

## Effect of Processing on the Chemical, Pasting and Anti-Nutritional Composition of Bambara Nut (*Vigna subterranea* L. Verdc) Flour

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**Abstract:** This study evaluates the effect of processing on the chemical, pasting and anti-nutritional composition of bambara nut flour. Bambara nut seeds were divided into two portions. Portion A was milled into raw flour while portion B was boiled for 10 min. The coats were removed and the dehulled nuts were dried in the oven at 50°C for 18 h. They were milled and sealed in polythene bags. Proximate, mineral and anti-nutritional compositions of the samples were carried out on the flour samples. Raw flour had the highest ash content (3.26%) while the least value was in the coat. Protein content ranged from 3.49-19.94%. Dehulled bambara nut had higher protein content than the raw sample. The coat was high in fibre content when compared to the raw and dehulled flour samples. The mineral composition of raw bambara nut flour were higher than the dehulled flour. Tannin contents ranged from 0.16 mg/100 g in dehulled flour to 0.32 mg/100 g in raw flour. Raw bambara nut flour had higher phytate content while the dehulled flour had lower value. The value of oxalate ranged from 0.10-1.34 mg/100 g. Boiling and dehulling drastically reduced the mineral and the anti-nutritional composition of the flour.

**Key words:** Boiling, coat, dehulling, mineral content, pasting, phytate

### INTRODUCTION

Bambara nut is economically important because it is an inexpensive source of high quality protein. It is highly valued among the Eastern and Northern states of Nigeria (Oloyede *et al.*, 2010). Bambara nut is processed into consumable food and taken in various forms as source of protein to Nigerians. Bambara nut (*Vigna subterranea* L. Verdc) is a novel legume of African origin grown mainly by subsistence female farmers intercropped with major commodities such as maize, millet, sorghum, cassava, yam, peanut and cowpea (Omoikhoje, 2008). Sellscope (1962) stated that bambara nut is the third most important legume after groundnut (*Arachis hypogea*) and cowpea (*Vigna unguiculata*) in Africa. The Bambara nut is one of the most adaptable of all plants and tolerates harsh conditions better than most crops. It is ideally suited for hot, dry regions where growing other pulses is risky. It yields on poor soils in areas of low rainfall and does not yield well in times of heavy rainfall. The cultivars had distinct colour differences ranging from cream through brown, maroon to black, with variations in the seed sizes and seed coat thicknesses (Nti, 2009). The seeds can be consumed in different forms either in the immature green state or matured form. But at maturity, the seeds become very hard and therefore require boiling before any specific preparation can be carried out. Brough and Azam-Ali

(1992) reported that bambara groundnut seed makes a balance food as it contains sufficient quantities of carbohydrate protein and fats with relatively high proportions of lysine and methionine as percentage of the protein. Despite the nutrient composition, bambara nut are still among the lesser known and under-utilized crop in Nigeria. There are limited works on the processing and nutritional value of the bambara nut flour. This research study studied the effect of processing on the chemical, pasting and anti-nutritional composition of bambara nut flour.

### MATERIALS AND METHODS

This study was carried out in Department of Food Science and Technology, Osun State Polytechnic, Iree, Osun State, Nigeria in August 2010. The bambara nuts were purchased in Benin city market, Edo State, Nigeria. They were divided into two portions. Portion A was milled into raw flour while portion B was boiled for 10 min. The coat were removed immediately with mortal and pestle. The coat and the dehulled nuts were dried in the oven at 50°C for 18 h. They were milled using fabricated attrition mill and sealed in polytene bags. Proximate and mineral contents were carried out using AOAC (1990) while anti-nutritional composition of the samples were determined using the methods of Kirk and Sawyer (1999)

for tannin determination, phytate was determined with the methods of Medoua *et al.* (2007). Method of Nwinnuka *et al.* (2005) was used for oxalate determination while pasting properties of the flour samples were studied using a Rapid Visco-Analyzer (RVA) (Newport Scientific Pty. Ltd.) with the aid of a thermocline for windows version 1.1 software (1998). All analyses (except pasting properties) were carried out in triplicate and the standard deviations were calculated.

## RESULTS AND DISCUSSION

The proximate composition of bambara nut coat and flour are shown in Table 1. Raw flour had the highest ash content (3.26 %) while the least value was in the coat. The ash content of bambara nut was lower than the values reported for pigeon pea (Amarteifio *et al.*, 2002). Protein content ranged from 3.49-19.94 %. Dehulled bambara nut had higher protein content than the raw sample. Increase in protein content after dehulling was due to the removal of the coat and this was in agreement with the findings of Nti (2009) who stated that dehulling increased the protein content of bambara products. The protein content of the raw and dehulled bambara nut were within the range reported by Stephen (2009) and Brough and Azam-Ali (1992). These values were lower than the protein values obtained for African yam bean, pigeon pea and cowpea (Abbey and Ayuh, 1991; Obatolu *et al.*, 2001). The coat was high in fibre content when compared to the raw and dehulled flour samples.

