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Effect of Processing on the Proximate Composition of Bambara Groundnut Flours

Chinwe .U. Elochukwu
Department of Food Technology, Federal Polytechnic Oko, Anambra State, Nigeria.

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ABSTRACT: Bambara groundnut (Vigna subterranean) was processed into flours using four different processing methods. The first portion was milled raw without any form of treatment. The second portion was processed using the conventional method that is the method adopted by the local bambara groundnut flour producers. The third portion was obtained by cooking the raw seed in boiling water for 25 minutes, cooled, dehulled, dried for 10 hours at 105^{o}C and milled into flour. The fourth portion was obtained by cooking the raw seeds in boiling water for 25 minutes, dehulling, heat steaming of the cotyledon for 20 minutes, drying and milling into flour. The proximate compositions of the flour samples were evaluated. The results obtained in the study showed that the bambara groundnut flour obtained by steaming the cotyledon for 20 minutes possessed the qualities that are required for the preparation complementary food products. It had the highest calorific value. It also had the highest protein level apart from the bambara groundnut whole flour which was not treated. Although some of these nutrients were lost during processing, processing is still a necessity to reduce the antinutrients, which are within the bambara groundnut seed in order to make the flour digestible.

Keywords: Bambara groundnut, processing, treatment, flour, proximate composition

I. INTRODUCTION

Bambara groundnut (Voandzeia subterranea) is a tropical food legume, a member of the family of fabaceae. . It is grown extensively in Nigeria but it is one of the underutilized legumes in Nigeria (Olapade and Adetuyi, 2007). This little known vegetable has the potential to improve nutrition, boost food security, foster rural development and support sustainable land care (National Research Council, 2006). Due to the high price of meat and fish, much importance is now placed on grain legumes as a source of proteins in all the developing countries. The nutritional value of the legume seeds is restricted by the presence of anti-nutrients such as substances that inhibit the action of pancreatic proteases (trypsin inhibitors), blood-clotting substances (haemagglutinin), polyphenols, phytic acid, cynaogenetic glucosides and flatus factors. However these antinutrients could be eliminated or reduced by certain processing techniques such as soaking, dehulling, germination and fermentation (Oluwale and Taiwo, 2009). Bambara groundnuts are grown primarily for their seeds which may be eaten raw when immature but becomes too hard when mature. When roasted or boiled, even the mature seeds are sweet and pleasant tasting. The seeds are often roasted and ground into flour. They make a well-balanced food with a caloric value equal to that of a high quality cereal grain (FAO, 1988). According to Purseglove (1991), bambara groundnut is a food legume with complete balanced food. The grain legume are useful sources of thiamine (VitaminB_1) ,carboxylase niacin,(Vitamin B_6) and of calcium. The seed coats are used to identify their varieties. The varieties of bambara groundnut are BBG, BBFG, BSWH (black seed coat-white hilum), CSCH (cream seed coat-cream hilum) and PSWH (purple speckle on cream seed coat-white hilum. Bambara groundnut is cultivated mainly for local production but seldom on a large scale.

The objective of this research work was to determine the effect of different processing methods on the proximate composition of the bambara groundnut flours in order to access the best method of processing for the production of different bambara groundnut based food products.

II. MATERIALS AND METHODS

Sample Collection

The raw material used in this study was the cream coloured bambara groundnut which was purchased from the open market at Umudike and identified in the research institute at Umudike.

Processing Methods

Raw seeds(1.5kg) of the bambara groundnut was manually sorted to remove stone, dirt and other contaminates and divided into four portions.The1st portion was milled raw without any form of treatment. The 2nd portion was processed the conventional method as adopted by the local bambara groundnut flour producers. The 3rd portion was obtained by cooking the raw seed in boiling water for 25 minutes, cooled, dehulled, dried for 10 hours at 105°C and milled into flour. The 4th portion was obtained by cooking the raw seeds in boiling water for 25 minutes, dehulling, heat steaming of the cotyledon for 20 minutes, drying and milling into flour.

Proximate Analysis

The flour samples were analyzed in duplicates for crude protein, ash, fat, crude fibre and moisture using AOAC(2000) methods. The determination of total carbohydrates was by difference. The energy content was calculated using the Atwater factors (Onwuka, 2000).

Statistical Analysis

One way analysis of variance was employed for analysis of the generated data using SPSS (2004).The results were reported as mean values with standard deviation.

