Title Antimicrobial efficacy of lactoferrin in chitosan-based edible film against foodborne pathogenic bacteria

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Abstract

The application of naturally-occurring antimicrobials such as lactoferrin to food preservation is gaining great attention due to consumers trend. Incorporation of antimicrobials to edible films has a great potential to enhance the safety of foods since the film can function as a physical barrier as well as an antimicrobial agent. The combination of natural antimicrobials and edible films may be an ideal approach to the environmental, food safety, and consumers' concerns. The objectives of this research were to evaluate the antimicrobial activity of lactoferrin in the chitosan-based edible film, and to investigate the synergistic effects of lactoferrin with lysozyme against foodborne pathogenic bacteria. Chitosan-based films were prepared by dissolving chitosan and glycerol in 1% acetic acid solution. Three concentrations of lactoferrin, lysozyme or nisin were added into film to possess final concentrations of 0.176, 0.352, or 0.703 mg in a circular disc of 10 mm-diameters. Three levels of lactoferrin or EDTA (0.1, 0.2, or 0.4 mg/disc) were also added into the film incorporated with lysozyme. The physical and morphological properties including tensile strength, elongation, water vapor permeability, and microscopic observation were characterized. Antimicrobial activity against *Listeria monocytogenes* and *E. coli* O157: H7 was investigated following both zone of inhibition assay and cell count assay. The chitosan-based films incorporated with antimicrobials exhibited good mechanical properties and water vapor permeability. Although the film incorporated with lysozyme exhibited significant antimicrobial activity against both *Listeria monocytogenes* and *E. coli* O157: H7, lactoferrin did not exhibit any significant antimicrobial activity ($p<0.05$). However, combination of lactoferrin with lysozyme exhibited significant synergistic effects against both bacteria. The addition of lactoferrin to the film with lysozyme exhibited greater antimicrobial activity than the addition of EDTA at the concentration of 0.4 mg/disc against *Listeria monocytogenes*. The results suggest that lactoferrin can be used to replace synthetic chelator such as EDTA with greater synergistic effects.