

POTENTIAL BACTERIOCINS OF *Pediococcus pentosaceus* AGAINST *Staphylococcus aureus* AND *Staphylococcus epidermidis* CAUSES OF ACNE VULGARIS

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ABSTRACT

Background: Lactic Acid Bacteria (BAL) are a group of bacteria that have the ability to produce various antimicrobial substances, one of which is bacteriocin. utilization of BAL and the bacteriocins it produces as natural antimicrobial agents. Its use not only has the potential to inhibit the growth of pathogenic bacteria, but it is also more environmentally friendly and has a lower risk of side effects compared to synthetic antibiotics. Further research on BAL and its applications in the health and food industry can be an innovative solution to address the challenges of antibiotic resistance in the future. **Objective:** To identify the potential of lactic acid bacteria to fight staphylococcus aureus and staphylococcus epidermidis bacteria that cause acne vulgaris. **Methods:** This study used a true experimental design with a post-test only control group design **Results:** *S. epidermidis* in *P. pentosaceus* 24 and 48 was (10.6 mm) and (35.5 mm), the inhibition zone of clindamycin antibiotics was (24.4 mm). Meanwhile, in *S. aureus* for *P. pentosaceus* 24 hours and 48 hours are (9.5mm) and (32.5 mm) while the inhibition zone in clindamycin antibiotics is (24.08mm). **Conclusion:** Bacterisoin derived from curd fermentation can inhibit the growth of *S. aureus* and *S. epidermidis* bacteria.

Keywords: *P. pentosaceus*, *S. aureus*, *S. epidermidis*, *Acne vulgaris*.

INTRODUCTION

Acne vulgaris is a state of inflammation in the polyskebatic glands that is chronic and can heal on its own. Many factors cause Acne vulgaris, generally often appearing in the adolescent phase along with hormonal growth (*Dehydroepiandrosterone* DHEA, testosterone and androgens that stimulate the sebaceous glands to produce more sebum.¹

Acne vulgaris is caused by several factors, namely internal factors such as excessive skin oil secretion, hyperkeratosis of hair follicles. Bacteria also play a role in causing acne vulgaris such as *Pronibacterium acnes*, *Staphylococcus aureus* and *Staphylococcus epidermidis*. External factors that can cause acne vulgaris such as stress, climate, temperature, and humidity, cosmetics, diet, and medications.²

Lactic acid bacteria (BAL) are a type of gram-positive bacteria that do not organize spores and are round or stem in shape. BAL as the main product in the metabolic process during fermentation. BAL plays a role in maintaining the balance of microbes in the skin, has been proven to help reduce inflammation (inflammation) and inhibit the growth of acne-causing bacteria, so it can be used as an alternative in treating acne.²

Bacteriocins derived from BAL can function to stop the growth of pathogens such as *S. aureus* and *S. epidermidis* bacteria as bacteria that cause acne vulgaris. Nowadays BAL has been used in the cosmetic industry as an anti-inflammatory to stop the growth of pathogenic bacteria capable of causing inflammation and skin diseases such as acne. Treating acne so far using antibiotics such as clindamasin, this antibiotic is effective in treating gram-positive

bacteria such as *Staphylococcus sp.* With the development of technology, the cosmetics industry releases skin care products packaged in the form of creams, gels, and acne patches.^{4,6}

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RESEARCH METHODS

This study uses a *true experimental research design*, as well as a *post test only control group design* as a research design. The research population used was *staphylococcus aureus* and *staphylococcus epidermidis*. The sample of this study used pure isolate of *Pediococcus pentosaceus*.

RESULT

This study was carried out by measuring the inhibitory zones in *S. aureus* and *S. epidermidis* bacteria. The goal was to find out how effective the bacteriocin antibacterial power of BAL *Pediococcus pentosaceus*, which comes from fermented curds of buffalo milk, against the development of pathogenic bacteria such as *S. aureus* and *S. epidermidis*. This result show in Table 1.

