Influence of pea protein on the stability and antimicrobial efficacy of Bifidobacterium lactis BPL1 postbiotics via spray drying processing

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The International Scientific Association of Probiotics and Prebiotics defines postbiotics as “a preparation of inactivated probiotics and/or their components that confer a health benefit to the host.” Postbiotics have gained great interest in food safety as they have demonstrated antimicrobial properties. Therefore, they can be potential natural antimicrobial additives that can help reduce outbreaks of pathogenic bacteria. Furthermore, spray drying is an option to enhance the stability and shelf life of postbiotics, however, high temperatures can affect the bioactive compounds. Adding pea protein (PP) can help protect bioactive compounds. Therefore, this study aimed to evaluate the effect of pea protein concentration on the characteristics of spray-dried Bifidobacterium lactis BPL1 postbiotics and the antimicrobial activity against Listeria monocytogenes Scott A and Escherichia coli ATCC 25922. The culture medium was prepared, based on powder 10% w/w whey, 1% w/w inulin, 0.3% w/w yeast extract, 250 ppm vitamin C, 5.75 ppm vitamin E, 0.02% w/w magnesium sulfate, and 0.005% w/w manganese sulfate. Subsequently, B. lactis BPL1 was inoculated (10 ^6 CFU/mL) and incubated at 35°C for 48 h. The fermented mediums were inactivated with ultrasound treatment with a wave amplitude of 90 µm at 55°C for 50 min. Then, maltodextrin was added to adjust the solids to 15% (w/w) and different concentrations of PP (0%, 1% and 2%). The solutions were spray-dried using laboratory-grade dryer equipment, using an air inlet temperature of 170°C and a solution mass flow rate of 10 g/min. The physicochemical characteristics and flowability parameters of the powder, and pH of the reconstituted powder (2.1 g of power per 10 mL) were determined. The diffusion method was used in agar wells to evaluate the antimicrobial properties, measuring inhibition halos diameters, after 24 h of incubation at 35°C against L. monocytogenes Scott A and E. coli ATCC 25922. For this method, the postbiotics before spray drying (liquid) and after the process (reconstituted powder) were evaluated. The incorporation of PP significantly affected ($p < 0.05$) moisture, aw, and particle size, especially with PP 2%. While for the flowability factors (Carr index and Hausner ratio), PP did not show a significant effect ($p > 0.05$) on postbiotics powders. B. lactis BPL1 postbiotics have demonstrated antimicrobial properties against various pathogens due to the presence of organic acids and low pH value. Without the addition of PP, this property was significantly decreased ($p < 0.05$) for both L. monocytogenes Scott A and E. coli. For L. monocytogenes Scott A and E. coli, the activity was maintained from 1% and 2% of PP respectively. This phenomenon is due to the proteins (PP) with carbohydrates (maltodextrin) improving the compound\'s microencapsulation and, therefore, their stability. From the obtained results it can be concluded that adding pea protein in B. lactis BPL1 postbiotics affected certain characteristics such as moisture, aw, and particle size. For the antimicrobial assay against L. monocytogenes Scott A and E. coli, pea proteins adequately protected the bioactive compounds from spray drying conditions since the antimicrobial activity was maintained before and after

drying. B. lactis BPL1 postbiotic powders could be a potential antimicrobial agent for the food industry.

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