Table 1: Proximate composition of Bambara Groundnut (BGN) Flour Samples

Bambara groundnut flour sample	Moisture content (%)	Crude protein(%)	Fat (%)	Crude fibre(%)	Ash(%)	Carbohydrates (%)	Energy (kj/100g)	% Dry matter
BGN Whole flour	8.65±0.00^{d}	19.77±0.01^{a}	5.75±0.00^{d}	2.29±0.01^{a}	2.72±0.02^{c}	61.82±0.00^{d}	378.11±0.03^{c}	91.35±0.01^{a}
Conventional BGN flour	11.96±0.03^{a}	14.80±0.02^{d}	6.20±0.00^{c}	1.95±0.02^{b}	2.52±0.02^{a}	62.57±0.02^{a}	365.28±0.03^{d}	88.04±0.02^{d}
BGN cotyledon Flour	9.60±0.02^{c}	16.65±0.02^{c}	7.86±0.02^{b}	0.90±0.00^{c}	2.48±0.03^{b}	62.51±0.20^{b}	387.38±0.00^{b}	90.40±0.02^{b}
Steamed BGN cotyledon flour	9.83±0.03^{b}	16.83±0.01^{b}	8.87±0.02^{a}	0.80±0.00^{d}	1.96±0.02^{d}	61.71±0.14^{c}	394.11±0.00^{a}	90.17±0.00^{c}

* Values are means ± Standard deviation (SD) from 3 determinations. Means not followed by the same letters along the column are significantly different @ $P \leq 0.05$

III. RESULTS AND DISCUSSION

Table 1 shows the proximate composition of all the different processed bambara groundnut flour samples. Statistical analysis showed significant difference ($p<0.05$) between the means of all the variables estimated. The moisture content of the flour samples fall within the acceptable limit of dry flour products (9-15%) (Ihekoronye and Ngoddy,1985) except that of the bambara groundnut whole flour (8.65%). The crude protein values of the flour samples ranged between 14.80%-19.77% with that of untreated bambara groundnut whole flour leading. This whole flour cannot be consumed since all the antinutritive factors will still be intact. Amongst the treated flour samples, the highest protein content was obtained from the steamed bambara groundnut cotyledon flour (16.83%). The decrease in crude protein was due to the pretreatment which indicates the susceptibility to protein denturation and leaching of these nutrients. The protein values obtained in the research were confirmed by reports of Onimawo et al., (1998) and Tchiosta et al., (2004) which revealed that the protein content of bambara ground flours fall within a range of 11-21%.

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The fat content ranged from a mean value of 5.75- 8.87% with significant difference ($p<0.05$) between the samples. The fat value was highest in steamed bambara groundnut flour samples followed by the bambara groundnut cotyledon flour samples. This may be caused by concentration of the endosperm by the processing method adopted. This corresponds with a previous work carried out by Mandokhot and Singh (1979) and Reichert et al., (1986) which stated that dehulling of legumes significantly concentrates major components like oil and proteins. The mean fibre and ash content ranged from 0.80-2.29% and 1.96-2.72% with the highest fibre and ash content found in the bambara groundnut whole flour sample 2.29% and 2.72% respectively. The least fibre and ash content in the steamed bambara groundnut flour samples having 0.80% and 1.96% respectively. This indicates that dehulling which entails the removal of some bran and the outer layer of the seed has resulted to the decrease in fibre and ash. This also showed that different processing methods decrease the fibre and ash content at different rates. The carbohydrates content showed that the conventional bambara groundnut flour sample had the highest carbohydrate content (62.57%) and this was significantly different ($P<0.05$) from other samples. The carbohydrates values are dependent on the values of other proximate components since it was determined by difference not chemically.

The steamed bambara groundnut cotyledon flour sample was of higher energy value and is significantly different ($P<0.05$) from other samples. This can be attributed to their high content of proteins and fats which are contributory factors in the calculation of energy values of food.

IV. CONCLUSION

Bambara groundnut is a potential source of protein and energy that can be used by food processor to produce new food products. The results obtained in the study showed that the bambara groundnut flour obtained by steaming the cotyledon for 20 minutes possessed the qualities that are required for the preparation complementary food products. It had the highest calorific value. It also had the highest protein level apart from the bambara groundnut whole flour which was not treated. Although some of these nutrients were lost during processing, processing is still a necessity to reduce the antinutrients which are within the bambara groundnut seed in order to make the flour digestible. There is the need to have variety of nutritious food products that will solve the problem of malnutrition in our ever increasing population. The increase in the industrial production of value added products from processed bambara groundnut flours will lead to the development of the bambara groundnut food chain and create employment.

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