STUDIES ON FUNCTIONALITY OF PLANTAIN- COWPEA BLENDS FOR EXTRUDED SNACKS

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ABSTRACT

Influence of functional and proximate properties of flour and blends of plantain and cowpea flour were determined to assess their suitability for making extruded snacks. The proximate and functional characteristics (Water absorption index, water solubility index and pasting) of the flour were determined. The rheological properties , protein, crude fiber and fat contents of blends of 90:10, 80:20, 70:30, 60:40 and 50:50 from the plantain and cowpea flours were determined. The influence of drying and extrusion on the functional properties of dried plantain and cowpea flours from different varieties was determined, along with their suitability for making extruded snacks. The varieties are: plantain (*Apantu* and *Apem*) and cowpea (*Nhyira* and *Asetenapa*), and there were significant differences ($P<0.05$) in both product varieties. The proximate composition, functional uniqueness, and rheological properties of dried plantain and cowpea blends (plantain: cowpea) 90:10, 80:20, 70:30, 60:40 and 50:50 were evaluated with the Brabender amylograph before extrusion cooking. For example, the rheological property peak paste viscosity in Brabender Units (BU) decreased from 595.5 BU for plantain, to 281.5 BU for plantain and cowpea (75:25%). Cowpea peak paste values were *Nhyira* 6 BU and *Asetenapa* 13BU. As the amount of cowpea in the plantain blends increased, the BU decreased. The extruded snacks were formulated from the plantain and cowpea flours at ratios of, plantains (75 to 100%), cowpea (0 to 25%), and oat fiber (0 to 25%) and extruded through a ZSK 30 twin-screw extruder at temperatures of 90 to 140 °C into half- and expanded-products. Pasting properties of the extruded blends determined with a Rotovisco Analyzer (RVA) were significantly different ($P<0.05$) among varieties. The peak viscosity for the extruded plantain was 6719.5 cP, blending with cowpea at 25 wt% reduced peak paste viscosity values to 4511.0 cP. Differences in rheological properties depended on plantain and cowpea varieties, and the paste property of extruded products was affected by the level of cowpea.

- Plantain (*musa paradisiacia*) is among the green vegetables with the richest iron and other nutrients contents.
- Plantains are highly perishable and subjected to fast deterioration, as their high moisture content.
- Cowpea*(Vigna unguiculata)* is an excellent source of niacin, thiamine, riboflavin and other water soluble vitamins, and calcium, magnesium, potassium and phosphorus.
- Extrusion cooking is the process where moistened starch and protein materials are cooked and worked into viscous, plastic-like dough.
- **OBJECTIVE:** To assess the suitability of plantain and cowpea flour blends for extruded snacks by studying the functional and proximate properties of the flours

MATERIALS AND METHODS

- Freshly harvested *Apantu* (falsehorn) and *Apem* (French) plantains varieties . Cowpeas- : *Asetenapa* and *Nhyira* varieties.
- Commercially processed plantain flour obtained from(Raymond- Hadley Corp.Spencer, NY 14883), white bean flour(Bob's Red Mill Natural Foods, INC.), and oat fiber from Sun Opta Ingredient Group(Chelmsford, MA).

Sample Preparation:

Plantain flour (Singh and Heldman, 2001)

Cowpea flour

- Soak cowpea for 36hr
- Dehulled by rubbing with hands in water
- Cotyledons were washed and blanched for 6mins at 100°C
- Dried at 60°C for 8hr, m.c 8-10%.
- Milled and sifted with 250micron sieve
- Flour packaged in air-tight container at 37°C for further analysis.

Analytical Methods:

- Proximate Composition (AOAC, 2000).
- Water absorption Index (WAI) & Water Solubility Index (WSI) (Jin *et* al., 1995).
- Rheological determination (AACC, 2000) (Zhuo *et al*, 1998).
- Extrusion processing was conducted for Half and expanded product at USDA-ARS Eastern Regional Research Center, U.S.A using 100kg of commercially plantain flour, white flour and oat fiber.
- Blends used 1) 100% plantain, 2)100% white bean flour 3) 75% plantain and 25% white bean flour 4) 75% plantain, 25% oat fiber and 5) 50% plantain, 25% white bean flour and 25% oat fiber.
- Statistical Analysis Systems version- 9.1227 SAS 2003 was used to analyze data.

RESULTS AND DISCUSSION

- Cowpea flours recorded high protein content compared to plantain flour.
- The water absorption Index of plantain flours were higher than the cowpea flours.
- Apantu plantain flour gave high rheological properties.
- Protein content increased as the level of cowpea addition to plantain flour increased.
- Color of the extruded half-product looked more appealing. Similar expansion and puffing characteristics was reported for cassava, barley, and quinoa products (Onwulata *et al*., 2010).
- Drying after the extrusion process reduced the moisture content in the extrudates,.

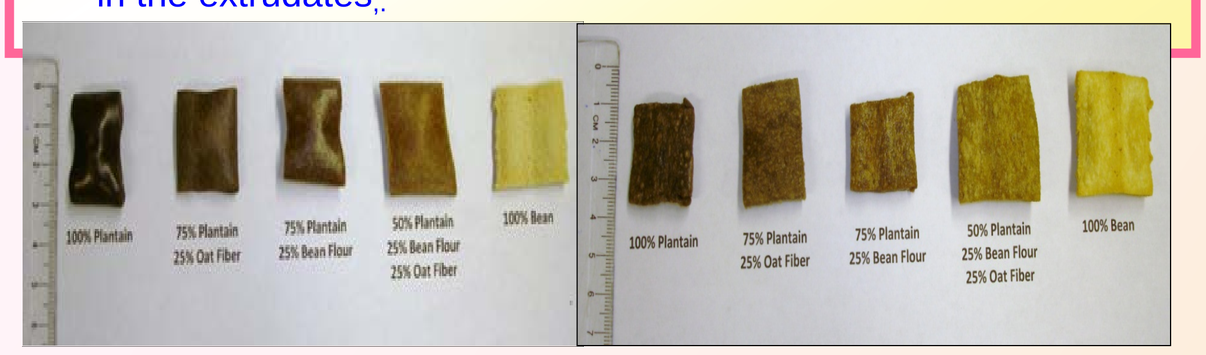

Fig. 1 Pictures showing extruded and baked half-products from plantain, white bean flour and oat fiber

Table 1: Proximate composition of Plantain and Cowpea flour

Flour	Moisture (g/100g)	Protein (g/100g)	Carbohydrate (g/100g)	Crude fiber (g/100g)
Plantains				
Apantu	8.2	1.7	85.6	0.6
Apem	8.7	2.6	84.4	0.6
Cowpeas				
Asetenapa	7.8	23.4	62.3	1.4
Nhyira	6.1	22.7	65.2	0.7

CONCLUSION

Differences in the rheological properties of extruded plantain and cowpea flours depended on the varieties, and the amount of cowpea added. The addition of cowpea flour boosted the protein content of the plantain flour formulation.

REFERENCES

- AOAC, (2000). Official Methods of Analysis. 17th edition. Association of Official Analytical Chemists, Washington D.C.
- Onwulata, C.I., Thomas, A.E., Cooke, P.H., Phillips, J.G., Carvalho, C.W.P.,Ascheri, J.L.R., and Tomasula, P.M. 2010. Production of Extruded barley, cassva, corn and quinoa enriched with whey proteins and cashew pulp. International Journal of Food Properties, 13(12),1-22.

Acknowledgements: African Women in Agricultural Research Development (AWARD) . USDA- ERRC

Presented at the 10th African Crop Science Society Conference. Maputo, Mozambique, 10-13 October, 2011