UTILISATION OF FLOUR MILLED FROM MICRONISED (130ºC) COWPEAS IN MAIZE BASED TRADITIONAL MALAWIAN SNACKS

P. Katungwe, A. Mulwafu and A.M. Mwangwela

Department of Home Economics and Human Nutrition, Bunda College of Agriculture, University of Malawi, Lilongwe, Malawi, amwangwela@bunda.unima.mw

INTRODUCTION

Maize flour based snacks are widely consumed in most Malawian households. These snacks are prepared using maize flour and they include: whole maize flour bread (*chikondamoyo/chigumu*), whole maize flour fritters (*zitumbuwa*) and white maize flour steamed bread (*mkate*) respectively. These snacks are of low protein quality which can be improved by incorporating flour from locally found legumes such as cowpeas. Cowpea contains substantial quantities of lysine and, when blended with cereal grains, gives mixtures with complementary amino acid profiles and improved protein quality (Bressani, 1985).

Cowpea flour has been incorporated in other snack products such as cookies and bread. However it has been reported that the use of flour from raw cowpeas in such formulations produces bakery products that have a raw legume flavour and a hard texture (Hallen et al., 2003). Thus, there is need to explore the use of heat treated cowpea flour to reduce the raw legume flavour and improve on the texture of the end products (McWatters, et al., 2003). Micronisation is a short-time, high-temperature process that utilises electromagnetic radiation in the infra red region (wavelength of 1.8-3.4 nm) to rapidly heat materials (Zheng et al., 1998). Micronisation of moisture-conditioned seeds has been shown to precook legumes such as cowpeas (Mwangwela et al., 2006). Therefore the objective of this study was to investigate the possible use of flour from micronised cowpeas in maize flour based snacks.

MATERIALS AND METHODS

Pre-conditioned white cowpeas (var. Bechuana) were micronized to 130 °C and air-dried at approximately 40 °C followed by milling into fine flour (250 μm). The cowpea flour (C) was blended with either whole maize flour (M) or white maize flour (60 % extraction) in the following proportions: Maize:cowpea; 3:1, 3:2, 3:3. The resulting flours were used to prepare three maize-based traditional Malawian products, i.e. (1) maize bread; (2) maize-banana fritters and (3) steamed maize-banana bread.

Properties of the flour - The methods for determining least gelation concentration, water absorption capacity and swelling index were as reported by Mwangwela, et al. (2007). Gel strength was determined using the % sag method. Crude protein content in the composite flours was determined using the micro-Kjeldahl method (AOAC actions 24.BO1-24.BO3).

Recipe for maize bread - Whole maize flour (450g) was mixed with bicarbonate of soda (7g), salt (3g) and sugar (100g). The dry ingredients were then mixed with 120 ml of water and 260 ml of milk. The dough (50 g) was weighed into a greased muffin pan and baked in a preheated oven at 250 ºC for 10 min and at 200 ºC for 35 min.

Recipe for fritters - Whole maize flour (300 g) was thoroughly mixed with 300 g mashed ripe bananas and formed into balls (40 g). The ball was flattened to a uniform thickness using a base of a plate. The fritters were then deep fried at 140 ºC for 4 min.

Recipe for steamed bread - White maize flour (300 g) was mixed with 300 g mashed ripe bananas. The dough was formed into a ball (70 g) and flattened using a base of a plate of uniform thickness. The flattened dough was wrapped in aluminium foil and steamed in a steamer for 15 min.

Sensory evaluation of snacks - A descriptive sensory panel was used to evaluate the sensory attributes of the snacks. A 10 member panel was recruited and trained to evaluate the sensory attributes of the snacks using a scale ranging from 0 to 9, where 0 was the absence of an attribute and 9 was an extreme presence or manifestation of the same.

Mean values for the functional properties of the flours and sensory properties of the snacks were obtained from three repetitions. One way analysis of variance (ANOVA) of the data and correlations of variables was performed using Microsoft Excel (2003) and SPSS (Version 12 for Windows) statistical software. The least significance difference test at $P \leq 0.05$ was used to separate the means.

RESULTS AND DISCUSSION

The incorporation of cowpea flour from micronised seeds significantly ($P \leq 0.05$) increased the protein content of the composite flours (Table 1). Flour from micronised cowpeas has been reported to contain about 24.7% crude protein (Mwangwela et al. 2007).

Table 1. Effect of incorporating flour from micronised cowpeas on protein content and functional properties of maize-cowpea composite flour

	Protein (%)	**Water Absorption Capacity (%)**	**Swelling index**	**Gel strength (% sag)**	**Least gelation concentration (%)**
M	14.6	97.1	12.4	35.2	13
MC 3:1	17.5	134.7	13.4	38.3	14
MC 3:2	21.2	163.4	14.0	27.3	14
MC 3:3	21.9	168.1	14.6	24.6	14
W	11.7	134.6	9.1	1.9	10
WC 3:1	15.3	136.6	11.5	3.7	10
WC 3:2	16.8	152.9	11.8	2.7	11
WC 3:3	20.4	163.7	13.4	3.7	11

M- Whole maize flour; W – White maize flour (60% extraction); C- flour from micronised cowpeas

Cowpea flour had significant ($P \leq 0.05$) effects on the functionality of the blended maize flours. Water absorption capacity, swelling index, and least gelation index increased. While cowpea flour increased the gel strength of the white maize flour it reduced the gel strength of whole maize flour.

