease, pineapple hump extract, *Porphyromonas gingivalis*

How to cite this article: Souliissa AG, Lombardo B, Widyarman AS. Antibacterial and antibiofilm efficacy of pineapple hump (*Ananas comosus*) on *Porphyromonas gingivalis* in vitro. J Dent Indones. 2021;28(3):153-157

## INTRODUCTION

Periodontal disease is a common disorder of the human oral cavity. As the population increases, periodontal disease has become a significant health problem in the health sector.<sup>1,2</sup> Periodontal disease is an inflammatory disease of the oral cavity caused by microorganisms in the supporting tissues of the teeth.<sup>2</sup> Uncontrolled accumulation of plaque and bacteria is the main etiology of periodontal disease.<sup>3,4</sup> The prevalence of periodontitis in Indonesia is high; data obtained from the 2018 National Basic Health Research indicate a percentage of periodontitis cases in Indonesia of 74.1%.<sup>5</sup>

*Porphyromonas gingivalis* (*P. gingivalis*) is a bacterial species that plays an important role in the pathogenesis of periodontal disease.<sup>6</sup> These bacteria are classified as Gram-negative anaerobic bacteria and are found mostly in subgingival plaque, where they cause chronic periodontitis.<sup>7</sup> Plaque control is important

in periodontal treatment, and can be performed by gargling with chlorhexidine solution, which has antimicrobial properties that can inhibit the growth of bacteria that cause periodontal disease.<sup>8</sup> However, long-term use of chlorhexidine will cause discoloration of the teeth and the formation of supragingival calculus, while also leaving a bitter taste.<sup>9</sup>

The side effects of chemical-based mouthwashes can be reduced by natural ingredients that are beneficial in the health sector. Medicinal plants have been widely used in the management of infectious and it has been proof against oral pathogens.<sup>10-12</sup> One of these is the hump of pineapple. This fruit contains the enzyme bromelain which an enzyme that has been shown to reduce and break the glutamine-alanine and arginine-alanine bonds.<sup>13,14</sup> Almost all parts of the pineapple (*Ananas comosus*) can be beneficial for health including the flesh, skin, and stems. The bromelain enzyme



contained in pineapple hump has many benefits as anti-inflammatory, anticancer, antimicrobial, and reduces the severity of angina pectoris.<sup>15</sup> The mechanism of antimicrobial action on the bromelain enzyme is by destroying the structure of the bacterial wall. According to previous research, the concentration of bromelain contained in pineapple hump is higher than pineapple flesh.<sup>16</sup> The skin and hump of pineapple commonly regarded as wastes, in fact there is an enzyme bromelain which has an inhibitory effect on the growth of periodontal bacteria.<sup>17,18</sup> Some studies have been tested the antibacterial activity of the pineapple hump extract against oral pathogen bacteria and found that pineapple hump extract had antibacterial effects against *P. gingivalis* and *Enterococcus faecalis*.<sup>19,20</sup>

No research has yet investigated the effectiveness of pineapple hump extract on the adherence of *P. gingivalis* biofilms. Therefore, the aim of this study was to determine the effectiveness of pineapple hump extract on bacterial growth and adhesion of *P. gingivalis* biofilms.

## METHODS

This research was an *in vitro* laboratory experimental study with a post-test-only control design, conducted at the Laboratory of Microbiology Center of Research and Education (MiCORE), Faculty of Dentistry, Trisakti University. An extract of pineapple hump from Balai Penelitian Tanaman Rempah dan Obat (Balitro) plantation was prepared by a maceration method using 96% ethanol as a solvent and was then diluted with distilled water to obtain concentrations of 100%, 50%, 25%, 12.5%, 6.25%, and 3.125%. Firstly, the pineapple hump is separated from the flesh. Secondly, it is dried under the sun and then put into a grinder until it becomes powder. Thirdly, the pineapple hump powder was extracted by maceration using a 96% ethanol solution in a ratio of 1:5 for 24 hours. Then, the resulting solution is filtered with a filter paper and then evaporated with a rotary evaporator which aims to obtain a thick extract and free from solvents. Finally, this thick extract was diluted with distilled water to obtain concentrations of 100%, 50%, 25%, 12.5%, 6.25%, and 3.125%. The well diffusion method was used, so the inhibition zone formed could be measured using a caliper. The biofilm assay method was used to measure the density of biofilm by crystal violet staining and measurement with a microplate reader at a wave length of 490 nm.

### Phytochemical test on pineapple hump extract

#### Flavonoid test

A small amount of Mg powder and concentrated hydrochloric acid were added to a 2 mL sample. An orange or pink to red color indicated the presence of flavonoid compounds.

#### Phenol test

A few drops of hot water and 1–2 drops of 1% FeCl<sub>3</sub> were added to a 2 mL sample. A blue or purple color indicated the presence of phenolic compounds.

#### Saponin test

A 10 mL volume of distilled water was added to a 2 mL sample and shaken. Formation of a foam that lasted for 5 min indicated the presence of saponin compounds.

#### Terpenoid test

Liebermann-Burchard reagent was added to a 2 mL sample. A green to blue color indicated the presence of terpenoid compounds.

#### Alkaloid test

A 5 mL volume of chloroform and ammonia solution was added to a 2 mL sample and heated, shaken, and then filtered. A 1 mL volume of 2N HCl was added, shaken for 2 min, and left until two layers separated. The acid (top) layer was taken and 1–2 drops of Dragendorff reagent were added. A red color indicated the presence of alkaloids.

#### Tannin test

A 2 mL sample was combined with 1% FeCl<sub>3</sub>. A blackish green or dark blue color indicated the presence of tannin compounds.

### *Porphyromonas gingivalis* cultures

*Porphyromonas gingivalis* samples were obtained from MiCORE, Faculty of Dentistry, Trisakti University with ATCC 33277 strain. The bacteria were cultured on nutrient broth medium and then incubated for 24 h at 37°C in an anaerobic jar using the Gaspack jar system to maintain anaerobic conditions.

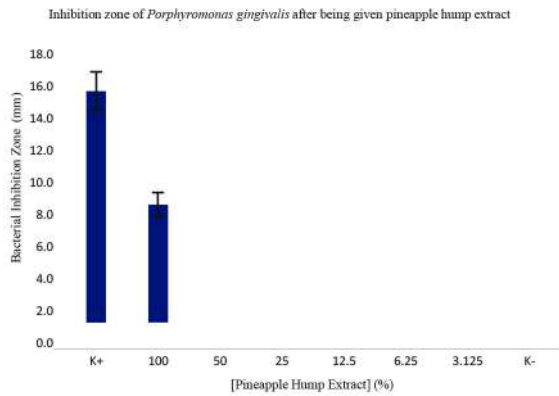
#### Inhibition test

A 20 µL sample of bacterial culture was spread on BHI until evenly distributed in each of 12 petri dishes. Five wells were made in BHI agar. Three wells contained different concentrations of pineapple hump extract, one well served as a positive control (chlorhexidine), one well served as a negative control (sterilised water), and each pineapple hump extract at a concentration of 100%, 50%, 25%, 12.5%, 6.25%, and 3.12%. The wells were filled with 20 µL of test solution using a sterile micropipette, and all concentrations were tested in triplicate.

