Antimicrobial Activity of Novel Probiotic Strains *against Listeria monocytogenes, Salmonella* and *E. coli O157:H7*

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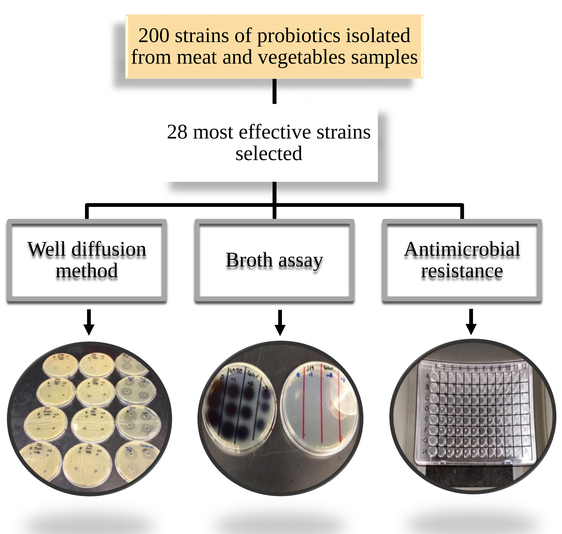
Abstract

A natural alternative to counteract foodborne pathogens are probiotics, live microorganisms that when administered in adequate amounts confer beneficial health effects to the host. Probiotics are also an alternative to decrease the use of antibiotics in animal feed, which could have potential risks such as the development of antimicrobial resistance and the spread of antibiotic resistance genes.

Introduction

In the United States, 9.4 million episodes of foodborne illness are caused by 31 major pathogens, from which *Listeria monocytogenes*, *Salmonella* and *E. coli* O157:H7 are among the most common causes of foodborne infections. Indeed, over 40,000 and 3,500 laboratory-confirmed *Salmonella* and *E. coli* O157:H7 cases respectively are reported annually to the Centers for Disease Control and Prevention. On the other hand, an estimated 1,600 people get listeriosis each year, and about 260 die. Probiotics are a natural alternative to counteract foodborne pathogens, they are live microorganisms that when administered in adequate amounts confer beneficial health effects to the host. Lactic acid bacteria are the most commonly used group of bacteria as probiotic strains, they produce antimicrobial compounds such as bacteriocins able to reduce and/or inhibit human foodborne pathogens. This study aimed to characterize potential probiotic strains to reduce *Salmonella, E. coli* O157:H7, and *Listeria monocytogenes.*

Methods



Results

Antimicrobial Activity of Probiotic Strains by Well Diffusion Agar Method

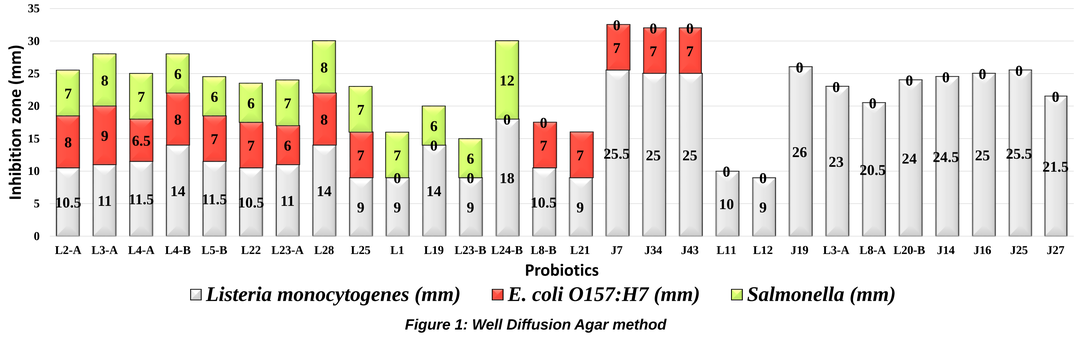


Figure 1: Well Diffusion Agar method

From the selected panel of 28 probiotic strains, 13 probiotic strains had antimicrobial activity on the agar well diffusion assay against *Salmonella* with a maximum inhibition zone of 12 mm; 13 strains for *E. coli O157:H7* with 9mm; and all 28 strains showed antimicrobial activity against *L. monocytogenes* with up to 26 mm of inhibition.

