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Title: Evaluation of the cellulose acetate nanofibers containing postbiotics of *Lactiplantibacillus plantarum* subsp. *plantarum* and *Bifidobacterium animalis* spp. lactis BB-12 on the microbial, chemical, and organoleptic qualities of packed chicken breast meat at 4°C

Abstract:

As a source of protein with low fat content, chicken breast meat has drawn significant attention among various perishable foods. Due to its high moisture content and favorable conditions for microbial growth, chicken breast meat is susceptible to spoilage and poses considerable economic losses and health risks. In this study, postbiotics derived from *Lactobacillus plantarum* (*Plantarum* postbiotic) and *Bifidobacterium animalis* subsp. *lactis* BB12 (BB12 postbiotic) were prepared and examined in MRS broth culture. The antioxidant activity of *Plantarum* and BB12 postbiotics was confirmed using two methods: DPPH (with IC50 values of 7.82 and 11.63 mg/mL, respectively) and FRAP (total antioxidant capacity of 158.69 and 143.69 nanomolar, respectively). Agar well diffusion and minimum inhibitory concentration (MIC) methods were used to determine the antimicrobial properties of the postbiotics in solution at concentrations of 100, 200, 300, and 400 mg/mL against four foodborne pathogenic bacteria (*Listeria monocytogenes*, *Staphylococcus aureus*, *Salmonella* Typhimurium, and *Escherichia coli*), revealing dose-dependent antibacterial activity. Considering the importance of *Salmonella* in poultry meat, inhibition of *Salmonella* Typhimurium was further investigated. The count of *Salmonella* Typhimurium cells after ten days of storage at 4 ± 1°C in chicken breast meat treated with different concentrations of postbiotics by the immersion method was reported to be nearly 2 log10 CFU/g lower compared to the control groups. In this research, cellulose acetate-based nanofiber films containing *Plantarum* and BB12 postbiotics (at 15% w/w based on polymer weight) were also fabricated via electrospinning. Based on the results, the addition of postbiotics had a positive effect on the mechanical properties of the fibers. The antimicrobial properties of nanofibers containing a mixture of postbiotics (at 10% w/w based on polymer weight) against *Listeria monocytogenes* and *Salmonella* Typhimurium were reported using the disk diffusion method, with inhibition zones measuring 15.98 mm and 15.64 mm, respectively. Chemical interactions stabilizing the postbiotics within the cellulose acetate nanofiber matrix were confirmed by Fourier Transform Infrared Spectroscopy (FTIR). According to scanning electron microscopy images, the addition of postbiotics improved film uniformity and reduced nanofiber diameter from 290.682 to 250.078 and 247.432 nm,

respectively. Moreover, the effects of the nanofiber coatings on various aspects of chicken breast meat during 15 days of storage at 4 ± 1°C—including microbial growth, physicochemical properties, color changes, and consumer acceptance—were investigated. It was observed that nanofibers containing single and mixed postbiotics enhanced the shelf life of chicken breast meat, with mixed groups showing significantly better effects than single groups, leading to reductions in total aerobic mesophilic bacteria (2.2 log10 CFU/g), psychrotrophic bacteria (2.2 log10 CFU/g), lactic acid bacteria (1.7 log10 CFU/g), and coliforms (2.1 log10 CFU/g) over 15 days of storage at 4 ± 1°C compared to the uncoated control group. Compared to the uncoated control samples, chicken breast meat slices coated with a 10% postbiotic mixture treatment exhibited a decrease in pH value (6.95 versus 6.50), total volatile basic nitrogen content (45.54 versus 24.76 mg per 100 g of meat), and thiobarbituric acid value (1.82 versus 1.02 mg MDA/kg). Additionally, there was a reduction in total color changes of the meat, accompanied by higher overall consumer acceptance. The findings of this study suggest that cellulose acetate nanofibers loaded with postbiotics have significant potential to enhance poultry meat packaging safety and quality strategies.

Keywords:

Postbiotics, Active packaging, Electrospinning, Nanofiber, Cellulose acetate, Chicken breast meat