Global Scientific and Academic Research Journal of Dentistry and Oral Medicine
ISSN: 2584-2382 (Online)
Frequency: Monthly
Published By GSAR Publishers
Journal Homepage Link- https://gsarpublishers.com/journal-gsarjdom-home/

Antibacterial activity of pineapple hump extract (*ananas comosus (l.) Merr)* against *staphylococcus aureus*

BY

Chairunas[1], Munifah Abdat[2], Syahla Mielda Nabila[3]

[1]Department of Oral and Maxillofacial Surgery, Faculty of Dentistry Syiah Kuala Univesity, Indonesia
[2,3]Department of Dental Public Health, Faculty of Dentistry Syiah Kuala Univesity, Indonesia

Article History

Received: 01/08/2024
Accepted: 25/08/2024
Published: 31/08/2024

Vol – 1 Issue – 8

PP: -08-12

Abstract

Indonesia is a tropical country that is rich in natural biological resources that can be used as herbal ingredients to make medicine. One natural resource that has potential as a medicinal ingredient is pineapple. However, the hump part of the pineapple has not been utilized optimally, and is even considered waste and is simply thrown away. Pineapple hump has active compounds that have antibacterial potential. This research aimed to determine the antibacterial activity of pineapple hump extract in inhibiting the growth of Staphylococcus aureus. The type of research used is a posttest-only control group design. Testing of pineapple hump extract with concentrations of 75% and 90% as an antibacterial was carried out using the disc diffusion method. 90% pineapple hump extract has better inhibitory power than 75% pineapple hump extract. Based on the inhibition zone produced, it shows that pineapple hump extract can inhibit the growth of Staphylococcus aureus bacteria. So it can be concluded that pineapple hump extract has antibacterial activity against Staphylococcus aureus.

KEYWORDS: *Antibacterial activity, Pineapple hump, Staphylococcus aureus.*

INTRODUCTION

Staphylococcus aureus bacteria is classified as Gram-positive bacteria which is also a normal flora that is commonly found in humans but also has the potential to cause opportunistic infections. This microorganism is found in the nose in around 30% - 50%. Healthy, in the feces around 20% and in the skin around 5-

10%.[(1),(2),(3)] Regarding oral infections, Staphylococcus aureus is associated with facial cellulitis and bullous-type facial infections around the nose and mouth. Staphylococcus aureus is also reported to be associated with other orofacial infectious diseases, such as angular cheilitis, dry mouth, and acute dentoalveolar abscesses.[(4),(5)] *Staphylococcus aureus* is also mentioned as a pathogen for many oral diseases, such as osteomyelitis, sialadenitis, oral mucositis, periodontitis, peri-implantitis, infection endodontics, and even dental caries.[(6), (7)]

As previously explained, apart from causing diarrhea, *Staphylococcus aureus also* causes an oral cavity infection, namely dental caries. Dental caries is described as a pathological process that causes demineralization and destruction of hard tooth tissue with the formation of holes in the teeth.[(11)]

Regarding oral infections, Staphyloccocus aureus is associated with facial cellulitis and bullous-type facial infections around the nose and mouth. Staphyloccocus aureus is also reported to be associated with other orofacial infectious diseases, such as angular cheilitis, dry mouth and acute dentoalveolar abscess.[(4),(5)] *Staphyloccocus aureus* is also mentioned as a pathogen for many oral diseases, such as osteomyelitis, sialadenitis, oral mucositis, periodontitis, peri-implantitis, infection endodontics and dental caries.[(6),(7)]

As previously explained, *Staphylococcus aureus* also causes an oral cavity infection, namely dental caries. Dental caries is described as a pathological process that causes demineralization and destruction of hard tooth tissue with the formation of holes in the teeth.[11] Dental caries is the most common infection that occurs and develops slowly over years, and if not treated appropriately can cause damage to the teeth and surrounding tissue.[(12), (13)]

Based on survey data from the World Health Organization (WHO) notes that throughout the world 60- 90% of children experience dental caries. Based on the results of data from Basic Health Research Indonesia (Riskesdas) in 2018, it is stated that the largest proportion of dental problems in Indonesia are damaged/caved caved/sick teeth (45.3%).

*Corresponding Author: **Chairunas** .

Half of the 75 million children in Indonesia experience dental caries and the number is increasing from year to year.[14] Consuming foods containing antibacterial substances can reduce the risk of oral cavity infections, one of which is by consuming pineapple. Consuming foods containing antibacterial substances can reduce the risk of oral cavity infections, one of which is by consuming pineapple.

