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EFFECTS OF PROCESSING ON THE FUNCTIONAL, MINERAL AND SENSORY PROPERTIES OF LOCAL SNACKS (CASSAVA CHIPS) PRODUCED FROM CASSAVA-BAMBARA GROUND-NUT BLEND

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ABSTRACT

Local Snacks (Cassava chips) developed from cassava and Bambara groundnut flour blend were analyzed and evaluated. The objective was to evaluate functional, mineral and sensory properties of the products. From the results, it was indicated that the results of Functional Properties of local snacks

Introduction

Background of the Study

Inconsistent supply of healthy food subjected a lot of people in developing countries especially Nigeria unable to meet the nutrient requirements for a period of time, which result in imbalances associated with homeostasis, body weight, physical activities and other specific functions (Marshall, 2016; Grover & Ge, 2009). Similarly, recurrent problems associated with malnutrition in children and lactating women who have been projected as better and economically possible alternative sources of protein and calories than animal protein especially in low

revealed that, the bulk density was found to be statistically ($p<0.05$) higher in Sample E (5.00±0.07 mg/100g). Also, water absorption capacity was found to be statistically ($p<0.05$) higher in Sample E (5.92±0.14 mg/100g). Similarly, Oil absorption capacity was highest in Sample D and E (10.03±0.04mg/100g). Swelling capacity was found to be statistically ($p<0.05$) higher in Sample A (22.40±0.64 mg/100g). The results of mineral composition of local snacks indicated that, the sodium content was found to be statistically ($p<0.05$) higher in Sample D (10.45±0.19 mg/100g). Also, potassium content was found to be statistically ($p<0.05$) higher in Sample C (9.90±0.21 mg/100). Similarly, Calcium content was highest in Sample C (13.40±0.07mg/100g). Phosphorus content was found to be statistically ($p<0.05$) higher in Sample D (8.74±0.19 mg/100g). Magnesium content was statistically ($p<0.05$) higher in Sample C (10.68±0.04 mg/100g). Similarly, Sample C showed the highest iron content of (11.81±0.04 mg/100g). Also zinc content of (10.66±0.49 mg/100g) was statistically higher in Sample C (5.66 ±0.049mg/100g). The results of Sensory Evaluation of local snacks revealed that, the Taste was found to be statistically ($p<0.05$) higher in Sample A (7.66±1.11). Also, appearance was found to be statistically ($p<0.05$) higher in Sample B (8.53±0.14 mg/100). Similarly, Aroma was highest in Sample C (8.80±0.07mg/100g). Color was found to be statistically ($p<0.05$) higher in Sample D (8.73±0.19 mg/100g). Also, texture was found to be statistically ($p<0.05$) higher in Sample D (8.73±0.14 mg/100). Similarly, Aroma was highest in Sample C (8.80±0.07mg/100g). General Acceptability was found to be statistically ($p<0.05$) higher in Sample A (7.83±0.19 mg/100g).In conclusion, Local snacks can be produced from Cassava/Bambara Ground-nut blend using cooking method.

Keywords: Snacks, Cassava Chips, Bambara ground-nut Processing, Sensory Properties

income countries (Famurwa & Raji, 2005). Exploitation of nutritional value of leguminous seeds and other dicotyledonous contributes to agricultural and economic development, food security and self-defence (Snathar, 2007).

Wild plants play an important role in the diet of most rural dweller in Nigeria. These plants tend to be drought resistant and collected due to their availability, affordability as well as the need (Kubmarawa, Mogomya, Yebpella, & Adebayo, 2011). Throughout the year, wild plants aid in supplying nutrients and calories especially during dry season when cultivated vegetables are scarce.