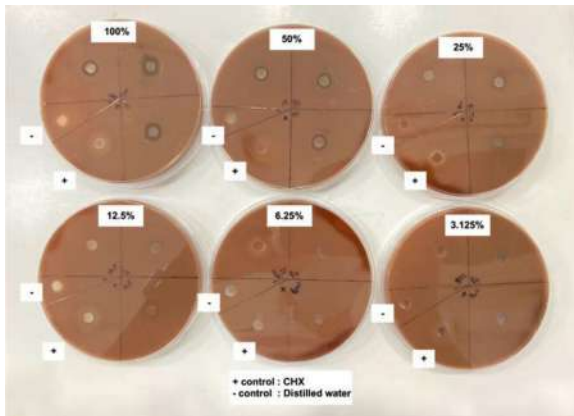
The samples were incubated at 37°C and observed for 24h. The diameter of the inhibition zone around the wells was measured using a caliper.

#### Biofilm assay

This study used 0.2% chlorhexidine as a positive control and sterilised water as a negative control. A 200 µL sample of bacterial culture was added to a 96-well plate and incubated at 37°C for 48 h under anaerobic conditions. The medium from the culture was then discarded, leaving the remaining biofilm layer adhered



**Figure 1.** Inhibition zone of pineapple hump extract against *Porphyromonas gingivalis*

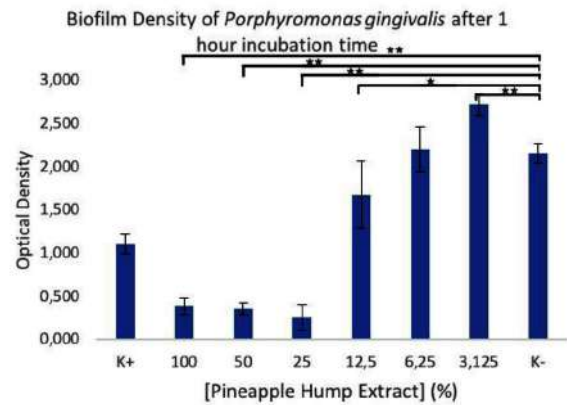


**Figure 2.** Minimum Inhibitory Concentration of Pineapple Hump for *P.gingivalis* in different concentration 100%, 50%, 25%, 12.5%, 6.25%, and 3.125%. Distilled water were used as the negative control and chlorhexidine (0.2%) was used as the positive control. All treatment were done in triplicate

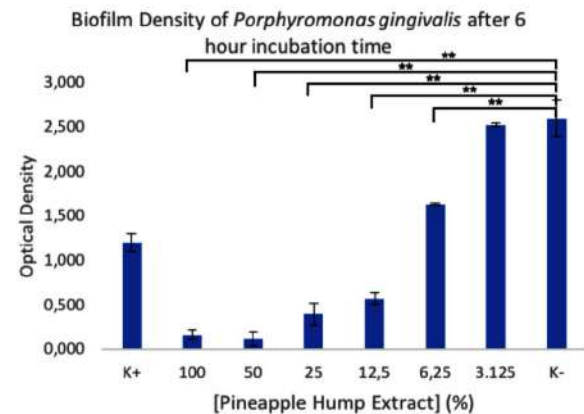
to the bottom surface of the well plate. The well plate was rinsed with phosphate buffered saline (PBS). Pineapple hump extract (up to 200  $\mu$ L) was added at several concentrations (100%, 50%, 25%, 12.5%, 6.25%, and 3.12%), and the well plates were incubated under anaerobic conditions at 37°C and observed for 1, 6, and 24 h. The extract was then discarded and the well plate was rinsed with phosphate buffer saline (PBS), then heat-fixed. The biofilms were stained for 15 min with crystal violet (0.05% w/v) and then rinsed with PBS. A 200  $\mu$ L volume of 96% ethanol was added, and the stained biofilm in the well plate was measured with a microplate reader at a wavelength of 490 nm.

### Statistical analysis

All data collected were analyzed using the Shapiro-Wilk normality test, followed by a one-way analysis of variance (ANOVA) and post hoc least significant difference (LSD). A normality test confirmed a normal distribution of the results ( $p > 0.05$ ). The one-way ANOVA showed a significant difference ( $p < 0.05$ ).



**Figure 3.** Density of *Porphyromonas gingivalis* biofilm treated with pineapple hump extract at several concentrations for 1 h. \* $p < 0.05$ , \*\* $p < 0.01$



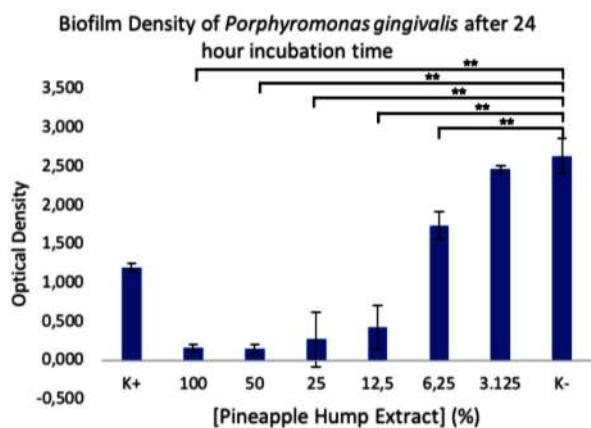
**Figure 4.** Density of *Porphyromonas gingivalis* biofilm treated with pineapple hump extract at several concentrations for 6 h. \* $p < 0.05$ , \*\* $p < 0.01$

The post hoc LSD test, performed to determine the significant differences between the results of the study, confirmed a significant difference ( $p < 0.05$ ).

## RESULTS

The phytochemical test results revealed that the pineapple hump extract contained alkaloids, saponins, and flavonoids. The inhibition zone measurements for *Porphyromonas gingivalis* bacteria revealed that a clear zone began to form at an extract concentration of 50%. By contrast, concentrations of 25%, 12.5%, 6.25%, 3.125%, and the negative control showed no inhibition zones. (Figure 1)

The biofilm assay on *Porphyromonas gingivalis* bacteria after a 1 h incubation showed that the pineapple hump extract significantly reduced the amount of *Porphyromonas gingivalis* biofilm at all concentrations and all incubation times ( $p < 0.05$ ). (Figure 3,4,5). The most effective concentration was 25% with a 1 h incubation time.