Table 1. Results of measurement of the growth inhibition zone of *S. epidermidis* bacteria (mm)

<i>S. epidermidis</i>			
Experiment	Treatment groups		
To	<i>P. pentosaceus</i> 24	<i>P. pentosaceus</i> 48	Antibiotics
	hours (mm)	hours (mm)	(Clinomycin)
1	10,5	36,8	24,1
2	10,4	35,7	28,2
3	10,8	34	24,4
4	10,3	36	26,1
5	10,8	35	19,2
Average	10,56	35,5	24,4

There are three known treatment groups: antibiotics (clindamycin), 24-hour *Pediococcus pentosaceus*, and 48-hour *Pediococcus pentosaceus*. In this study, the average inhibitory zone value for this treatment group was calculated from five experiments. The result for antibiotics was 24.4 mm, the 24-hour *Pediococcus pentosaceus* was 10.56 mm, and the 48-hour *Pediococcus pentosaceus* was 35.5 mm.

Table 2. Measurement results of the growth inhibition zone of *S. aureus* bacteria (mm)

<i>S. aureus</i>			
Experiment	Treatment groups		
To	<i>P. pentosaceus</i> 24	<i>P. pentosaceus</i> 48	Antibiotics
	hours (mm)	hours (mm)	(Clinomycin)
1	11,9	34,6	22,3
2	8,3	34,7	23,1

3	9,7	34,6	26,2
4	8,1	39,6	27,4
5	9,5	24,3	21,4
Average	9,5	33,56	24,08

It is known that there are three treatment groups: antibiotics (clindamycin), *Pediococcus pentosaceus* 24 hours, and *Pediococcus pentosaceus* 48 hours. From the five trials, the mean inhibition zone value for antibiotics was 24.08 mm, 24-hour *Pediococcus pentosaceus* was 9.5 mm, and 48-hour *Pediococcus pentosaceus* was 33.56 mm.

Table 3. Normality test using Saphiro-Wilk on *S. epidermidis* bacteria

	Treatment	Saphiro Wilk		
	Groups	Statistics	Df	Sig.
Inhibition Zone	<i>P.</i>	.868	5	0.257
	<i>pentosaceus</i>			
	24 hours			
	<i>P.</i>	.987	5	0.966
	<i>pentosaceus</i>			
	48 hours			
	Antibiotic	.940	5	0.665

Table 4. Normality test using Saphiro-Wilk on *S. aureus* bacteria

	Treatment Groups	Saphiro Wilk		
		tatistics	f	Sig.
Zone	<i>P. pentosaceus</i> 24 hours	.891		0.364
Obstacles	<i>P. pentosaceus</i> 48 hours	.827		0.131
	Antibiotic	.906		0.442

In the 24-hour *P. pentosaceus*, 48-hour *P. pentosaceus*, and antibiotic groups, Sig values greater than 0.05 were found, indicating that all three data were normally distributed.

The homogeneity test using the Levene *statistical test* was carried out to test whether the sample had the same variance or not.

The Least Significance Different test is a follow-up test by conducting Post Hoc analysis on the One Way ANOVA test.

Table 5. Post Hoc analysis data with LSD (Least Significance Different) in *S. epidermidis* bacteria

Kelompok		Mean difference (I-II)	P
I	II		
<i>P. pentosaceus</i> 24 hours	<i>P. pentosaceus</i> 48 hours	- 24.9400*	0.000

		Klindamisin	-13.8400*	0.000
<i>P. pentosaceus</i> 48 hours		<i>P. pentosaceus</i> 24 hours	24.9400*	0.000
		Klindamisin	11.1000*	0.000
		<i>P. pentosaceus</i> 24 hours	13.8400*	0.000
Klindamisin		<i>P. pentosaceus</i> 48 hours	-11.100*	0.000

Showing the results of the LSD post hoc test for all intervariable *P. pentosaceus* 24 hours. *P. pentosaceus* 48 hours and antibiotics are significant have a value of $p=0.000$ which means $P<0.05$ this value indicates that there is a difference in the average difference from the inhibition zone formed.

