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Effect of Incorporating Peeled and Unpeeled Orange Fleshed Sweet Potato Flour on Rheological Properties of Dough and Quality Characteristics of Bread

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Abstract

Utilisation of alternative flours from underutilised crops rich in essential nutrients in the bakery industry would help improve nutrition and reduce wheat flour importation in Sub-Saharan African countries. However, wheat flour substitution with gluten free flours could significantly affect quality properties of baked foods. Therefore, this study compared the effect of replacing wheat flour with peeled and unpeeled orange fleshed sweet potato (OFSP) flour on dough and bread quality properties. The experiments were designed using the constraint mixture design. Wheat flour was replaced with either peeled or unpeeled OFSP flour between 10–60 % and breads were baked between 150–200 °C for 15–25 min. Dough and bread quality properties were analysed using standard equipment and procedures. Farinograph results showed peeled OFSP composite dough had lower optimum water absorption for consistent dough development (54.5–60.1 %) and degree of softening (59–134 BU) but longer dough development time (2.7–11.2 min) and higher stability (6.5–13.6 min) than the unpeeled OFSP composite doughs whose values ranged between 59.8–63.0 %, 92–168 BU, 2.7–9.2 min and 4.7–7.3 min respectively. The optimum water absorption reduced greatly while dough development increased as peeled or unpeeled OFSP flour addition exceeded 45 %. Moreover, peeled OFSP composite breads had a significantly ($p < 0.05$) higher loaf volume (174–330 cm^3/100 g flour) and specific volume (1.573–2.613 cm^3 g^{-1}) than the unpeeled OFSP composite breads (152–280 cm^3 and 1.381–2.297cm^3 g^{-1}). The crumb moisture and water activity were slightly lower in the peeled OFSP composite breads (25.32–31.43 % and 0.866–0.917, respectively) than the unpeeled OFSP composite breads (25.73–36.50 % and 0.874–0.925, respectively). The crust and crumb colour L*, a* and b* values were similar ($p > 0.05$) among the corresponding peeled and unpeeled OFSP composite breads. Textural profile analysis of bread crumbs showed peeled OFSP composite breads had significantly ($p < 0.05$) higher hardness, springiness, chewiness, resilience but similar cohesive values as compared with the unpeeled OFSP composite breads. Generally, loaf volume, specific volume, crumb cohesiveness, springiness and resilience decreased while hardness and chewiness increased as OFSP flour levels, baking temperature and time

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increased. Peeled OFSP flour could be used to substitute wheat flour for bread production at inclusion rate of 35 % and baking between 160–180 °C for 15–17 min.

Keywords: Crumb hardness, dough development, loaf volume, optimum water absorption, orange fleshed sweet potato, springiness