**Figure 5.** Density of *Porphyromonas gingivalis* biofilm treated with pineapple hump extract at several concentrations for 24 h. \* $p < 0.05$ , \*\* $p < 0.01$

## DISCUSSION

Pineapple hump was confirmed to contain alkaloids, flavonoids, and saponins. Alkaloids act as antibacterial agents, as they can interfere with the formation of peptidoglycan in bacterial cells. This prevents the complete formation of the bacterial cell wall layer, resulting in cell death. Flavonoids are polar phenolic compounds that can penetrate into the bacterial peptidoglycan layer, break down the bacterial cell proteins, and damage the cytoplasmic membrane. This causes an efflux of amino acids and nucleotides and leads to cell death.<sup>20</sup> Saponins in pineapple hump can damage the cytoplasmic membrane of bacteria and reduce cell membrane permeability, causing disruption of nutrient uptake into the bacterial cells and resulting in cell death.<sup>21</sup>

The results of the inhibition zone test indicated that pineapple hump extract was more effective than chlorhexidine (the positive control) at inhibiting bacterial growth. Pineapple hump extract also had the potential to inhibit the growth of *P. gingivalis* biofilms. The *P. gingivalis* biofilm tests showed that pineapple hump extract was more effective than chlorhexidine at eradicating biofilms. The results of this study are supported by the results of previous research conducted by Chatty (2019), who used an agar well diffusion method to test the inhibition of *P. gingivalis* by pineapple hump extract. The hump extract showed an antibacterial activity against *P. gingivalis* bacteria starting at a concentration of 50%, with an average inhibition zone diameter of 9.85 mm.<sup>20</sup> Another study by Udin *et al.* (2018) tested the antibacterial effect of pineapple hump extract on *Staphylococcus aureus* and found that pineapple hump extract was effective at inhibiting and killing *S. aureus* bacteria, optimally at a concentration of 70%.<sup>22</sup> Mukti *et al.* (2018) tested the antibacterial effect of pineapple hump extract on *Streptococcus mutans* and found a very

strong inhibitory effect at a concentration of 100%.<sup>21</sup> Liliyani, *et al.* (2018) tested the antibacterial effect of the bromelain enzyme from pineapple hump extract against *Enterococcus faecalis* and found that it was effective at inhibiting the growth of *E. faecalis* bacteria at a concentration of 12.5%.<sup>19</sup>

According to Rahmat *et al.* (2016), the concentration of bromelain contained in pineapple hump is higher than pineapple flesh.<sup>16</sup> The bromelain enzyme can destroy the structure of the bacterial wall as the mechanism of its antimicrobial action. This enzyme breaks the protein that builds the bacterial cell wall, thus the bacterial wall becomes weak and the cell will be damaged. The bromelain enzyme is present in all pineapple tissues. About half of the protein in pineapple contains the protease bromelain.<sup>24,25</sup>

## CONCLUSION

The results of the present study confirm that the extract of pineapple hump is able to inhibit bacterial growth and eradicate the adhesion of *Porphyromonas gingivalis* biofilms. Further research is still needed to confirm the effectiveness of pineapple hump extract against other pathogenic bacteria. Toxicity tests are also needed to determine any side effects of pineapple hump extract in the oral cavity.

## ACKNOWLEDGMENT

The authors would like to thank Faculty of Dentistry, Trisakti University for their invaluable support for this research. Authors would like to thank MiCORE laboratory at Trisakti University for their support for this study.

## CONFLICT OF INTEREST

Authors declared that there is no conflict of interest related to this study.

## REFERENCES

1. Tonetti MS, Jepsen S, Jin L, Otomo-Corgel J. Impact of the global burden of periodontal diseases on health, nutrition and wellbeing of mankind: A call for global action. *JvClin Periodontol.* 2017;44(5):456–62.
2. Bui FQ, Almeida-da-Silva CLC, Huynh B, Trinh A, Liu J, Woodward J, *et al.* Association between periodontal pathogens and systemic disease. *Biomed J.* 2019;42(1):27–35.
3. Goh EXJ, Ong MMA. Anatomical, microbiological, and genetic considerations in treatment of Chinese

- periodontal patients. *J Investig Clin Dent*. 2019;10(1):e12381.
4. Davis IJ, Jones AW, Creese AJ, Staunton R, Atwal J, Chapple ILC, et al. Longitudinal quantification of the gingival crevicular fluid proteome during progression from gingivitis to periodontitis in a canine model. *J Clin Periodontol*. 2016;3(7):584–94.
  5. Kementerian Kesehatan Republik Indonesia. Laporan nasional riset kesehatan dasar (RISKESDAS) tahun 2018. Kementerian Kesehatan Republik Indonesia, Jakarta; 2018.
  6. Chukkapalli SS, Rivera MF, Velsko IM, Lee JY, Chen H, Zheng D, et al. Invasion of oral and aortic tissues by oral spirochete *Treponema denticola* in ApoE<sup>-/-</sup> mice causally links periodontal disease and atherosclerosis. *Infect Immun*. 2014;82(5):1959–1967.
  7. How KY, Song KP, Chan KG. *Porphyromonas gingivalis*: An overview of periodontopathic pathogen below the gum line. *Front Microbiol*. 2016;7:53.
  8. Balagopal S, Arjunker R. Chlorhexidine: the gold standard antiplaque agent. *J Pharm Sci*. 2013;5(12):270-74.
  9. Strydonck DACV, Slot DE, Velden UV der, Weijden FV der. Effect of a chlorhexidine mouthrinse on plaque, gingival inflammation and staining in gingivitis patients: A systematic review. *J Clin Periodontol*. 2012;39(11):1042–55.
  10. Widyarman AS, Widjaja SB, Idrus E. Strawberry extract's effects on *Enterococcus faecalis* and *Porphyromonas gingivalis* biofilms *in vitro*. *Sci Dent J*. 2017;1(1):1-5.
  11. Widyarman AS, Suhalmi OP, Nandary D, Theodora CF. Pomegranate juice inhibits periodontal pathogens biofilm *in vitro*. *Sci Dent J*. 2018;2(3):101-8.
  12. Radita DC, Widyarman AS. Mahkota dewa (God's crown) fruit extract inhibits the formation of periodontal pathogen biofilms *in vitro*. *J Indones Dent Assoc*. 2019;2(2):57-62.
  13. Lobo MG, Yahia E. Biology and postharvest physiology of pineapple. In: Lobo MG, Paull RE, editors. *Handbook of Pineapple Technology* [Internet]. Chichester, UK: John Wiley & Sons, Ltd; 2016 [cited 2020 May 30]. p. 39–61. Available from: <http://doi.wiley.com/10.1002/9781118967355.ch3>
  14. Praveen NC, Rajesh A, Madan M, Chaurasia VR, Hiremath NV, Sharma AM. In vitro Evaluation of Antibacterial Efficacy of Pineapple Extract (Bromelain) on Periodontal Pathogens. *J Int Oral Health*. 2014;6(5):96–8.
  15. Rathnavelu V, Alitheen NB, Sohila S, Kanagesan S, Ramesh R. Potential role of bromelain in clinical and therapeutic applications. *Biomed Rep*. 2016;5(3):283–8.
  16. Rahmat D, Ratih LD, Nurhidayati L, Bathini MA. Peningkatan aktivitas antimikroba ekstrak nanas (*Ananas comosus* (L.) Merr) dengan pembentukan nanopartikel. *Jurnal Sains dan Kesehatan*. 2016. 1(5): 236–44.
  17. Tonetti MS, Dyke TEV. Periodontitis and atherosclerotic cardiovascular disease: Consensus report of the Joint EFP/AAP workshop on periodontitis and systemic diseases. *J Clin Periodontol*. 2013;40(s14): S24–9.
  18. Aravind KV, Gokulakrishnan M. Extraction, purification of bromelain from pineapple and determination of its effect on bacteria causing periodontitis. *Int J Phar Sci Res*. 2015;6(12):5284-94.
  19. Lilianny D, Widyarman AS, Erfan E, Sudiono J, Djamil MS. Enzymatic activity of bromelain isolated pineapple (*Ananas comosus*) hump and its antibacterial effect on *Enterococcus faecalis*. *Sci Dent J*. 2018.;2(2):39–50.
  20. Gultom CH. Perbedaan efektifitas antibakteri kulit dan bonggol buah nanas (*Ananas comosus*) terhadap *Porphyromonas gingivalis* [skripsi]. Jakarta: Universitas Trisakti; 2019.
  21. Mukti A, Mardianingrum R, & Mardiana U. Aktivitas daya hambat ekstrak etanol bonggol nanas (*Ananas comosus* L.) terhadap bakteri *Streptococcus mutans*. *Pharmacoscript*. 2018. 1(1): 9.
  22. Udin U, Sari RY, & Anto S. Efektivitas daya hambat ekstrak etanol 96% bonggol nanas (*Ananas comosus* L.) terhadap pertumbuhan bakteri *Staphylococcus aureus*. *Journal of Pharmacy and Science*. 2018. 3(2): 32–36.
  23. Bala M, Ismail NA, Mel M, Jami MS, Salleh HM, Amid A. Bromelain Production: Current Trends and Perspective. In 2012.
  24. Purwaningsih, I. Potensi Enzim Bromelain Ekstrak Nanas (*Ananas comosus* l.) Dalam Meningkatkan Kadar Protein Pada Tahu. *Jurnal Teknologi Laboratorium*, 2017 6(1), 39-46.
  25. Ujjiani S, Marhamah M. Efektivitas Ekstrak Nanas (*Ananas comosus*(L.) pada Pertumbuhan *Streptococcus beta-hemolyticus*. *Jurnal Kesehatan*. 2019 Nov 30;10:390.