Pineapple is a highly nutritious tropical fruit with various health benefits.[15] Pineapple has active compounds that function as antibacterials including ferulic acid, phytol, ferulic, iso-ferulic, linalool, α- terpineol, p-hydroxybenzoic acid, syringic acid, benzoic acid, cinnamic acid, and vanillin.[16] Apart from that, pineapple also contains an important compound called bromelain which has an important role in health.

One of the wastes from the pineapple plant, namely the hump, has various active components and various benefits but has not been utilized optimally.[19] The pineapple hump contains chemical compounds including bromelain enzymes, saponins, alkaloids, and flavonoids.[20] Flavonoid compounds work to form complex compounds with extracellular proteins. which can damage bacterial cell membranes. On the other hand, tannins can inhibit the enzyme reverse transcriptase and DNA topoisomerase which can prevent the formation of bacterial cells.[15] Researchers argue that bromelain has antibacterial and antiviral activity which can control infectious diseases.[21] Supported by Triyani's research, the antibacterial activity of gargling with mouthwash from pineapple stem extract at a concentration of 40% had an average clear zone diameter of 12.07 mm and 10.96 mm.[22]

Based on the description above, the researcher wants to identify the antibacterial potential of pineapple stem extract originating from Central Aceh.

METHODS

The type of research used is laboratory experimental research with a post-test-only control group design. The sample used in this research was Staphylococcus aureus obtained from the Laboratory of the Faculty of Medicine, Syiah Kuala University and the test material used was pineapple obtained from a pineapple plantation in Pegasing District, Takengon City, Aceh, Indonesia. This study measured the inhibition zone for the growth of *Staphylococcus aureus* exposed to 75% and 90% pineapple hump (*Ananas.comosus (L.) Merr*) extract using the disc diffusion method. The research permit from the Ethics Committee of the Faculty of Dentistry, Syiah Kuala University No.491/KE/FKG/2024.

Research Procedure

This research step begins with making pineapple hump extract using 70% ethanol. Next, dilution was carried out until concentrations of 75% and 90% were obtained. *Staphylococcus aureus* which has previously been cultured and suspended according to Mc Farland standards was daubed evenly using a cotton bud on MHA media. Paper discs soaked with 75% and 90% pineapple hump extract were placed for the treatment group, paper discs soaked in the antibiotic amoxicillin as a positive control, and paper discs soaked in distilled water as a negative control. Then incubated for 24 hours at 37°C in an incubator. Inhibition zone measurements were carried out using a caliper.

RESULT

Bacteria	Group	Inhibition Zone (mm)	Antibacterial Ability
Staphylococcus aureus	75%	7,146	Medium
	90%	8,65	Medium
	K(+)	16,8	Strong
	K(-)	-	No Response

Table 1. Antibacterial Activity Test Results

Note Category : Very Strong : >20 mm; Strong : 10-20 mm Medium : 5-10 mm; None: <5 mm

Based on Table 1, it can be seen that the positive control group had the largest zone of inhibition, namely 16.8 mm against *Staphylococcus aureus* bacteria. In the 75% and 90% pineapple hump extract treatment groups, the inhibition zone results were not much different, both were in the medium category, the inhibitory zone results for the extract treatment group with 90% concentration of pineapple hump were slightly wider than those in the 75% concentration treatment group.

Table 2. Inhibition Zone Measurement at 14, 18, 21 and 24 hours

Bacteria	Repetition/Group		Inhibition Zone (mm) 14 hours	18 hours	21 hours	24 hours	Sig
S. aureus	1	75%	6,19	7,25	7,37	7,42	0,000
		90%	7,84	8,30	7,82	7,86	
		K(+)	14,83	15,25	15,3	15,3	
		K(-)	5,25	5,30	5,33	5,35	
	2	75%	6,71	7	7,12	7,15	
		90%	8,58	9	10,3	10,4	
		K(+)	14,43	14,8	14,9	14,9	
		K(-)	-	-	-	-	
	3	75%	7,34	7,65	6,84	6,87	
		90%	8,66	9	9,39	9,45	
		K(+)	18,72	20	20,2	20,2	
		K(-)	-	-	-	-	

Based on Table 2. The largest inhibition zone for *Staphylococcus aureus* bacteria was formed in the positive control group, followed by the 90% extract treatment group, the 75% extract treatment group, and the negative control group with distilled water.

