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Rheological Properties of Orange Fleshed Sweet Potato, Pumpkin and Wheat Blended Flour Doughs and Quality Characteristics of Breads

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Abstract

There is increased demand for new bread products with health promoting benefits and good eating qualities. Orange fleshed sweet potato (OFSP) and pumpkin are high in bioactive compounds and fibre that can enrich the nutritional values of bakery products. However, incorporating gluten free flours such as OFSP and pumpkin flours into wheat flour may affect the quality characteristics of dough and bread. The study assessed the rheological properties of OFSP-pumpkin-wheat flour blended doughs as well as physicochemical and textural properties of breads baked at different temperatures and times. The constraint mixture design was used for the experimental design. The flour limits in the mixtures were: 40% wheat 90%, 10% OFSP 60%, and 10% pumpkin 40% whereas breads were baked at temperature and time ranged between 150–200 °C and 15–25 min, respectively. Farinograph analysis of dough showed that optimum water absorption, dough development, stability and degree of softening of doughs varied significantly ($p < 0.05$) between 50.8–60.1%, 2.2–33.8 min, 6.0–50.3 min and 9.0–138.0 BU, respectively. Moreover, increased incorporation of OFSP and pumpkin flours significantly ($p < 0.05$) decreased optimum water absorption and degree of softening whereas dough development and stability increased. The flour mixtures, baking temperature and time significantly ($p < 0.05$) influenced breads physicochemical and textural properties. Baking loss, loaf volume, loaf specific volume, crumb moisture and water activity of composite breads reduced while loaf weight increased as OFSP and pumpkin flours levels increased. Bread crusts and crumbs lightness (L^*) reduced whereas redness (a^*) and yellowness (b^*) increased with increased addition of OFSP and pumpkin flours. Additionally, baking at higher temperature (>180 °C) for longer time (>19 min) caused a significant ($p < 0.05$) reduction in loaf weight, volume, specific volume, L^* and b^* of breads while a^* increased. Furthermore, textural analysis of bread crumbs showed that hardness and chewiness increased significantly ($p < 0.05$) whereas cohesiveness, springiness and resilience decreased as OFSP and pumpkin flours, baking temperature and time increased. Generally, OFSP and pumpkin flours have potentials to replace wheat flour for bread development at inclusions not exceeding 33% and 12% respectively and baking at 160–180 °C for 15–19 min.

Keywords: Baking temperature, composite bread, orange fleshed sweet potato, pumpkin, rheological properties, textural properties