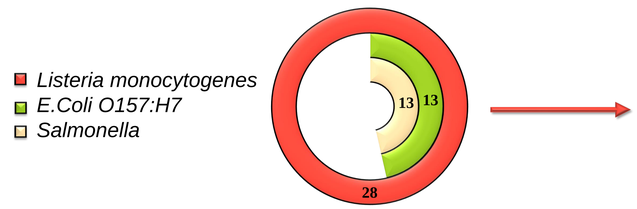


Figure 2: Inhibition of pathogens by probiotic strains

Figure 3: Inhibition of Listeria monocytogenes by probiotic J27 with a zone of inhibition of 21.5 mm, and probiotic J7 with 25.5 mm.

Antimicrobial Activity of Probiotic Strains by Broth assay

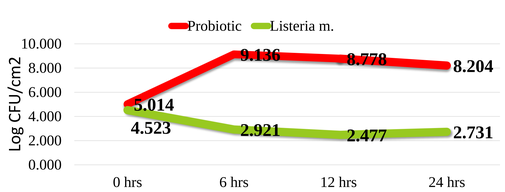


Figure 4: Probiotic J14

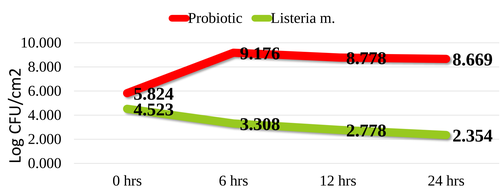


Figure 5: Probiotic L20-B

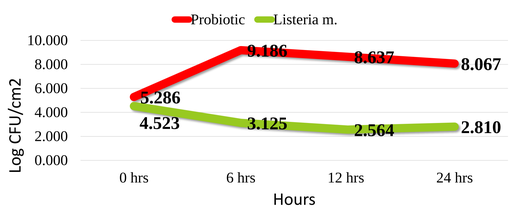


Figure 6: Probiotic J16

Results

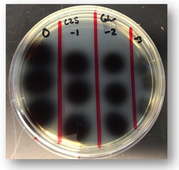


Figure 7: Inhibition of Listeria monocytogenes by probiotic L25 on timepoint 6 hours

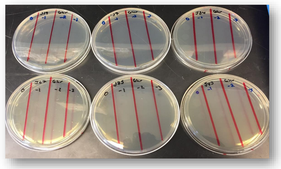


Figure 8: Inhibition of Listeria monocytogenes by probiotic J19, J7, J34, J27, J25, J43 on timepoint 6 hours

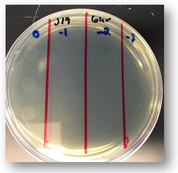


Figure 9: Inhibition of Listeria monocytogenes by probiotic J19 on timepoint 6 hours

The antimicrobial activity of probiotic strains tested by broth assay showed inhibition of *Listeria monocytogenes* up to 6.60 $\log_{10}$ CFU/ml and probiotic growth of up to 8.66 $\log_{10}$ CFU/ml .

Antimicrobial Susceptibility Profile

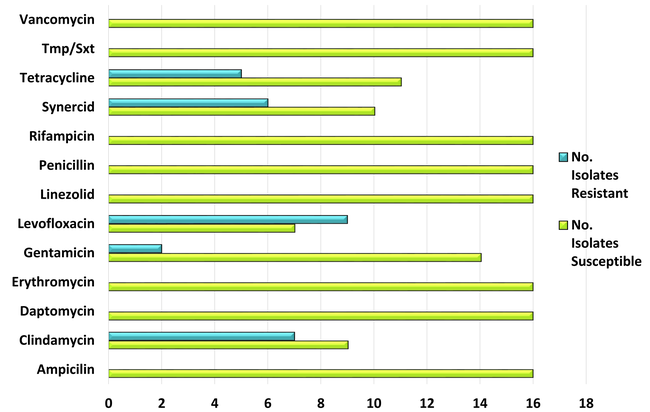


Figure 10: Antimicrobial resistance

Conclusion

- Probiotic strains analyzed in this study were able to reduce *Salmonella, E. coli O157:H7, and Listeria monocytogenes.*
- A similar effect was observed when comparing the antimicrobial effect of overnight cultures to cell-free suspensions.
- Probiotics showed bacteriostatic activity against *Salmonella and E. coli O157:H7*, compared to a bactericidal activity against *Listeria monocytogenes.*
- From the 28 selected strains, 3 were selected for further study to reduce *Listeria monocytogenes* in ready-to-eat meats.

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