The results of the ANOVA analysis showed that there were significant differences between the treatment groups (75%, 90%, K+, and K-) in their effect on the growth of *Staphylococcus aureus* at 14, 18, 21, and 24 hours with a significance value (Sig) of 0.000 (<0.05). The results of this study rejected the null hypothesis (H0) that there were differences between treatment groups, and concluded that at least one pair of treatment groups had significantly different means in their effect on the growth of *Staphylococcus aureus*. Thus, based on the results it was concluded that different

*Corresponding Author: **Chairunas** .

treatments (75%, 90%, K+, and K-) had different impacts in controlling the growth of *Staphylococcus aureus* at different times (14, 18, 21, and 24 hours).

Table.3 *Post Hoc* test

			Sig
S. aureus (14 hours)	75%	90%	0.749
		K+	0.002*
		K-	0.056
	90%	75%	0.749
		K+	0.006*
		K-	0.014*
S. aureus (18 hours)	75%	90%	0.830
		K+	0.003*
		K-	0.050
	90%	75%	0.830
		K+	0.008*
		K-	0.016*
S. aureus (21 hours)	75%	90%	0.681
		K+	0.003*
		K-	0.073
	90%	75%	0.681
		K+	0.013*
		K-	0.015*
S. aureus (24 hours)	75%	90%	0.674
		K+	0.003*
		K-	0.072
	90%	75%	0.674
		K+	0.014*
		K-	0.015*

Based on Table 3, the results of the *Post Hoc* test carried out showed significant differences in several comparisons between groups because the p value was <0.05. This can be interpreted as the existence of statistically significant differences in inhibition zones between groups which are given the information (*).

DISCUSSION

This research used pineapple hump taken from pineapples originating from Pegasing District, Central Aceh Regency. The choice of pineapple was because researchers wanted to explore pineapples originating from Aceh.Based on research by Talitha (2023), pineapple hump originating from Central Aceh contains chemical compounds including flavonoids, alkaloids, saponins, tannins and phenols.[23] In line with research by Udin (2018) which concluded that pineapple hump contains chemical compounds including the enzyme bromelain. , saponins, alkaloids, and flavonoids which are known to have antibacterial potential.[20]

The inhibition of the growth of *Staphylococcus aureus* bacteria occurs due to secondary metabolite compounds contained in pineapple tuber extract, namely the enzyme bromelain, flavonoids, saponins, alkaloids, and tannins. The bromelain enzyme is a proteolytic enzyme that plays a role in protein breakdown. The bromelain enzymeis a protease enzyme that is capable of hydrolyzing peptide bonds into amino acids.[20]

The bromelain enzyme has antibacterial activity related to its ability to deactivate microbial cell adhesins as well as enzymes and prevent protein transport in the inner layers of cells. The formation of cell walls in bacteria is not complete due to the action of the bromelain enzyme on cell wall polypeptides. As a result of osmotic and physical pressure, lysis occurs in the bacteria so that the bacteria die. The role of the bromelain enzyme is to reduce the surface tension of bacteria by hydrolyzing salivary proteins and glycoproteins which are bacterial mediators that stick to the tooth surface.[24] It is known that flavonoid compounds have antibacterial capabilities by attacking phospholipids in the cytoplasmic membrane of bacteria which results in leakage of the cytoplasmic membrane, this leakage is likely This cause *Staphylococcus aureus* bacteria to die or have their growth stunted. Apart from flavonoids, there are also saponin and alkaloid compounds that play a role in increasing the permeability of bacterial cell membranes so that the cell membrane becomes unstable and hemolysis occurs in the cell which results in the release of important components in the cell so that the bacteria die more quickly. Tannin compounds act as antibacterials because they can form complex compounds with proteins through hydrogen bonds. If hydrogen bonds are formed between tannin and protein, the protein will be denatured so that bacterial metabolism will be disrupted.[25]

Testing of 75% and 90% pineapple hump extract as antibacterial against *Staphylococcus aureus* was carried out using the disc diffusion method. This method is carried out by observing the inhibition zone formed during the test. The advantage of this method is greater flexibility in choosing the antibiotic drug to be used. The results of *Staphylococcus aureus* culture on NA media which had been incubated for 24 hours at 37°C showed colonies that were golden yellow, round in shape, had a shiny surface and had a soft consistency. In accordance with the results of research by Vienna (2022) which showed that the results of *Staphylococcus aureus* bacterial culture showed that the colonies had a round, convex shape with flat edges, a shiny surface and had a soft consistency.[26]

The results of this study show that pineapple hump extract can inhibit the growth of *Staphylococcus aureus* bacteria. Pineapple hump extract with a concentration of 75% produces an average inhibition zone of 7.146 mm and a concentration of 90% produces an average inhibition zone of 8.65 mm.