Fibre content value of the coat was similar to the value reported for pigeon pea (Amarteifio *et al.*, 2002). Fibre contents decrease drastically in the dehulled flour due to removal of the coat and cooking. This was in agreement with the findings of Rehman and Salariya (2005) that cooking under pressure promoted the reduction of neutral fiber by 35 and 29% in red and white kidney beans, respectively. The fat contents were lower than the reported values of 6-14% for bambara nut (Brough and Azam-Ali, 1992; Stephen, 2009). This may be due to the species and methods of analysis used to determine the fat content.

The mineral composition of raw bambara nut flour were higher than the dehulled flour (Table 2). Boiling and dehulling reduced the mineral composition of the dehulled bambara flour. Decrease in mineral composition of dehulled bambara nut may be due to removal of the hull and leaching of the components in cooking water during boiling. Dehulled flour samples had higher values in peak viscosity (159.92 RVU), holding strength (106.25 RVU), breakdown (53.67 RVU), final viscosity (171.75 RVU) (Table 3). High peak viscosity is an indication of high starch content (Osungbaro, 1990). The high viscosity exhibited by dehulled sample is an indication that the samples may be suitable for product requiring high gel

Table 1: Proximate composition of bambara nut coat and flour

Parameter	Coat	Raw flour	Dehulled flour
% Ash	1.52±0.04	3.26±0.10	2.28±0.07
% Moisture	10.50±0.11	10.50±0.15	10.54±0.09
% Protein	3.49±0.07	17.41±0.04	19.94±0.07
% Fibre	5.66±0.22	3.41±0.27	1.61±0.12
% Fat	1.35±0.46	4.81±0.34	4.27±0.26

Mean values ± standard deviation (n = 3)

Table 2: Mineral composition of raw and dehulled bambara nut flour

Parameter	Raw flour	Dehulled flour
Ca%	0.70±0.31	0.35±0.40
Mg%	0.36±0.02	0.18±0.11
K%	0.21±0.27	0.12±0.19
P (ppm)	79.83±0.44	47.39±0.36
Na (ppm)	86.73±0.13	21.45±0.21
Mn (ppm)	54.81±0.11	17.98±0.31
Fe (ppm)	69.83±0.27	26.33±0.33
Cu (ppm)	9.77±0.10	2.26±0.14
Zn (ppm)	12.16±0.30	5.53±0.28

Mean values ± standard deviation (n = 3)

Table 3: Pasting properties of raw and dehulled bambara nut flour

Parameter	Raw flour	Dehulled flour
Peak (RVU)	100.83±0.21	159.92±0.11
Holding strength (RVU)	94.92±0.52	106.25±0.44
Breakdown (RVU)	5.92±1.12	53.67±1.00
Final viscosity	145.25±1.40	171.75±0.92
Setback (RVU)	50.33±0.90	65.50±0.87
Peak time (min)	6.73±1.00	5.13±0.69
Pasting temp (°C)	95.00±0.78	93.65±1.00

Mean values ± standard deviation (n = 2)

Table 4: Anti-nutritional content of bambara nut coat and flour

Parameter	Coat	Raw flour	Dehulled flour
Tannin (mg/100 g)	0.27±0.33	0.32±0.41	0.16±0.58
Phytate (mg/100 g)	22.11±0.14	18.41±0.23	8.33±0.11
Oxalate (mg/100 g)	0.91±0.21	1.34±0.11	0.10±0.37

Mean values ± standard deviation (n = 3)

strength and elasticity (Adebowale *et al.*, 2005). Dehulled bambara nut flour also had the ability to form viscous gel after cooking and cooling. It had the least minimum time for cooking and at a low temperature than the raw sample. Dehulling improved the viscosity and reduced the cooking time of dehulled bambara nut flour.

The anti-nutritional composition of bambara nut are shown in Table 4. Tannin contents ranged from 0.16 mg/100 g in dehulled flour to 0.32 mg/100 g in raw flour. Tannin contents were reduced drastically after boiling and dehulling. Dehulling and cooking had been reported to reduce tannin content in bean (Deshpande *et al.*, 1982; Rehman and Salariya, 2005). Reduction of tannin content in the dehulled flour is expected to improve its nutritional value because tannins form complexes with proteins and reduce their digestibility and palatability (Eka, 1985).

Bambara nut coat had higher phytate (22.11 mg/100 g) content while the dehulled flour had the least value (8.33 mg/100 g). Dehulling and boiling also reduced phytate content in bambara nut. Cooking had been reported to reduce phytate levels in several plant

foodstuffs (Badifu, 2001). Phytate decreases calcium bioavailability and forms calcium phytate complexes that inhibit the absorption of Fe and vary depending on the crop variety, climatic conditions, location, irrigation conditions, type of soil, and the growing season of the plant (Deshpande *et al.*, 1982; Plaami, 1997).

The value of oxalate ranged from 0.10-1.34 mg/100 g. Oxalate content also decreased with the treatment given to the sample. Boiling cause considerable skin (epidermal) ruptures and facilitates the leakage of soluble oxalate into cooking water (Albihn and Savage, 2001). Therefore, the reduction in the levels of oxalate in the dehulled flour may be due to its solubility in hot water (Bradbury and Nixon, 1998).

### CONCLUSION

Bambara nut seeds are good sources of protein, dietary fibre and minerals. They also contain anti-nutrients most of which are reduced during boiling and dehulling of the seeds. Thus, improving the nutritional value and making the dehulled flour safe for consumption.

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