(Received June 20, 2021; Accepted November 11, 2021)

# Antibacterial and Antibiofilm Efficacy of Pineapple Hump (Ananas comosus) on Porphyromonas gingivalis in vitro : JDI VOL 28 NO 3

*by Abdul Gani Soulissa*

---

**Submission date:** 07-Apr-2022 11:30AM (UTC+0700)

**Submission ID:** 1804021576

**File name:** ple\_Hump\_Ananas\_comosus\_on\_Porphyromonas\_gingivalis\_in\_vitro.pdf (274.95K)

**Word count:** 3414

**Character count:** 18967

12-31-2021

## Antibacterial and Antibiofilm Efficacy of Pineapple Hump (*Ananas comosus*) on *Porphyromonas gingivalis* in vitro

Abdul Gani Soulissa

*Department of Periodontic, Faculty of Dentistry Trisakti University, Jakarta, Indonesia,*  
abdulsoulisa@yahoo.co.id

Billy Lombardo

*Undergraduate Program, Faculty of Dentistry Trisakti University, Jakarta, Indonesia,*  
billylombardo.bl@gmail.com

Armelia Sari Widyarman

*Department of Microbiology, Faculty of Dentistry Trisakti University, Jakarta, Indonesia,*  
armeliasari@trisakti.ac.id

Follow this and additional works at: <https://scholarhub.ui.ac.id/jdi>

Part of the [Dental Hygiene Commons](#), [Dental Materials Commons](#), [Endodontics and Endodontology Commons](#), [Health Economics Commons](#), [Oral and Maxillofacial Surgery Commons](#), [Oral Biology and Oral Pathology Commons](#), [Orthodontics and Orthodontology Commons](#), [Pediatric Dentistry and Pedodontics Commons](#), and the [Periodontics and Periodontology Commons](#)

### Recommended Citation

Soulissa, A. G., Lombardo, B., & Widyarman, A. Antibacterial and Antibiofilm Efficacy of Pineapple Hump (*Ananas comosus*) on *Porphyromonas gingivalis* in vitro. *J Dent Indones.* 2021;28(3): 153-157

This Article is brought to you for free and open access by the Faculty of Dentistry at UI Scholars Hub. It has been accepted for inclusion in *Journal of Dentistry Indonesia* by an authorized editor of UI Scholars Hub.

---

## Antibacterial and Antibiofilm Efficacy of Pineapple Hump (*Ananas comosus*) on *Porphyromonas gingivalis* in vitro

### Cover Page Footnote <sup>1</sup>

The authors would like to thank Faculty of Dentistry, Trisakti University for their invaluable support for this research. Authors would like to thank MiCORE laboratory at Trisakti University for their support for this study.

ORIGINAL ARTICLE

Antibacterial and Antibiofilm Efficacy of Pineapple Hump (*Ananas comosus*) on *Porphyromonas gingivalis* in vitro

Abdul Gani Souli<sup>1</sup>, Billy Lombardo<sup>2</sup>, Armelia Sari Widyarman<sup>3</sup>

<sup>1</sup>Department of Periodontic, Faculty of Dentistry Trisakti University, Jakarta, Indonesia

<sup>2</sup>Undergraduate Program, Faculty of Dentistry Trisakti University, Jakarta, Indonesia

<sup>3</sup>Department of Microbiology, Faculty of Dentistry Trisakti University, Jakarta, Indonesia

Correspondence e-mail to: armeliasari@trisakti.ac.id

ABSTRACT

**Background:** Periodontal disease is one of the most prevalent oral health problems in Indonesia that affects supporting tissues of the teeth. *Porphyromonas gingivalis* plays an important role in the pathogenesis of periodontal disease. Alternative therapy with natural plant extracts, including pineapple (*Ananas comosus*) hump extract may inhibit the growth of bacteria that cause periodontal disease. **Objective:** To determine the effect of pineapple hump extract on bacterial growth and adhesion of *Porphyromonas gingivalis* biofilms. **Method:** The bacterial inhibition test was performed by the agar well diffusion method, and biofilm density measurements were made using the biofilm assay method. **Results:** Pineapple hump extract can inhibit bacterial growth optimally at a concentration of 100%, with an average zone of inhibition of 7.3 mm. The extract at a 50% concentration can eradicate the biofilms in a 6 h incubation time with an average OD of 0.124. The Shapiro-Wilk method confirmed a normal distribution of the data. Both one-way ANOVA and post hoc test showed a significant difference between the inhibitory ability of pineapple hump extract and between concentrations to restrict formation of *Porphyromonas gingivalis* biofilms. **Conclusion:** Pineapple hump extract was able to inhibit bacterial growth and eradicate the adhesion of *Porphyromonas gingivalis* biofilms in vitro.