Based on the results of this research, it is known that pineapple hump extract with a concentration of 90% has a stronger antibacterial effect compared to 75% extract. This happens because the higher the concentration, the more antibacterial compounds it contains, so it can influence the inhibition zone that is formed.[27] In line with research by Liliany (2018) which concluded that 100% pineapple hump extract has a better antibacterial effect than extract pineapple tubers 50% against the growth of *Enterococcus faecalis* bacteria.[28]

Based on this discussion, it can be concluded that pineapple hump extract with concentrations of 75% and 90% has antibacterial activity against *Staphylococcus aureus*. This is also in line with research by Omorotionmwan (2019) which states that 100% pineapple peel extract (*Ananas comosus*) in powder form is effective in inhibiting the growth of *Streptococcus faecalis* bacteria.[29] This research is supported

*Corresponding Author: **Chairunas** .

by research by Abbas (2020) which concludes that pineapple hump extract also effective in inhibiting the growth of *Pseudomonas aeruginosa* bacteria. 16 Sumiati (2020) also stated that pineapple hump extract has an antibacterial effect against *Streptococcus sanguinis* bacteria.[15]

CONCLUSION

Based on the research results, it can be concluded that pineapple hump extract (*Ananas comosus (L.) Merr*) has antibacterial activity against Staphylococcus aureus.

SUGGESTION

1. Future research can use other extraction methods besides maceration so that better extracts can be produced.
2. Further research can test the Minimum Kill Concentration and Minimum Inhibitory Concentration.

CONCLUSION

Based on the research results, it can be concluded that pineapple hump extract (*Ananas comosus (L.) Merr*) has antibacterial activity against Staphylococcus aureus.

ACKNOWLEDGMENT

The Author would like to the Research Laboratory of the Faculty of Medicine, Syiah Kuala University, Banda Aceh for permission and for facilitating this research process.

REFERENCES

1. Lu M, Xuan S, Wang Z. Oral microbiota: A new view of body health.
2. *Food Science and Human Wellness*. 2019;8(1):8–15.
3. Priya Nimish D, Deshmukh R. Oral Microbiome : Unveiling the Fundamentals. *Journal of Oral and Maxillofacial Pathology*. 2017;21(3):244–51.
4. Lin FH, Chou YC, Chen BC, Lu JC, Liu CJ, Hsieh CJ, et al. An increased risk of school-aged children with viral infection among diarrhea clusters in taiwan during 2011–2019. *Children*. 2021;8(9):1–11.
5. Eugene Sampakang R, Herwanto. Incidence of Diarrhea in Children Aged 6-24 Months with a History of Exclusive Breastfeeding at the Grogol Petamburan District Health Center. *Tarumanagara Medical Journal*.2019;2(1):143-7.
6. Azmi AH, Adnan SNA, Ab Malik N. The Prevalence of *Staphylococcus aureus* in the Oral Cavity of Healthy Adults in Malaysia. *Sains Malaysiana*. 2020;49(3):583–91.
7. Al-Akwa AAY, Zabara AQMQ, Al- Shamahy HA, Al-labani MA, Al- Ghaffari KM, Al-Mortada AM, et al. Prevalence of *Staphylococcus aureus* in Dental Infections and the Occurrence of Mrsa in Isolates. *Universal Journal of Pharmaceutical Research*. 2020;5(2):23–7.
8. Ghom AG. Textbook of Oral Medicine. 2008. page 462, 657.
9. Malik I, Anjayati S, Musdhalifa P, Binti D, Tosepu R. Impact of weather and climate on diarrhea incidence: A review. *IOP Conference Series : Earth and Environmental Science*. 2021;755(1):1–6.
10. Kemenkes RI. Basic Health Research Results 2018. Ministry of Health of the Republic of Indonesia. 2018;53(9):1689–99.
11. Setyaningsih R, Diyono D. Factors That Influence the Incidence of Diarrhea in Toddlers. *KOSALA : Jurnal Ilmu Kesehatan*. 2020;8(2):63–70.
12. Loban GA, Faustova MO, Chereda VV, Ananieva MM. Epidemiological and etiological aspects of dental caries development. *Acta Facultatis Medicae Naissensis*. 2021;38(1):27–34.
13. Al-amin NTTA, Al-jubouri YHO, Shaker RJ. Isolation and Identification of Dental Caries Bacteria and Study of Their Sensitivity to Some Antibiotics and Nanoparticles. *World Bulletin of Public Health*. 2022;(February):43– 58.
14. Pitts NB, Twetman S, Fisher J, Marsh PD. Understanding dental caries as a non-communicable disease. *British Dental Journal*. 2021;231(12):749–53.
15. Andriyani A, Putri N, Lusida N, Ernyasih E, Rosyada D, Jaksa S, et al. Factors Related to Parental Behavior in Preventing Children's Dental Caries in East Jakarta. *Jurnal Kedokteran dan Kesehatan*. 2023;19(1):11.
16. Fatia Asy-Syahidah Al-Haq, Kiki Mulkiya Yuliawati, Yani Lukmayani. Literature Search of Pineapple (Ananas comosus L. Merr.) Fruit Stem and Peel Extract as Antibacterial. *Bandung Conference Series: Pharmacy*. 2022;2(2):145–53.
17. Rise Yantika, Lanny Mulqie, Suwendar. Literature Review of Antibacterial Activity of Pineapple Plants (Ananas Comosus L. Merr) against Escherichia coli Bacteria and *Pseudomonas aeruginosa*. *Bandung Conference Series : Pharmacy*. 2022;2(2):1071–9.
18. Loon YK, Satari MH, Dewi W. Antibacterial effect of pineapple (*Ananas comosus*) extract towards *Staphylococcus aureus*. *Padjadjaran Journal of Dentistry*. 2018;30(1):1–6.
19. Minarni, Rosmalia D. Antibacterial Inhibitory Power Test of Pineapple Stem Extract Against Streptococcus mutans Bacteria. *Jurnal Kesehatan*. 2022;8(1):10–5.
20. Juariah S, Wati D. Effectiveness of Pineapple Stem Extract (Ananas comosus L. Merr) Against Escherichia coli. Meditory *The Journal of Medical Laboratory*. 2021;8(2):95–100.
21. Udin U, Sari RY, Anto S. Effectiveness of 96% Ethanol Extract of Pineapple Stem (Ananas Comosus L) Inhibitory Power on the Growth of Staphylococcus aureus Bacteria. *Journal of Pharmacy and Science*. 2018;3(2):32– 6.
22. Bakri Z, Hatta M, Muh. Nasrum Massi. Detection of the Presence of Escherichia coli O157:H7 Bacteria

