CHARACTERIZATION OF PUFFED SNACKS FROM MALTED PEARL MILLET AND COWPEA COMPOSITE FLOUR

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ABSTRACT

Cowpea is a rich source of plant proteins with a well-balanced amino acid profile and a sustainable alternative to animal proteins. Pearl millet is a climate-smart and sustainable cereal grain rich in nutrients. Nigeria is a leading producer of cowpea and pearl millet. Malted pearl millet flour is characterised by reduced anti-nutrients and improved nutritional quality. The perceived quality and convenience associated with puffed snacks as ready-to-eat food would increase its consumption. The aim of this study was to characterise puffed snacks from malted pearl millet (MPM) and cowpea (CP) composite flour. Simplex lattice mixture design was used at MPM flour (70-90%) and CP flour (10-30%) as independent variables that produced eight formulations. Puffed snack samples were produced from the flour formulations using a twin-screw extruder. Proximate (moisture, crude fat, crude fibre, crude protein, crude ash and total carbohydrate), total dietary fibre, phytochemical (phenol, phytate, flavonoid) and antinutrients (tannin and oxalate) compositions of the flours and snacks were evaluated. Consumer acceptability of the snacks was evaluated. Data from experimental runs were analysed using ANOVA, regression model generation and numerical optimisation. The optimised snack sample was analysed for amino acid profile, protein digestibility, instrumental texture profile and quantitative descriptive sensory profile. The composite flours differed significantly ($p<0.05$) in moisture (4.60-5.90%), crude fat (7.50-9.00%), crude fibre (0.50-1.00%), crude protein (9.20-14.45%), crude ash (1.33-2.49%), total carbohydrate (68.91-74.65%), dietary fibre (4.72-5.65 mg/100 g), phenol (103.60-110.00 mg/100 g), phytate (3.04-3.97%), flavonoid (518.46-583.54 mg/100 g) tannin (69.40-77.32 mg/100 g), and oxalate (4.82-8.56 mg/100 g) contents. The puffed snacks also differed significantly ($p<0.05$) in moisture (3.20-6.00%), crude fat (4.00-6.00%), crude protein (10.51-13.55%), total carbohydrate (73.89-77.56%), phenol (31.56-47.86 mg/100 g), flavonoid

(205.16-277.29 mg/100 g), tannin (53.37-75.97 mg/100 g), contents and overall acceptability (7.02-7.62). The optimised puffed snack had MPM flour of 70% and CP flour of 30% with a desirability (0.603). Characteristics of the optimised puffed snacks included essential amino acids [tryptophan (0.78±0.00 g/100 g), leucine (6.74±0.04 g/100 g), methionine (1.35±0.01 g/100 g), lysine (3.46±0.01 g/100 g)], non-essential amino acids [cysteine (1.09±0.00 g/100 g), glutamic acid (15.63±0.06 g/100 g), tryptophan (0.78 g/100 g) and cysteine 1.09 g/100 g]. The *in-vitro* protein digestibility of the optimised snack was 74%. Texture profile of the optimised snack was hardness (4115.00 N), adhesiveness (2118.98 Pa), chewiness (35.00 N), gumminess (360.00 N) and springiness (0.10 mm). Sensory profile of the optimised snack was described by ten terms: beige colour, puffy appearance, hollow shape, bland taste, bitter aftertaste, malty and grainy aroma, rough, crunchy and chewy texture. In conclusion the optimum ratio of 70% MPM and 30% CP composite flour was recommended for commercial production of puffed snacks due to its favourable characteristics such as high protein content and protein digestibility, good amino acid profile and low anti-nutrients composition.