

Antimicrobial Peptides As Sustainable Food Safety Alternatives

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Objectives: The growing challenges of antimicrobial resistance and the limited effectiveness of conventional food disinfectants highlight the need for innovative and sustainable alternatives. Lactic-acid bacteria (LAB) fermentation is a promising approach for producing bactericidal peptides that are generally recognized as safe (GRAS grade-1). This study aimed to evaluate the potential antimicrobial peptides produced by fermentation as alternatives to food disinfectants and test their antibacterial and antifungal activities in practical approaches.

Material and Methods: Fermentation was developed using a previously developed protocol. Low molecular weight peptides were isolated via ultrafiltration and tested for antibacterial and antifungal activities against foodborne and relevant pathogens, using a microdilution assay. The peptides effects on salads and fruits were further tested in lettuce spiked with *L. monocytogenes*, *Salmonella* Goldcoast, and *E. coli* O157:H7, and in strawberries spiked with *Botrytis cinerea*.

Results: Fermentation-derived peptides exhibited strong antibacterial activity, with MICs of 6 µg/mL against *Listeria monocytogenes* and *Escherichia coli* O157. Significant ($p < 0.001$) dose-dependent growth inhibition was also observed for *Klebsiella pneumoniae*, *Proteus mirabilis*, and *Pseudomonas aeruginosa*. Antifungal activity was detected against *Botrytis cinerea*, with MICs of 180 µg/mL. Concerning the peptides effects in lettuce, there was a growth reduction of approximately 33.5% for *E. coli* O157 and *Salmonella* Goldcoast and 19.5% for *L. monocytogenes* ($p < 0.05$). Regarding strawberries, the reduction was 31% ($p < 0.05$).

Conclusions: Fermentation-derived peptides exhibit potential as potent antimicrobial agents, providing a sustainable and effective alternative to conventional antibiotics and food disinfectants. These findings align with global One Health efforts to combat antimicrobial resistance, presenting a transformative and sustainable approach to food safety and public health challenges.

Keyword: Antibacterial peptides, Sustainable alternatives, Fermentation, Food disinfectants, One Health.

Funding: This work was supported by the project Smartpep, funded by Lusófona University, Portugal and FERMENTA by Fazer + Lusófona University.