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Title: A comprehensive comparison of the chemical composition, functional properties, and toxicity of postbiotics and parabiotics derived from *Lactiplantibacillus plantarum*

Abstract:

Biotics, including postbiotics and parabiotics, have new and varied applications in various industries, including food and pharmaceutical industries. In this study, powders of postbiotics and parabiotics derived from *Lactiplantibacillus plantarum* were prepared using MRS culture media. Their toxicity, antimicrobial properties, and antioxidant activity were evaluated, and their compositions were characterized using chromatography and spectroscopy. Antioxidant activity was assessed through two methods: DPPH assay, showing IC₅₀ values of 0.54 mg/mL for postbiotics and 0.62 mg/mL for parabiotics, and FRAP assay, showing total antioxidant capacities of 59.88 nM for postbiotics and 32.12 nM for parabiotics. The MTT assay indicated that postbiotics at concentrations below 1 mg/mL and parabiotics at 0.1 mg/mL were non-toxic to healthy cells (HFF cell line), while all concentrations tested (0.1, 1, 2.5, 5, and 10 mg/mL) were toxic to cancer cells (HT-29 cell line). Antimicrobial properties of postbiotics and parabiotics solutions at different concentrations (125, 250, and 500 mg/mL) were evaluated against *Escherichia coli* and *Listeria monocytogenes* using the agar well diffusion method. The results demonstrated that the antimicrobial activity of postbiotics was generally 1.5-fold stronger than that of parabiotics at the same concentrations. In liquid media, postbiotics (50 and 100 mg/mL) inhibited the growth of *E. coli* and *L. monocytogenes* after 3h, showing significant differences compared to the control, whereas parabiotics (100 mg/mL) showed similar inhibition after 9h. The stability of the antimicrobial effect of postbiotics and parabiotics from *L. plantarum* at 250 mg/mL was studied at 4 °C and 25 °C during 8 weeks storage, and the comparison with control samples showed no significant differences by the end of the study period. GC-MS and FTIR analyses showed a diverse spectrum of organic and inorganic compounds in both biotics, with differing compositions. The findings suggest that both postbiotics and parabiotics can be used in food formulations (favoring postbiotics) and pharmaceutical applications (favoring parabiotics).

Keywords: Postbiotics, parabiotics, lactic acid bacteria, chemical composition, antimicrobial, antioxidant