Papain (cysteine protease), subtilisin (Protin SD-AY10, serine protease), and bacillolysin (Protin SD-NY10, metallo protease) increased the specific volume of gluten-free rice breads by 19–63% compared to untreated bread. In contrast, Newlase F (aspartyl protease) did not expand the volume of the rice bread. In a rheological analysis, the viscoelastic properties of the gluten-free rice batters also depended on the protease categories. Principal component analysis (PCA) analysis suggested that the storage and loss moduli (G′ and G″, respectively) at 35 °C, and the maximum values of G′ and G″, were important factors in the volume expansion. Judging from the PCA of the viscoelastic parameters of the rice batters, papain and Protin SD-AY10 improved the viscoelasticity for gluten-free rice bread making, and Protin SD-NY effectively expanded the gluten-free rice bread. The rheological properties differed between Protin SD-NY and the other protease treatments.

Principal component analysis suggested that protease treatment affected not only the volume expansion of gluten-free rice bread, but also its rheological properties.