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Evaluation of Fermentation Dynamics and Volatile Compound Profiles of Probiotic *Lactobacillus* spp. Inhabiting Tender Coconut Water

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Abstract

Lactic acid bacteria fermentation of tender coconut water creates a beverage with enhanced probiotic and biopreservation properties. This study examines the potential fermenters with a preferred volatile profile among four indigenous lactic acid bacteria inhabiting tender coconut water: *Lactiplantibacillus plantarum* CWJ3, *Lacticaseibacillus rhamnosus* CWKu-12, *Lacticaseibacillus paracasei* CWKu-14, and *Lacticaseibacillus casei* CWM15. The lactic acid bacteria strains were cultured in de Man, Rogosa, and Sharpe broth, and inoculated into pasteurized tender coconut water. Their fermentation characteristics were monitored over 48 hours at 37 °C, and volatile profiles were analyzed using gas chromatography-mass spectrometry coupled with solid-phase microextraction (GCMS-SPME). In all samples, pH and residual sugar levels consistently decreased, while viable cell counts increased during fermentation. *L. plantarum* CWJ3 exhibited the significantly lowest pH (3.86±0.26) and Brix (3.78±0.54) values while maintaining high cell viability (5×10⁶ CFU mL⁻¹). This strain also demonstrated relatively stable viable cell productivity (78,194 to 102,950 CFU mL⁻¹h⁻¹), and a growth rate (0.0417 to 0.0516 h⁻¹), making it the most suitable strain for fermentation. GCMS-SPME analysis confirmed the production of acids, esters, ketones, lactones, and aldehydes during fermentation. *L. plantarum* CWJ3 produced the significantly highest amounts of acetic acid (13.12±1.21%), and acetaldehyde (1.25±0.23%), and the lowest ethanol levels (4.56±0.87%). Conversely, *L. rhamnosus* CWKu-12 produced elevated levels of ketones and lactones, such as 2-heptanone (8.15±1.02%) and 2,3-butanedione (4.16±0.81%), contributing to a unique volatile profile. Ethyl acetate was the primary ester produced by all strains, with *L. paracasei* CWKu-14 generating the significantly highest amount (7.65±0.54%). Notably, *L. plantarum* CWJ3 was the only strain to produce ethyl isobutyrate. The volatile compounds from *L. plantarum* CWJ3 and *L. rhamnosus* CWKu-12 contribute to a fruitier flavor, while their increased acetic acid and reduced ethanol levels enhance the product's biopreservation.

Keywords: fermentation, GCMS-SPME, lactic acid bacteria strains, probiotics, volatile profile