**Key words:** periodontal disease, pineapple hump extract, *Porphyromonas gingivalis*

How to cite this article: Souli AG, Lombardo B, Widyarman AS. Antibacterial and antibiofilm efficacy of pineapple hump (*Ananas comosus*) on *Porphyromonas gingivalis* in vitro. J Dent Indones. 2021;28(3):153-157

INTRODUCTION

Periodontal disease is a common disorder of the human oral cavity. As the population increases, periodontal disease has become a significant health problem in the health sector.<sup>1,2</sup> Periodontal disease is an inflammatory disease of the oral cavity caused by microorganisms in the supporting tissues of the teeth.<sup>2</sup> Uncontrolled accumulation of plaque and bacteria is the main etiology of periodontal disease.<sup>3,4</sup> The prevalence of periodontitis in Indonesia is high; data obtained from the 2018 National Basic Health Research indicate a percentage of periodontitis cases in Indonesia of 74.1%.<sup>5</sup>

*Porphyromonas gingivalis* (*P. gingivalis*) is a bacterial species that plays an important role in the pathogenesis of periodontal disease.<sup>6</sup> These bacteria are classified as Gram-negative anaerobic bacteria and are found mostly in subgingival plaque, where they cause chronic periodontitis.<sup>7</sup> Plaque control is important

in periodontal treatment, and can be performed by gargling with chlorhexidine solution, which has antimicrobial properties that can inhibit the growth of bacteria that cause periodontal disease.<sup>8</sup> However, long-term use of chlorhexidine will cause discoloration of the teeth and the formation of supragingival calculus, while also leaving a bitter taste.<sup>9</sup>

The side effects of chemical-based mouthwashes can be reduced by natural ingredients that are beneficial in the health sector. Medicinal plants have been widely used in the management of infectious and it has been proof against oral pathogens.<sup>10-12</sup> One of these is the hump of pineapple. This fruit contains the enzyme bromelain which an enzyme that has been shown to reduce and break the glutamine-alanine and arginine-alanine bonds.<sup>13,14</sup> Almost all parts of the pineapple (*Ananas comosus*) can be beneficial for health including the flesh, skin, and stems. The bromelain enzyme



contained in pineapple hump has many benefits as anti-inflammatory, anticancer, antimicrobial, and reduces the severity of angina pectoris.<sup>15</sup> The mechanism of antimicrobial action on the bromelain enzyme is by destroying the structure of the bacterial wall. According to previous research, the concentration of bromelain contained in pineapple hump is higher than pineapple flesh.<sup>16</sup> The skin and hump of pineapple commonly regarded as wastes, in fact there is an enzyme bromelain which has an inhibitory effect on the growth of periodontal bacteria.<sup>17,18</sup> Some studies have been tested the antibacterial activity of the pineapple hump extract against oral pathogen bacteria and found that pineapple hump extract had antibacterial effects against *P. gingivalis* and *Enterococcus faecalis*.<sup>19, 20</sup>

No research has yet investigated the effectiveness of pineapple hump extract on the adherence of *P. gingivalis* biofilms. Therefore, the aim of this study was to determine the effectiveness of pineapple hump extract on bacterial growth and adhesion of *P. gingivalis* biofilms.

## METHODS

This research was an *in vitro* laboratory experimental study with a post-test-only control design, conducted at the Laboratory of Microbiology Center of Research and Education (MiCORE), Faculty of Dentistry, Trisakti University. An extract of pineapple hump from Balai Penelitian Tanaman Rempah dan Obat (Balitro) plantation was prepared by a maceration method using 96% ethanol as a solvent and was then diluted with distilled water to obtain concentrations of 100%, 50%, 25%, 12.5%, 6.25%, and 3.125%. Firstly, the pineapple hump is separated from the flesh. Secondly, it is dried under the sun and then put into a grinder until it becomes powder. Thirdly, the pineapple hump powder was extracted by maceration using a 96% ethanol solution in a ratio of 1:5 for 24 hours. Then, the resulting solution is filtered with a filter paper and then evaporated with a rotary evaporator which aims to obtain a thick extract and free from solvents. Finally, this thick extract was diluted with distilled water to obtain concentrations of 100%, 50%, 25%, 12.5%, 6.25%, and 3.125%. The well diffusion method was used, so the inhibition zone formed could be measured using a caliper. The biofilm assay method was used to measure the density of biofilm by crystal violet staining and measurement with a microplate reader at a wave length of 490 nm.

### Phytochemical test on pineapple hump extract

#### Flavonoid test

A small amount of Mg powder and concentrated hydrochloric acid were added to a 2 mL sample. An orange or pink to red color indicated the presence of flavonoid compounds.

#### Phenol test

A few drops of hot water and 1–2 drops of 1% FeCl<sub>3</sub> were added to a 2 mL sample. A blue or purple color indicated the presence of phenolic compounds.

#### Saponin test

A 10 mL volume of distilled water was added to a 2 mL sample and shaken. Formation of a foam that lasted for 5 min indicated the presence of saponin compounds.

#### Terpenoid test

Liebermann-Burchard reagent was added to a 2 mL sample. A green to blue color indicated the presence of terpenoid compounds.

#### Alkaloid test

A 5 mL volume of chloroform and ammonia solution was added to a 2 mL sample and heated, shaken, and then filtered. A 1 mL volume of 2N HCl was added, shaken for 2 min, and left until two layers separated. The acid (top) layer was taken and 1–2 drops of Dragendorff reagent were added. A red color indicated the presence of alkaloids.

#### Tannin test

A 2 mL sample was combined with 1% FeCl<sub>3</sub>. A blackish green or dark blue color indicated the presence of tannin compounds.

### *Porphyromonas gingivalis* cultures

*Porphyromonas gingivalis* samples were obtained from MiCORE, Faculty of Dentistry, Trisakti University with ATCC 33277 strain. The bacteria were cultured on nutrient broth medium and then incubated for 24 h at 37°C in an anaerobic jar using the Gaspack jar system to maintain anaerobic conditions.

