

## **Functional bread: Effect of red kidney bean and peanut flour on dough and bread characteristics**

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**Introduction:** Functional bread offers healthy options to consumers and manufacturers. The United Nations has increased public awareness of the nutritional benefits of pulses as a sustainable food source and declared 2016 the international year of pulses. Red kidney bean and peanuts have high protein and fiber and are potential ingredients for enriched functional baked products.

**Purpose:** The objective of this study is to evaluate the effect of red kidney bean and peanut flours on the physicochemical properties of dough and bread.

**Method:** Red kidney bean (RKB) and peanut (P) flours were prepared in the laboratory. Preliminary experiments were conducted on bread formulations to determine the levels of substitution using the criteria of acceptable flavor, aroma and appearance. Seven levels of substitution of RKB and P flours were used in a wheat flour base at 0:0, 25:00, 25:10, 25:15, 30:00, 30:10 and 30:15 ratio (w/w) RKB/P flour. Viscoelastic properties of dough were analyzed with creep recovery test using 100 Pa, strain sweep test (0.01 - 0.1% strain at 1 Hz) and frequency sweep test (0.1-10 Hz). Bread was evaluated for proximate analyses, volume, color, moisture content, texture properties and sensory evaluation.

**Results:** The substitution of RKB/P flour decreased significantly ( $p<0.05$ ) dough deformation (creep strain) making it stiffer compared to the control. When P-flour was included in the ratio, the dough deformation increased as the P-flour content increased. All RKB/P flour ratios increased dough solid- and liquid-like behavior in addition to zero shear viscosity as revealed by the frequency sweep test. The dough viscous to elastic behavior ratio with 25:00 and 30:00 RKB/P flour was not different from control. P-flour decreased bread volume compared to RKB-flour. Bread crumb and crust were darker and as the level of RKB-flour increased, the redness of bread increased. RKB/P flours increased the moisture of bread compared to control and increased crumb firmness ( $p<0.05$ ). Sensory evaluation scores of most bread characteristics of 25:00 and 30:00 RKB/P flour were comparable to the control and decreased with the incorporation of P-flour.

**Significance:** RKB flour at 30% substitution in yeasted bread had overall comparable sensory characteristics as wheat flour bread and improved protein and fiber up to 23.8 and 66%, respectively, compared to control. P-flour improved dough viscoelastic properties but not sensory scores. Research is needed to optimize peanut roasting to improve organoleptic characteristics of its flour for potential use in baked products.

**Keywords:** Functional bread, red kidney bean flour, peanut flour, viscoelastic properties