On the other hand, one of the major problems of plants is the present of anti-nutrient which limit their utilization (Kathirvel & Kunydha, 2011). Mineral from plant sources, particularly those from plant seeds are less bio-accessible than those from animal sources due to phytic acids, tannins and fibre content (Moeelijo, Field, & Gordon, 1998) Cooking/boiling (Omenna, Olapekun, & Kolade, 2016), germination (Sokrab &Babiker, 2012) and fermentation (Osman, 2011) have been found to reduce significantly the level of most of the of the anti-nutrients.

Cassava chips are dried irregular slices of roots, which vary in size but should not exceed 5cm in length (Onyenwoke, 2014). The tuberous roots, either peeled or unpeeled are cut up into chips and dried to be used for human consumption and in the animal feed industry.

In Nigeria, cassava roots are processed into different products as a means of preservation due to their perishability. These products vary depending on culture of the individuals. Some include gari, fufu (Akpu), lafun, starch, flour, tapioca and local chips (Andrew, 2002). The increasing demand for cassava and its products for export and other utilization purposes has necessitated its conversion into chips, prior to further processing. This practice has become a widespread practice for both small and large scale processors. Size reduction shortens the drying time with the added advantage of eliminating the cyanide component present in the fresh root (Aristizabal, 2007).

According to (FAO, 2004), Nigeria was ranked the largest producer of cassava globally; a third more than production in Brazil and almost double the production of Indonesia and Thailand. More recently, it is documented that Nigeria produces an estimated 54 million metric tonnes of cassava per annum (FAO, 2014); identified the north central zone in Nigeria as the

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highest producing zone for cassava on a per capital basis, of which Benue, Kogi and Niger states were the highest contributors.

One of the major challenges faced by processors is the poor storage capacity of fresh cassava produce, as tubers may contain up to 70% moisture. This has led to traditional marketing and storage systems being adapted to avoid root perishability (Aristizabal, 2007).

Bambara groundnut crops are most herbaceous plants from the family of legume. It is an important item in the diet of West African. It is a source of plant protein. It can be consumed boiled after freshly harvested, roasted and eaten with palm kernel as a snack when dry (Alozie, et al, 2001). (Ijarotimi & Keshinro, 2012) revealed that protein-energy malnutrition among children is the major health challenges in developing countries particularly Nigeria.

Bambara groundnut flour is eaten in various ways, either alone or mixed with maize, rice, fish or gari. Bambara groundnuts are sometimes grown as cover crops because it is valuable for improving soil fertility. Bambara contain 7.3% moisture, 18 to 24% protein, 6.0 to 6.5% fat and 60 – 63% carbohydrate. The immature seeds are boiled and eaten as an early harvested source of food and the matured seeds are cooked or made into flour. It is cultivated both as an intercrop with maize, cowpea, melon or as a sole soup.

Materials and Methods

Materials

Cassava tubers (Manihot esculenta) was be purchased at Old Market, Bida, Niger State while Bambara groundout was obtained from National Cereals Research Institute (NCRI), Badeggi, Niger State.

Preparation of Samples

Cassava Flour Processing

Two bunch of cassava tubers was washed to remove the surface dirt. The tubers were peeled and grate into mash. The mashed product was fermented for 12 hours to reduce the toxic level. The fermented pulp was then dehydrated to remove excess water. Thereafter, the dehydrated cassava pulp was sieved and package until require for usage.

Bambara Groundnut Flour

Two kilogrammes of Bambara groundnut seeds was de-stoned cleaned from contaminants manually. The seeds were soaked in three litres of clean water for 5 hours. The soaked seeds were de-hulled by pounding in a mortar and pestle and washed in a floating water to remove the seed coat. The de-hulled seeds were drained and dried at ambient temperature to moisture content of 6%. The dried Bambara nut was milled in a milling machine into fine flour, sieved through a 2mm mesh and then packaged in an airtight plastic container until required for usage.

Table 1: Formulation of the Blends

Samples	Cassava	Bambara ground-nut
A	100%	0%
B	95%	5%
C	85%	15%
D	75%	25%
E	50%	50%

Functional properties

The water absorption capacity, bulk density, swelling index, oil absorption was determined by the method described (by Obaroakpo et al., (2010).