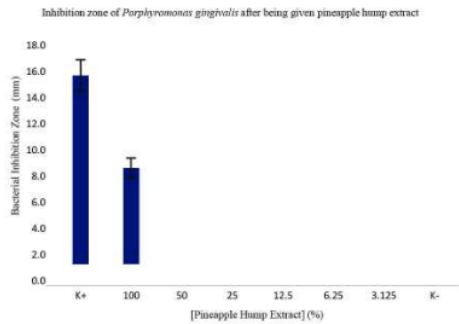
#### Inhibition test

A 20 µL sample of bacterial culture was spread on BHI until evenly distributed in each of 12 petri dishes. Five wells were made in BHI agar. Three wells contained different concentrations of pineapple hump extract, one well served as a positive control (chlorhexidine), one well served as a negative control (sterilised water), and each pineapple hump extract at a concentration of 100%, 50%, 25%, 12.5%, 6.25%, and 3.12%. The wells were filled with 20 µL of test solution using a sterile micropipette, and all concentrations were tested in triplicate.

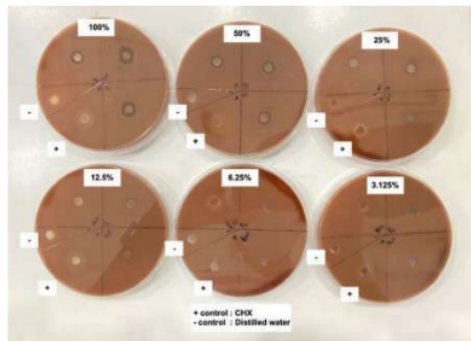
The samples were incubated at 37°C and observed for 24h. The diameter of the inhibition zone around the wells was measured using a caliper.

#### Biofilm assay

This study used 0.2% chlorhexidine as a positive control and sterilised water as a negative control. A 200 µL sample of bacterial culture was added to a 96-well plate and incubated at 37°C for 48 h under anaerobic conditions. The medium from the culture was then discarded, leaving the remaining biofilm layer adhered



**Figure 1.** Inhibition zone of pineapple hump extract against *Porphyromonas gingivalis*

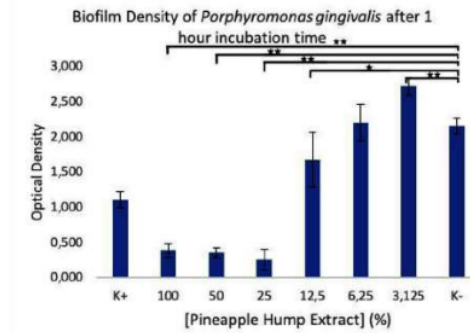


**Figure 2.** Minimum Inhibitory Concentration of Pineapple Hump for *P.gingivalis* in different concentration 100%, 50%, 25%, 12.5%, 6.25%, and 3.125%. Distilled water were used as the negative control and chlorhexidine (0.2%) was used as the positive control. All treatment were done in triplicate

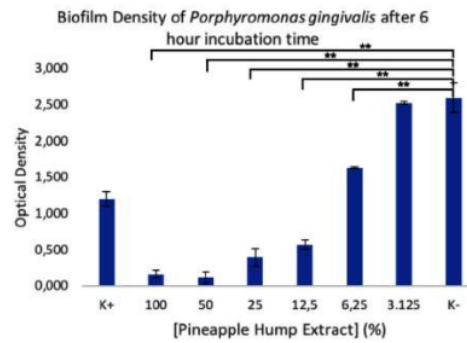
to the bottom surface of the well plate. The well plate was rinsed with phosphate buffered saline (PBS). Pineapple hump extract (up to 200  $\mu$ L) was added at several concentrations (100%, 50%, 25%, 12.5%, 6.25%, and 3.12%), and the well plates were incubated under anaerobic conditions at 37°C and observed for 1, 6, and 24 h. The extract was then discarded and the well plate was rinsed with phosphate buffer saline (PBS), then heat-fixed. The biofilms were stained for 15 min with crystal violet (0.05% w/v) and then rinsed with PBS. A 200  $\mu$ L volume of 96% ethanol was added, and the stained biofilm in the well plate was measured with a microplate reader at a wavelength of 490 nm.

#### Statistical analysis

All data collected were analyzed using the Shapiro-Wilk normality test, followed by a one-way analysis of variance (ANOVA) and post hoc least significant difference (LSD). A normality test confirmed a normal distribution of the results ( $p > 0.05$ ). The one-way ANOVA showed a significant difference ( $p < 0.05$ ).



**Figure 3.** Density of *Porphyromonas gingivalis* biofilm treated with pineapple hump extract at several concentrations for 1 h. \* $p < 0.05$ , \*\* $p < 0.01$



**Figure 4.** Density of *Porphyromonas gingivalis* biofilm treated with pineapple hump extract at several concentrations for 6 h. \* $p < 0.05$ , \*\* $p < 0.01$

The post hoc LSD test, performed to determine the significant differences between the results of the study, confirmed a significant difference ( $p < 0.05$ ).

## RESULTS

The phytochemical test results revealed that the pineapple hump extract contained alkaloids, saponins, and flavonoids. The inhibition zone measurements for *Porphyromonas gingivalis* bacteria revealed that a clear zone began to form at an extract concentration of 50%. By contrast, concentrations of 25%, 12.5%, 6.25%, 3.125%, and the negative control showed no inhibition zones. (Figure 1)

The biofilm assay on *Porphyromonas gingivalis* bacteria after a 1 h incubation showed that the pineapple hump extract significantly reduced the amount of *Porphyromonas gingivalis* biofilm at all concentrations and all incubation times ( $p < 0.05$ ). (Figure 3,4,5). The most effective concentration was 25% with a 1 h incubation time.

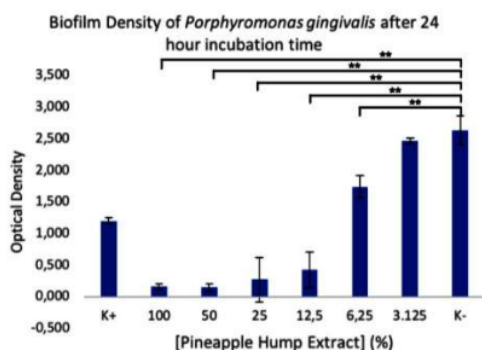


Figure 5. Density of *Porphyromonas gingivalis* biofilm treated with pineapple hump extract at several concentrations for 24 h. \* $p < 0,05$ , \*\* $p < 0,01$

## DISCUSSION

Pineapple hump was confirmed to contain alkaloids, flavonoids, and saponins. Alkaloids act as antibacterial agents, as they can interfere with the formation of peptidoglycan in bacterial cells. This prevents the complete formation of the bacterial cell wall layer, resulting in cell death. Flavonoids are polar phenolic compounds that can penetrate into the bacterial peptidoglycan layer, break down the bacterial cell proteins, and damage the cytoplasmic membrane. This causes an efflux of amino acids and nucleotides and leads to cell death.<sup>20</sup> Saponins in pineapple hump can damage the cytoplasmic membrane of bacteria and reduce cell membrane permeability, causing disruption of nutrient uptake into the bacterial cells and resulting in cell death.<sup>21</sup>