DISCUSSION

This study studied the antibacterial ability of BAL derived from curd, especially *P. pentosaceus*, to prevent *S. aureus* and *S. epidermidis* bacteria from multiplying. *P. pentosaceus* isolate is grown with BHIB (*Brain Heart Infusion Broth*) medium. After the bacteria were incubated for 24 and 48 hours, their antibacterial activity (bacterioxin) was retested against *S. aureus* and *S. epidermidis* bacteria.

This antibacterial strength criterion is in accordance with the CLSI 2024 which is used to show the results of microorganism sensitivity tests to various types of antibiotics. It is part of Antibiotic *Susceptibility Testing* (AST) which measures how sensitive or resistant bacteria are to certain antibiotics. The CSLI table usually presents information regarding the antibiotics being tested, effective doses, and sensitivity categories such as Sensitive (S), Resistant (R), or Intermediate (I). This data is important to help medical professionals choose the most effective antibiotics to treat infections caused by specific microorganisms. In general, this table helps doctors in choosing the right antibiotics.⁵

The results of antibacterial tests on *P. pentosaceus* and clindamycin showed the presence of an inhibitory zone. The average diameter of the inhibition zone in *S. epidermidis* for 24-hour *P. pentosaceus* is 10.6 mm which means that the resistance zone formed is resistant and weak in inhibiting pathogenic bacteria, while the average diameter of the inhibition zone of *S. epidermidis* in *P. pentosaceus* 48 hours is 35.5 mm which means that the formed inhibition zone is sensitive and strong in inhibiting pathogenic bacteria. The average diameter of the *S. aureus* inhibitory zone for *P. pentosaceus* 24 hours is 9.5 mm which means it is resistant or weak as an antimicrobial, on the other hand in *P. pentosaceus* the average diameter of the 48-hour inhibitory zone is 32.5 mm, which means it is sensitive (strong).

Based on the results of statistical calculations using SPSS on *S. aureus* and *S. epidermidis*, the difference between *P. pentosaceus* 24 hours, *P. pentosaceus* 48 hours and antibiotics was obtained. The Post Hoc analysis test in the One Way Anova test with (LSD) has a value of $P=0.000$ which means $P<0.05$, this value shows that there is a difference in the mean difference from the inhibition zone formed in *S. epidermidis* and *S. aureus* bacteria, the results are known to be significant. in each group of 24-hour *P. pentosaceus* was significant against 48-hour *P. pentosaceus* and antibiotics. *P. pentosaceus* 48 hours is significant against *P. pentosaceus* 24 hours and antibiotics. Antibiotics were significant against *P. pentosaceus* 24 hours and *P. pentosaceus* 48 hours. The results of the One Way ANOVA test showed that the fermentation time had a significant effect ($p < 0.05$) on TAT and total BAL. Then, it was followed by the Post Hoc LSD test to find out the difference in each treatment. The results of the Post Hoc LSD test showed a significant difference ($p < 0.05$).⁶

The results of this study show that *P. pentosaceous* has the ability to inhibit pathogenic bacteria, because it has an antimicrobial compound in the form of bacteriocin. Bacteriocins have bactericidal (killing) or bacteriostatic (inhibiting) ability of pathogenic bacteria. *S. epidermidis* and *S. aureus* bacteria are bacteria that are able to infect the skin. Lactic acid bacteria have antibacterial agents such as lactic acid and bacteriocins that can inhibit the growth of pathogenic bacteria. Bacteriocins can inhibit pathogenic bacteria by forming pores and affecting the permeability of bacterial cell membranes so that it will inhibit energy production and biosynthesis of proteins or nucleic acids which will result in the death of pathogenic bacterial cells. All of these mechanisms will cause inhibition of the growth of pathogenic bacteria such as *S. epidermidis* and *S. aureus*.³

CONCLUSION

Bacterisoin derived from curd fermentation can inhibit the growth of *S. aureus* and *S. epidermidis* bacteria.

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