Mineral Analysis

Zinc (Zn), Iron (Fe), Calcium (Ca), Sodium (Na), Potassium (K) and Magnesium (Mg) were determined by Atomic Absorption Spectrophotometers (AAS); according to the method of AOAC (2003).

Sensory Evaluation

The sensory evaluation of the products was performed using a 9 point hedonic scale ranking 1-9, where 1 = extremely dislike, 2=dislike moderately 3=dislike slightly 4=dislike very much 5= neither like or dislike 6= like very much 7= like slightly 8= like moderately and 9 = like extremely with 12 panelist which comprises of Staff and students of Nutrition and dietetics in Federal Polytechnic Bida who will assess the product for flavor, Aroma, color, taste and overall acceptability.

Statistical Analysis

Data was analyzed using analysis of variance ANOVA and Duncan multiple range test to test significant differences between means p>0.05. Data analysis was done using statistical package for social sciences SPSS version 20.0.

Results and Discussion

Bulk density serves as an important functional property which aids in assessing the bulk density of the products. (Filli *et al*., 2013). The processing methods strongly influenced the bulk density values as observed in this study, suggesting an optimum relationship since the lowest value of bulk density was observed. Similarly, high temperature has been linked to low bulk density which could be due to starch gelatinization under such conditions (Hagenimana *et al.,* 2006). Also, Ding *et al.* (2006) reported decrease the bulk density. The high dependence of bulk density and Swelling capacity would reflect its influence on elasticity characteristics of the starch-based material.

Water absorption index is a measure of starch digestibility and is dependent on the degree of gelatinization and dextrinization (Pardhi *et al.,* 2017). Thus, presence of polar head groups in the developed blend determines its interaction with water molecules. Cooking reduced the degradation of granules and increasing the water absorption index (Hagenimana *et al.,* 2006). Similarly, High temperature was reported to support low water absorption during cooking of starch based binders (Pan *et al.,* 1998). The amount of water associated to proteins is closely related with its amino acids and increases with the number of charged residues, conformation, hydrophobicity, pH, temperature, ionic strength and protein concentration (Suresh*et al.,* 2013).

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Table 2: Functional Properties of Local Snacks (Cassava Chips) produced from Cassava/Bambara ground-nut flour blend

Parameters	Sample A	Sample B	Sample C	Sample D	Sample E
Bulk Density	5.57±0.05	5.69±0.07	5.71±0.02	5.78±0.07	6.00±0.07
Water Absorption	6.84±0.05	6.86±0.06	6.80±0.07	6.77±0.04	6.92±0.14
Oil Absorption	7.84±0.221	8.49±0.05	9.74±0.35	10.03±0.01	10.03±0.04
Swelling Capacity	22.40.±0.64	21.02.±0.67	19.92±0.11	18.39±0.71	18.09±0.27

Values are mean± SD. Values with different superscripts on the same row are significantly different at p<0.05.

Key: Sample A (100:0), Sample B (95:5), Sample C (85:15), Sample D (75:25), Sample E (50:50)

The result of mineral composition of the samples showed that there were significant differences (p≤0.05) in all the parameters except phosphorus content. But unlike sample D had the highest sodium content (10.45±0.19) and sample C had the calcium content (13.40±0.07) while sample E had the highest magnesium (7.75±0.07 mg/100g) content, but when compared with Chima *et al.* 2012, the result showed that the mineral composition of the samples increased above the values of the control with increase in the addition of legumes. Thus, the addition of Benniseed improved the content of both the major and trace mineral ions. This observation may be as a result of proportional increment in the content of the minerals possibly as a result of enzyme solubilization and leaching of the anti-nutritional factors binding them through leaching. Minerals like iron, calcium and zinc are often added to food for the improvement of nutritional composition (Camire *et al.*, 1990). In this study, the result of both iron and zinc contents were observed to be statistically higher in all the samples. This increase could be attributed to destruction of antinutrients (phytic acid) during cooking. Similarly, iron and zinc act as cofactors for enzymes during normal metabolic processes

(Agunbiadeand Ojezele, 2010). In addition, iron is needed for the prevention of anaemia; while zinc is a component of living cells and essential for assisting enzyme reaction and wound healing (Agunbiade and Ojezele, 2010).