The results of the inhibition zone test indicated that pineapple hump extract was more effective than chlorhexidine (the positive control) at inhibiting bacterial growth. Pineapple hump extract also had the potential to inhibit the growth of *P. gingivalis* biofilms. The *P. gingivalis* biofilm tests showed that pineapple hump extract was more effective than chlorhexidine at eradicating biofilms. The results of this study are supported by the results of previous research conducted by Chatty (2019), who used an agar well diffusion method to test the inhibition of *P. gingivalis* by pineapple hump extract. The hump extract showed an antibacterial activity against *P. gingivalis* bacteria starting at a concentration of 50%, with an average inhibition zone diameter of 9.85 mm.<sup>20</sup> Another study by Udin *et al.* (2018) tested the antibacterial effect of pineapple hump extract on *Staphylococcus aureus* and found that pineapple hump extract was effective at inhibiting and killing *S. aureus* bacteria, optimally at a concentration of 70%.<sup>22</sup> Mukti *et al.* (2018) tested the antibacterial effect of pineapple hump extract on *Streptococcus mutans* and found a very

strong inhibitory effect at a concentration of 100%.<sup>21</sup> Liliyani, *et al.* (2018) tested the antibacterial effect of the bromelain enzyme from pineapple hump extract against *Enterococcus faecalis* and found that it was effective at inhibiting the growth of *E. faecalis* bacteria at a concentration of 12.5%.<sup>19</sup>

According to Rahmat *et al.* (2016), the concentration of bromelain contained in pineapple hump is higher than pineapple flesh.<sup>16</sup> The bromelain enzyme can destroy the structure of the bacterial wall as the mechanism of its antimicrobial action. This enzyme breaks the protein that builds the bacterial cell wall, thus the bacterial wall becomes weak and the cell will be damaged. The bromelain enzyme is present in all pineapple tissues. About half of the protein in pineapple contains the protease bromelain.<sup>24,25</sup>

## CONCLUSION

The results of the present study confirm that the extract of pineapple hump is able to inhibit bacterial growth and eradicate the adhesion of *Porphyromonas gingivalis* biofilms. Further research is still needed to confirm the effectiveness of pineapple hump extract against other pathogenic bacteria. Toxicity tests are also needed to determine any side effects of pineapple hump extract in the oral cavity.

## ACKNOWLEDGMENT

The authors would like to thank Faculty of Dentistry, Trisakti University for their invaluable support for this research. Authors would like to thank MiCORE laboratory at Trisakti University for their support for this study.

## CONFLICT OF INTEREST

Authors declared that there is no conflict of interest related to this study.

## REFERENCES

1. Tonetti MS, Jepsen S, Jin L, Otomo-Corgel J. Impact of the global burden of periodontal diseases on health, nutrition and wellbeing of mankind: A call for global action. *JvClin Periodontol.* 2017;44(5):456–62.
2. Bui FQ, Almeida-da-Silva CLC, Huynh B, Trinh A, Liu J, Woodward J, *et al.* Association between periodontal pathogens and systemic disease. *Biomed J.* 2019;42(1):27–35.
3. Goh EXJ, Ong MMA. Anatomical, microbiological, and genetic considerations in treatment of Chinese

- periodontal patients. *J Investig Clin Dent*. 2019;10(1):e12381.
4. Davis IJ, Jones AW, Creese AJ, Staunton R, Atwal J, Chapple ILC, et al. Longitudinal quantification of the gingival crevicular fluid proteome during progression from gingivitis to periodontitis in a canine model. *J Clin Periodontol*. 2016;3(7):584–94.
  5. Kementerian Kesehatan Republik Indonesia. Laporan nasional riset kesehatan dasar (RISKESDAS) tahun 2018. Kementerian Kesehatan Republik Indonesia, Jakarta; 2018.
  6. Chukkapalli SS, Rivera MF, Velsko IM, Lee JY, Chen H, Zheng D, et al. Invasion of oral and aortic tissues by oral spirochete *Treponema denticola* in ApoE<sup>-/-</sup> mice causally links periodontal disease and atherosclerosis. *Infect Immun*. 2014;82(5):1959–1967.
  7. How KY, Song KP, Chan KG. *Porphyromonas gingivalis*: An overview of periodontopathic pathogen below the gum line. *Front Microbiol*. 2016;7:53.
  8. Balagopal S, Arjunker R. Chlorhexidine: the gold standard antiplaque agent. *J Pharm Sci*. 2013;5(12):270–74.
  9. Strydom DACV, Slot DE, Velden UV der, Weijden FV der. Effect of a chlorhexidine mouthrinse on plaque, gingival inflammation and staining in gingivitis patients: A systematic review. *J Clin Periodontol*. 2012;39(11):1042–55.
  10. Widyarman AS, Widjaja SB, Idrus E. Strawberry extract's effects on *Enterococcus faecalis* and *Porphyromonas gingivalis* biofilms *in vitro*. *Sci Dent J*. 2017;1(1):1–5.
  11. Widyarman AS, Suhaimi OP, Nandary D, Theodora CF. Pomegranate juice inhibits periodontal pathogens biofilm *in vitro*. *Sci Dent J*. 2018;2(3):101–8.
  12. Radita DC, Widyarman AS. Mahkota dewa (God's crown) fruit extract inhibits the formation of periodontal pathogen biofilms *in vitro*. *J Indones Dent Assoc*. 2019;2(2):57–62.
  13. Lobo MG, Yahia E. Biology and postharvest physiology of pineapple. In: Lobo MG, Paull RE, editors. *Handbook of Pineapple Technology* [Internet]. Chichester, UK: John Wiley & Sons, Ltd; 2016 [cited 2020 May 30]. p. 39–61. Available from: <http://doi.wiley.com/10.1002/9781118967355.ch3>
  14. Praveen NC, Rajesh A, Madan M, Chaurasia VR, Hiremath NV, Sharma AM. In vitro Evaluation of Antibacterial Efficacy of Pineapple Extract (Bromelain) on Periodontal Pathogens. *J Int Oral Health*. 2014;6(5):96–8.
  15. Rathnavelu V, Alitheen NB, Sohila S, Kanagesan S, Ramesh R. Potential role of bromelain in clinical and therapeutic applications. *Biomed Rep*. 2016;5(3):283–8.
  16. Rahmat D, Ratih LD, Nurhidayati L, Bathini MA. Peningkatan aktivitas antimikroba ekstrak nanas (*Ananas comosus* (L.) Merr) dengan pembentukan nanopartikel. *Jurnal Sains dan Kesehatan*. 2016. 1(5): 236–44.
  17. Tonetti MS, Dyke TEV. Periodontitis and atherosclerotic cardiovascular disease: Consensus report of the Joint EFP/AAP workshop on periodontitis and systemic diseases. *J Clin Periodontol*. 2013;40(s14): S24–9.
  18. Aravind KV, Gokulakrishnan M. Extraction, purification of bromelain from pineapple and determination of its effect on bacteria causing periodontitis. *Int J Phar Sci Res*. 2015;6(12):5284–94.
  19. Liliyany D, Widyarman AS, Erfan E, Sudiono J, Djamil MS. Enzymatic activity of bromelain isolated pineapple (*Ananas comosus*) hump and its antibacterial effect on *Enterococcus faecalis*. *Sci Dent J*. 2018;2(2):39–50.
  20. Gultom CH. Perbedaan efektifitas antibakteri kulit dan bonggol buah nanas (*Ananas comosus*) terhadap *Porphyromonas gingivalis* [skripsi]. Jakarta: Universitas Trisakti; 2019.
  21. Mukti A, Mardianingrum R, & Mardiana U. Aktivitas daya hambat ekstrak etanol bonggol nanas (*Ananas comosus* L.) terhadap bakteri *Streptococcus mutans*. *Pharmacoscript*. 2018. 1(1): 9.
  22. Udin U, Sari RY, & Anto S. Efektivitas daya hambat ekstrak etanol 96% bonggol nanas (*Ananas comosus* L.) terhadap pertumbuhan bakteri *Staphylococcus aureus*. *Journal of Pharmacy and Science*. 2018. 3(2): 32–36.
  23. Bala M, Ismail NA, Mel M, Jami MS, Salleh HM, Amid A. Bromelain Production: Current Trends and Perspective. In 2012.
  24. Purwaningsih, I. Potensi Enzim Bromelain Ekstrak Nanas (*Ananas comosus* L.) Dalam Meningkatkan Kadar Protein Pada Tahu. *Jurnal Teknologi Laboratorium*, 2017 6(1), 39–46.
  25. Ujiani S, Marhamah M. Efektivitas Ekstrak Nanas (*Ananas comosus*(L.) pada Pertumbuhan *Streptococcus beta-hemolyticus*. *Jurnal Kesehatan*. 2019 Nov 30;10:390.