*Corresponding Author: **Chairunas** .

in the Feces of Diarrhea Patients Using Culture Methods and PCR. 2015;5(2):184–92.
23. Triyani S. Potential of Pineapple Stem Extract (Ananas comosus (L) Merr.) as a mouthwash. *Journal Katalisator*.2020; 5(2):215-23.
24. Vollmer K, Chakraborty S, Bhalerao PP, Carlr R, Frank J, Steingass CB. Effect of Pulsed Light Treatment on Natural Micribiota, Enzyme Activity, and Phytochemical Composition of Pineapple (Ananas comosus (L) Merr.) Juice. *Food Bioprocess Technol*. 2020. 13(7):1095-109.
25. Husna CA. Peranan Protein Adhesi Matriks Ekstraselular Dalam Patogenitas Bakteri *Staphylococcus aureus*. *AVERROUS: Jurnal Kedokteran dan Kesehatan Malikussaleh*. 2018;4(2):99–110.
26. Crawford JA, Blank TE, Kaper JB. *Escherichia coli* dalam kehidupan manusia. *BioTrends*. 2002;4(1):337–59.
27. Prihtiyantoro W, Slipranata M, Aziz F. Characterization of Virulence Factors of Zoonotic Pathogen Escherichia coli (O157:H7) Isolate of Fecal Cattle.*Agros*.2014;16(2):401-11.
28. Riski K, Fakhrurrazi, Abrar M. Isolation of Staphylococcus aureus Bacteria in Talang-Talang Salted Fish (Scomberoides commersonnianus) in Leupung District, Aceh Besar Regency. *Jimvet*. 2017;1(3):366–74.
29. Liliany D, Widyarman A, Erfan E, Sudiono J, Djamil M. Enzymatic activity of bromelain isolated pineapple (*Ananas comosus*) hump and its antibacterial effect on *Enterococcus faecalis* . *Scientific Dental Journal*. 2018;2(2):39.
30. Omorotionmwan FOO, Ogwu HI, Ogwu MC. Antibacterial Characteristics and Bacteria Composition of Pineapple (*Ananas comosus [Linn.] Merr*.) Peel and Pulp. *Food and Health*. 2019;5(1):1–11.

*Corresponding Author: **Chairunas .**