Table 3: Mineral composition of Local Snacks (Cassava Chips) produced from Cassava/Bambara ground-nut flour blend

Parameters	Sample A	Sample B	Sample C	Sample D	Sample E
Sodium	10.31±0.75	9.26±0.19	9.24±0.02	10.45±0.19	8.12±0.19
Magnesium	8.80±0.12	6.48±0.17	10.68±0.04	7.40±0.07	6.2±0.04
Calcium	9.90±0.08	9.90±1.47	13.40±0.07	12.53±0.07	10.36±0.09
Phosphorus	7.12±0.03	7.81±0.18	8.54±0.03	8.74±0.19	8.00±0.10
Potassium	11.46±0.14	13.60±0.07	14.90±0.21	13.30±0.07	11.61±0.08
Iron	11.23±0.07	11.56±0.21	11.81±0.04	11.71±0.15	10.02±0.13
Zinc	9.04±0.96	10.17±0.35	10.66±0.49	8.05±0.07	8.33±0.03

Values are mean± SD. Values with different superscripts on the same row are significantly different at $p<0.05$.
Key: Sample A (100:0), Sample B (95:5), Sample C (85:15), Sample D (75:25), Sample E (50:50)

The result of Sensory Evaluation of Cassava chips revealed that, the Taste was found to be statistically ($p<0.05$) higher in Sample A (8.66±1.11). Also, appearance was found to be statistically ($p<0.05$) higher in Sample B (8.53±0.14 mg/100). Similarly, Aroma was highest in Sample C (8.80±0.07mg/100g). Colour was found to be statistically ($p<0.05$) higher in Sample D (8.73±0.19 mg/100g). Also, texture was found to be statistically ($p<0.05$) higher in Sample D (8.73±0.14 mg/100). General Acceptability was found to be statistically ($p<0.05$) higher in Sample A (8.83±0.19 mg/100g).

Table 4: Consumer's Acceptability of Local Snacks (Cassava Chips) produced from Cassava/Bambara Ground-nut flour blend

Parameters	Sample A	Sample B	Sample C	Sample D	Sample E
Taste	7.66±1.11	7.53±1.30	6.93±1.33	7.53±1.35	6.86±1.35
Appearance	7.40±1.04	7.53±0.1.24	7.26±1.16	7.33±0.07	7.13±0.35
Aroma	7.13±0.08	7.60±1.47	7.80±0.07	7.20±0.07	7.46±0.09
Colour	7.53±0.03	7.66±0.18	7.66±0.03	7.73±0.19	7.20±0.10

Texture	7.73±0.14	7.46±0.07	7.53±0.21	7.33±0.07	7.66±0.08
Acceptability	7.83±0.07	7.53±0.21	7.40±0.04	7.13±0.15	7.00±0.13

Values are mean± SD. Values with different superscripts on the same row are significantly different at $p<0.05$. **Key**: Sample A (100:0), Sample B (95:5), Sample C (85:15), Sample D (75:25), Sample E (50:50)

Conclusion

In this work, different samples Cassava/Bambara ground-nut flour blends were produced. Out of the five samples prepared, sample C was enhanced in terms of functional and mineral properties value. In conclusion therefore, Local snacks can be produced from Cassava/Bambara ground-nut blend using cooking method.

References

Agunbiade, S.O. andOjezele, M.O. (2010). Quality Evaluation of instant Breakfast Cereals Fabricated from Maize sorghum soybean and African yam bean *(Sphenostylisstenocarpa). Journal of Dairy and Food Science*,5(1): 67-72.