(Received June 20, 2021; Accepted November 11, 2021)

# Antibacterial and Antibiofilm Efficacy of Pineapple Hump (Ananas comosus) on Porphyromonas gingivalis in vitro : JDI VOL 28 NO 3

## ORIGINALITY REPORT

24%

SIMILARITY INDEX

21%

INTERNET SOURCES

18%

PUBLICATIONS

14%

STUDENT PAPERS

## PRIMARY SOURCES

1	Submitted to Fakultas Kedokteran Gigi Universitas Trisakti Student Paper	2%
2	Submitted to Technological Institute of the Philippines Student Paper	1%
3	Dimitra Sakellari. "Proteomics of Periodontal Pocket", Current Oral Health Reports, 2017 Publication	1%
4	<a href="http://www.journalijar.com">www.journalijar.com</a> Internet Source	1%
5	<a href="http://arthritis-research.biomedcentral.com">arthritis-research.biomedcentral.com</a> Internet Source	1%
6	<a href="http://repositorio.unesp.br">repositorio.unesp.br</a> Internet Source	1%
7	<a href="http://akjournals.com">akjournals.com</a> Internet Source	1%

[enterpathog.abzums.ac.ir](http://enterpathog.abzums.ac.ir)

8	Internet Source	1 %
9	<a href="https://eprints.ucm.es">eprints.ucm.es</a> Internet Source	1 %
10	<a href="https://ijpsr.com">ijpsr.com</a> Internet Source	1 %
11	<a href="https://link.springer.com">link.springer.com</a> Internet Source	1 %
12	Submitted to Padjadjaran University Student Paper	1 %
13	<a href="http://www.ejournal.akfarsurabaya.ac.id">www.ejournal.akfarsurabaya.ac.id</a> Internet Source	1 %
14	<a href="http://www.scielo.br">www.scielo.br</a> Internet Source	1 %
15	<a href="http://www.repository.trisakti.ac.id">www.repository.trisakti.ac.id</a> Internet Source	1 %
16	Rahmi Amtha, Yohana Dela Derinda, Armelia Sari Widyarman. "A Comparison of Commercial Mouthwashes Towards Oral Pathogens Biofilms in vitro", 2021 IEEE International Conference on Health, Instrumentation & Measurement, and Natural Sciences (InHeNce), 2021 Publication	1 %
17	<a href="https://www.researchgate.net">www.researchgate.net</a> Internet Source	

1 %

18

[www.pnas.org](http://www.pnas.org)

Internet Source

1 %

19

[api.intechopen.com](http://api.intechopen.com)

Internet Source

1 %

20

[media.neliti.com](http://media.neliti.com)

Internet Source

1 %

21

[www.preprints.org](http://www.preprints.org)

Internet Source

1 %

22

Armelia Sari Widyarman, Nadeeka S. Udawatte, Citra Fragrantia Theodorea, Anie Apriani et al. "Casein phosphopeptide–amorphous calcium phosphate fluoride treatment enriches the symbiotic dental plaque microbiome in children", *Journal of Dentistry*, 2021

Publication

1 %

23

Submitted to Universitas Jember

Student Paper

1 %

24

[ejournal.warmadewa.ac.id](http://ejournal.warmadewa.ac.id)

Internet Source

1 %

25

[mobt3ath.com](http://mobt3ath.com)

Internet Source

1 %

26

Submitted to Badan PPSDM Kesehatan  
Kementerian Kesehatan

Student Paper

<1 %

27

Manolo Laiola, Francesca De Filippis, Paola Vitaglione, Danilo Ercolini. "A Mediterranean Diet Intervention Reduces the Levels of Salivary Periodontopathogenic Bacteria in Overweight and Obese Subjects", Applied and Environmental Microbiology, 2020

Publication

<1 %

28

[www.i-scholar.in](http://www.i-scholar.in)

Internet Source

<1 %

29

N M D Janurianti, I W Sudiarta, Y P Situmeang. "Chemical changes coconut oil in different fermentation during long time storage", Journal of Physics: Conference Series, 2019

Publication

<1 %

30

[repository-tnmgrmu.ac.in](http://repository-tnmgrmu.ac.in)

Internet Source

<1 %

31

[www.science.gov](http://www.science.gov)

Internet Source

<1 %

Exclude quotes  On

Exclude bibliography  On

Exclude matches  < 15 words



# Antibacterial and Antibiofilm Efficacy of Pineapple Hump (Ananas comosus) on Porphyromonas gingivalis in vitro : JDI VOL 28 NO 3

---

## GRADEMARK REPORT

---

FINAL GRADE

**/0**

GENERAL COMMENTS

**Instructor**

---

PAGE 1

---

PAGE 2

---

PAGE 3

---

PAGE 4

---

PAGE 5

---

PAGE 6

---

PAGE 7

---