ABSTRACT

Gluten in wheat accounts for the unique Visco-elastic behavior of dough used for making leavened bread. Although making bread takes advantage of gluten in wheat to provide a Visco-elastic dough, the need for gluten is not as critical in chapatti as it is in volume pan loaves of bread. Therefore, in chapatti, alternative non-gluten proteins can be used to provide the nutritional and functional properties provided by gluten. This research used extrusion to modify the functional and pasting properties of cassava and cowpeas flour for flatbread (chapatti) making in Uganda.

The effect of extrusion on functional (BD, WAC, OAC, SP, WAI & WSI) and pasting properties (Peak, trough, breakdown, final viscosity, setback, peak time & pasting temperature) of cassava and cowpeas were investigated. The effect of extrusion on dough properties of cassava, cowpeas, and cassava/cowpeas composite was also investigated. The study further explores the potential of using modified cassava, cowpeas, wheat, and NC in various proportions (80, 60, 40 & 20) for chapatti making and the effect of extrusion on the textural and sensory properties of the chapatti made from the composite flours.

Fresh roots of cassava and dry cowpeas were obtained and processed into flour for this research. Cassava roots of NAROCASS1 cassava variety were peeled, washed, grated, and dry in a hot air oven dryer for about 3 hours 40 minutes at 50 ^{o}C. Dry seeds of Secow2 cowpeas were soaked for 72 hours, dehulled, and dry at 50 ^{o}C for 3 hours. After drying, both cassava and cowpeas were milled and extruded. Cassava was extruded at varying moisture content (40, 30, 20 & 10%) and constant screw speed (40rpm) and temperature (60 ^{o}C) while cowpeas were extruded at constant screw speed (40rpm) and varying temperature (70 & 60 ^{o}C) and moisture content (10 & 15%) respectively. The functional properties and particle size distribution were determined using standard methods and the pasting properties were determined using the Rapid Visco Analyzer RVA. The textural properties were determined using a texture analyzer and the sensory analysis was conducted using the 9-point hedonic scale.

Moisture content (MC) had a significant effect on the properties of HQCF. Water absorption capacity (WAC) increased from 245% to 732%, swelling power (SP) increased from 3.4 g/g to

7.2 g/g, and water absorption index (WAI) increased from 3.0% to 3.3% after extrusion at 40% MC. While at lower MC levels, bulk density (BD) increased from 0.7g/ml to 0.8g/ml for the non-extruded and 30% MC; oil absorption capacity (OAC) from 215% to 253% for the non-extruded and 10% MC; water solubility index (WSI) from 6.0% to 56% for the non-extruded and 20% MC respectively. Moisture content had a significant effect on the functional and pasting properties of cowpeas flour followed by temperature. Increasing moisture content from 10% to 15%, increased the bulk density from 0.4 to 0.5, Oil Absorption Capacity 149 to 238, Water Absorption Capacity 407 to 422, Swelling Power from 4.6 to 4.9, Water Absorption Index from 3.9 to 4.2, as well as Peak & Breakdown viscosities. On the other hand, reducing the moisture content decreased Water Solubility Index (WSI) from 31 to 21.

Blending cassava and cowpeas flours showed a significant effect on the functional and pasting of flour blends. Reduction in the proportion of extruded cassava flour in composite blends increased BD from 4.7-5.2g/ml, WAC 609-628%, OAC 202-224%, and WAI 3.5-3.8% while increment of cassava substitution increased SP from 5.8-6.3g/g and WSI 40-43%. The pasting temperature increased from 50-53 ^{o}C with a reduction in the proportion of extruded cassava flour while the rest of the pasting properties increased as the proportion of extruded cassava flour was increased in the blends.

The increasing proportion of native cassava flour in the wheat-native cassava composite chapatti decreased the resistance to extension, and area under the curve but had no significant effect on the extensibility and yield of the chapatti. Increasing the proportion of modified cassava flour in wheat to wheat-modified cassava composite chapatti decreased resistance to extension of chapatti but increased extensibility of the chapatti with no effect on yield. Increasing the proportion of modified cassava flour for chapatti made from modified cowpea-cassava composite chapatti decreased resistance to extension and area under the curve but increased the extensibility of the chapatti with no effect on yield. Chapattis made from 80W:20EC and 80W:20NC were not distinguishable from those made from 100% wheat flour by the sensory panel. The sensory acceptability scores for chapattis made from 80W:20EC and 80W:20NC were about 6-8 (like slightly-like very much), while those for the chapattis made from 20CP:80EC were about 4-6 (dislike slightly to like slightly). Modification of cassava flour further improves the textural and sensory properties of the chapatti.