Fermentation characteristics of exogenous lactic acid bacteria in tartary buckwheat sourdough and changes in bread quality of frozen dough

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Abstract: Buckwheat is one of the world's minor cereal crops. Compared to major cereals such as rice, wheat, and maize, buckwheat contains 10% to 15% protein, 2.1% to 2.8% fatty acids, and a well-balanced proportion of all 18 amino acids. Frozen baked goods developed from diverse raw materials such as buckwheat have attracted more attention. In this study, Lactobacillus plantarum (Lp), Lactobacillus fermentum (Lf), and Weissella confuse (Wc) were employed as exogenous fermentation strains for sourdough preparation. Single-strain and two-strain mixed fermentations of buckwheat sourdough were conducted. Various analytical techniques, including HPLC and SDS-PAGE, were employed to explore the growth of exogenous lactic acid bacteria, major metabolic products such as organic acids and sugars, protein distribution, and their application in frozen dough bread production. The results indicated that in the fermentation of buckwheat sourdough, exogenous lactic acid bacteria strains all reached the logarithmic growth phase within 4 to 12 hours. The co-culture strains exhibited better growth, indicating a certain synergistic effect. Particularly, the co-culture strain Lf+Wc reached a bacterial count of 9.18 (lg(CFU/g)) at 12 hours of fermentation (sourdough mass basis) and generated a significant amount of fructose and extracellular polysaccharides. Compared to other groups, Lf+Wc demonstrated moderate acid production rate, lower protease activity, and slower protein degradation rate. Moreover, when applied to frozen dough bread, the Lf+Wc combination showed a smaller decrease in baking quality after 13 weeks of freezing. The baking loss rate only decreased by 5.3%. Additionally, GC-MS analysis of aroma compounds revealed an increase in eight volatile compounds in frozen dough bread from the Lf+Wc group after 13 weeks of freezing. In conclusion, Lf and Wc exhibited good synergistic effects, especially the metabolic products such as extracellular polysaccharides, which played a significant role in delaying the damage to frozen and frozen dough bread quality.

Key words: Lactic acid bacteria · Fermentation · Tartary buckwheat sourdough · Frozen dough bread · Flavor