NSIEX+RS 2025
NEGERI SEMBILAN INTERNATIONAL EXPOSITION

HARMONY IN PROGRESS:

INTEGRATING SCIENCE, TECHNOLOGY, AND SOCIAL INNOVATION FOR SUSTAINABLE DEVELOPMENT GOALS

e-Book of Extended Abstract
Negeri Sembilan International (NSIEx) & Research Symposium
2025

PST015 - CHOCOSHIELD: PROBIOTIC CHOCOLATE FROM LOCAL LACTIC ACID BACTERIA AGAINST MULTIDRUG-RESISTANT FOODBORNE PATHOGENS

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ABSTRACT

This study investigated the antimicrobial potential of cell-free supernatants (CFS) from *Lacticaseibacillus paracasei* dan *Lactobacillus plantarum* K014 against key foodborne pathogens. *L. paracasei* was identified as the most promising strain isolated from 'musangking' durian, demonstrating strong bactericidal activity and targeted inhibition of selected pathogens. Synergistic testing with tetracycline revealed complex interactions, highlighting the importance of optimising combinations of natural and conventional antimicrobials. The novelty of this work lies in the strain-specific antimicrobial potential of locally isolated lactic acid bacteria, which supports their application as natural biopreservatives. The findings further provide a scientific basis for developing functional food products, such as probiotic chocolate bars, that deliver both health benefits and extended shelf life.

Keywords – bacteriocin, antibiotic-resistant foodborne pathogen, mechanism, lactic acid bacteria, functional food products

INTRODUCTION

The World Health Organization has identified Gram-negative bacteria as top-priority antibiotic-resistant pathogens due to their role in severe, often fatal infections and their impermeable outer membranes, which limit antibiotic entry and accelerate resistance spread (Mogasale et al., 2021; Butler et al., 2022). In Malaysia, national antibiotic resistance surveillance data from 2016 revealed that 18% of *Staphylococcus aureus* isolates were methicillin-resistant (MRSA). *Streptococcus pneumoniae* showed resistance to erythromycin in the range of 33.9–35.2% over the past four years, while *Enterococcus faecium* exhibited an increasing trend of vancomycin resistance (Chong et al., 2020). These alarming trends highlight the urgent need for novel antimicrobial strategies targeting resistant pathogens, including MRSA, Extended Spectrum Beta-Lactamase (ESBL) producing *E. coli, Klebsiella pneumoniae,* and carbapenem-resistant *Pseudomonas aeruginosa.*

In recent years, bacteriocins are small, ribosome-synthesized peptides with potent and often strain-specific activity against antibiotic-resistant pathogens. Their unique mechanisms, from conventional antibiotics, make them promising candidates for both therapeutic and food applications (Chong et al., 2020). Harnessing bacteriocin-producing probiotic strains in functional food products presents an innovative strategy that could improve food safety, extend shelf life, and deliver probiotic health benefits, thereby bridging the gap between clinical antimicrobial research and food biotechnology (Abdul Hakim et al., 2023).

OBJECTIVE

This study aims to assess the antimicrobial activity of bacteriocins produced by locally isolated *Lacticaseibacillus paracasei* against key multidrug-resistant foodborne pathogens and to examine their potential synergy with conventional antibiotics. It further seeks to evaluate the stability of these antimicrobial properties during storage and apply the findings to the development of functional probiotic chocolate bars, combining targeted pathogen inhibition with probiotic health benefits.

DESCRIPTION OF THE PROJECT

This project develops a probiotic chocolate bar enriched with *Lacticaseibacillus paracasei*, a locally isolated lactic acid bacterium that has shown strong antibacterial activity against *Escherichia coli*, *Listeria monocytogenes*, and *Vibrio harveyi* through inhibition zone analysis, minimum inhibitory concentration (MIC) testing, and synergy assays with conventional antimicrobials. Embedding live probiotic cultures in a chocolate matrix offers dual benefits—delivering health-promoting probiotics while providing natural antimicrobial protection to enhance food safety. The chocolate's low moisture and protective fat content help preserve probiotic viability during storage, making it an ideal functional food carrier. Current research is evaluating probiotic viability, antimicrobial efficacy, and sensory qualities to optimise the formulation for potential market introduction.

L. plantarum CFS against pathogen	
Pathogenic bacteria	Inhibition zone (mm)
Escherichia coli	4.3 ± 1.19
Listeria monocytogenes	3.5 ± 3.54
Vibrio harvery	6.0 ± 1.00
L. paracasei CFS against pathogen	
Pathogenic bacteria	Inhibition zone (mm)
Escherichia coli	2.2 ± 0.29
Listeria monocytogenes	10.0 ± 0.00
Vibrio harvery	6.3 ± 0.58
Nisin (control) against pathogen	
Pathogenic bacteria	Inhibition zone (mm)
Escherichia coli	9.0 ± 1.08
Listeria monocytogenes	5.5 ± 0.71
Vibrio harvery	2.0 ± 0.00

Figure 1:Analysis on the LAB against pathogen with targeted chocolate to produce probiotic chocolate bar

NOVELTY

This research explores the unique antimicrobial potential of locally isolated bacteriocin-producing *Lacticaseibacillus paracasei*, revealing novel inhibition mechanisms against multidrug-resistant foodborne pathogens. It will identify resistance patterns, determine optimal bacteriocin dosages, and compare their efficacy with conventional antibiotics. The integration of these potent probiotics into a chocolate matrix represents a pioneering approach, creating a functional probiotic chocolate bar that delivers targeted antimicrobial benefits while maintaining probiotic viability and consumer appeal.

CONCLUSION

This study confirms the strain-specific antimicrobial activity of *Lacticaseibacillus paracasei* CFS against *E. coli*, *L. monocytogenes*, and *V. harveyi*. These findings highlight its potential as an alternative or complementary agent against antimicrobial resistance. Current work focuses on incorporating *L. paracasei* into probiotic chocolate, combining viable beneficial bacteria with demonstrated antimicrobial activity to create a functional, health-promoting confectionery.

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