Alozie, Y E; et al. (2001). Utilization of Bambara groundnut flour blend in bread production. *Journal of Food Technology* 7(4); 111-114.

Andrew, W. (2002). Cassava utilization, storage, and small scale processing. *Natural Resource Institute*.

AOAC, (2003).*Official method of Analysis*, 17th ed. Association of Official Analytical Chemists Washington D.C.

Aristizabal, J & Sanchez, T;. (2007). Cassava Production Analysis. *FAO Rome*.

Camire, M.E.; Camire, A.; Krumhar, K. (1990) Chemical and nutritional changes in foods during extrusion. Critical Review in Food Science and Nutrition. 29, 35–36.

Chima, C.E, Ariahu, C.C and Abu, J.O., (2013). Chemical Composition, Functional Properties and Pasting Properties of Cassava Starch and Soy protein Concentrates blend. *Journal of Food Science and Technology* 50 (1179-1185)

FAO. (2004). Food and Agriculture Organization of the UN. Retrieved from www.fao.org/3/a- i6198e.pdf

FAO. (2014). Food and Agriculture Organization of the UN. Retrieved from www.fao.org/3/a- i6198e.pdf

Filli K.B., Nkama, I. Jideani V. A.,& Abubakar U. M., (2013). Application of response surface methodology for the study of composition of extruded millet-cowpea

Hagenimana, A., Ding, X.,& Fang, T. (2006). Evaluation of rice flour modified by extrusion cooking. *Journal of Cereal Science.* 43: 38–46.

Ijarotimi, O S; Keshinro, O O;. (2012). *Biotechnology and Food Sciences*.

Kathirvel, P; Kunydha, P;. (2011). *Chemical Compostion of prosopis julifora (SW) D.C. (mosquito bean)*, 5-14.

Kubmarawa, D *et al*;. (2011). *Nutrient Content and Amino Acid Composition of the leaves of Cassava and Celtis integnoffolia*, 222-225.

Marshall, S. (2016). *Protein Energy Malnutrtion in the Rehabilitation Setting, Evidence to improce identification*, 460-463.

Moeelijo, P. S., Field, M. T., & Gordon, D. (1998). *Bio-availability of Zinc in Fermented Soybean*, 460-463.

Omenna, E. C. et al;. (2016). *Effect of boiling pressure cooking and germination on nutrient and anti-nutrients content of coupea (Vigna unguiculata)*, 1-8.

Onwuka, G.I. (2005). Food Analysis and Instrumentation. Theory and Practice. Naphthali Prints,Surulere, Lagos, Nigeria.

Onyenwoke, C A & Simonyan, K J;. (2014). Cassava post-harvest processing and storage in Nigeria. *A Review, African Journal of Agricultural Research*.

Osman, A. M. (2011). *Effect of traditional fermentation process on the nutrient and anti-nutrient content of pear millet during preparation of iloloh*, 1-6.

Pan, Z., Zhang, S.,& Jane, J. (1998). Effects of extrusion variables and chemicals on the properties of starch-based binders and processing conditions. *Journal of Cereal Chemistry*. (75) 541–546.

Pardhi,S.D., Singh, B., Nayik, G. A.,& Dar, B. N. (2017).Evaluation of functional properties of extrudedsnacks developed from brown rice grits by usingresponse surface methodology. *Journal of the Saudi society of agricultural Sciences.*3: 10-20

Snathar, K. R. & Bhat, R. (2007). *Lotus- A Potential Nutritional Source*.

Sokrab, A. M et al. (2012). Effect of germination on anti-nutritional factors, total and extractable minerals of high and low phylate can (Zea mays L.) genotypes.

Suresh, B., Kaur, A., Manikantan, M. R., & Baljit, S. (2013). Optimization of Extrusion Process for Production of Texturized Flaxseed Defatted Meal by Response Surface Methodology. *International Journal of Research in Engineering and Technology*. 2(10): 302-310