The incorporation of cowpea flour from micronised seeds did not have a significant effect on the perceived sweetness and softness of the steamed bread (Figure 1). However, for all the three

snacks the beany aroma and browning increased significantly ($P \leq 0.05$) with increasing proportions of flour from micronised cowpeas (Figures 1, 2, 3). The increase in browning of the steamed bread and the crumb (interior) of the fritters and baked bread could be attributed to the browning of the cowpea flour following the micronisation process (Mwangwela et al. 2007). However, the increased browning of the crust in fritters and baked bread would be attributed to Maillard reactions during the frying and baking of these products since the composite flours had higher protein content than the whole maize flour.

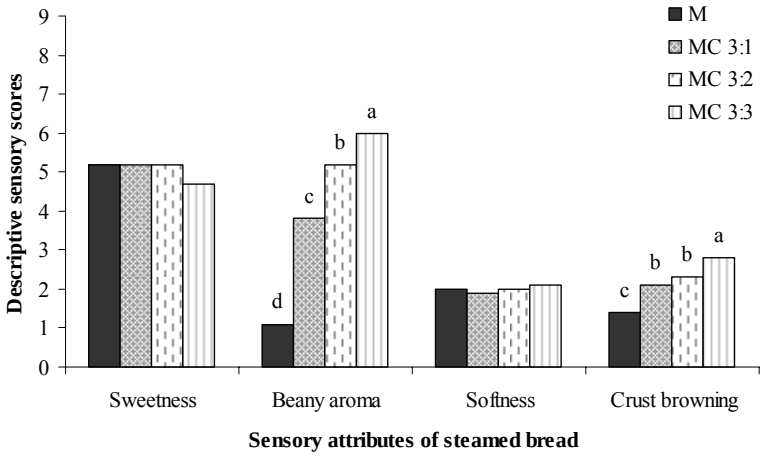

Figure 1: Effect of incorporating cowpea flour milled from micronised seeds on sensory attributes of traditional Malawian steamed bread
Values of the same sensory attribute but with different letters are significantly different at the 95% level.

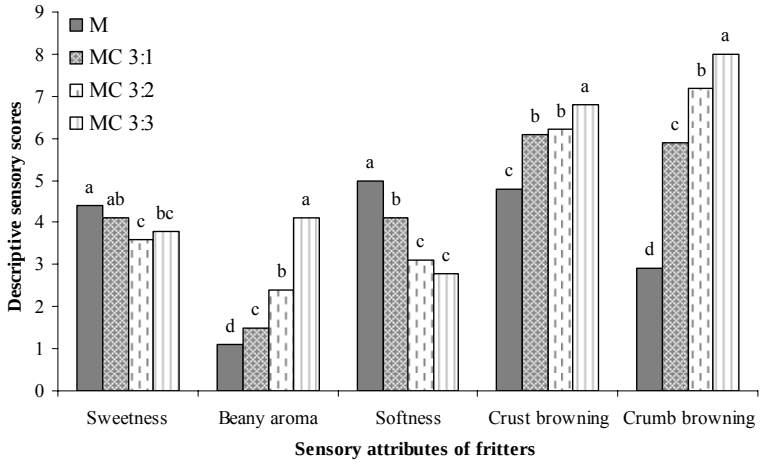

Figure 2: Effect of incorporating cowpea flour milled from micronised seeds on sensory attributes of traditional Malawian fritters
Values of the same sensory attribute but with different letters are significantly different at the 95% level.

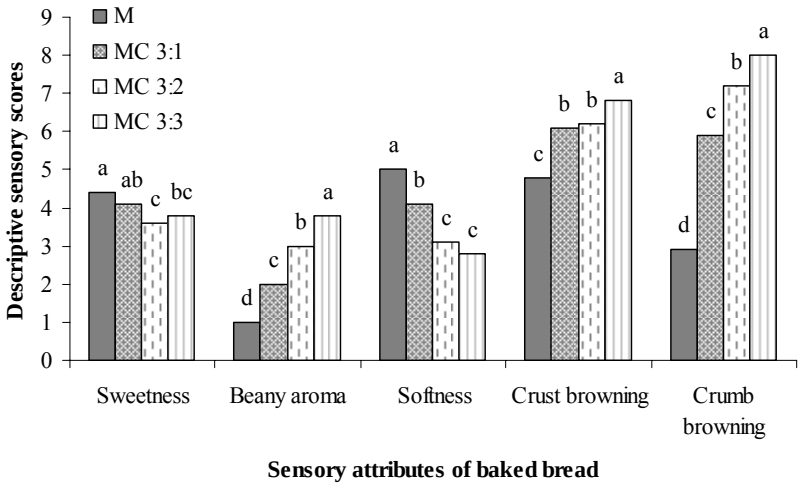

Figure 3: Effect of incorporating cowpea flour milled from micronised seeds on sensory attributes of traditional Malawian baked bread.
Values of the same sensory attribute but with different letters are significantly different at the 95% level.

The bread and fritters made from whole maize flour were significantly softer than the ones made with composite flours. The hardening of the texture could be attributed to the increased protein content of the composite flours. Since bicarbonate of soda was used as leavening agent for the bread, the solubility of the protein was possibly increased hence contributing towards the texture of the product.

CONCLUSIONS

The incorporation of cowpea flour milled from micronised seeds imparted a beany aroma in all the three snacks, reduced the softness and increased the browning of both the crust. The beany aroma was relatively stronger in steamed bread than the baked bread and fritters possibly due to the difference in moisture levels during cooking. Consumer evaluation of the snack will have to be conducted to determine the acceptability of the snacks.

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