International Journal of Academic Multidisciplinary Research (IJAMR)
ISSN: 2643-9670
Vol. 3 Issue 12, December – 2019, Pages: 9-12

Comparative Food Processing Techniques to Produce Wholesome Jackbean (*Canavalia Ensiformis*) Flours

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Abstract**:** *This study was designed to combine cracking, soaking, derailing, graded levels of fermentation of whole grain, cooking, drying to 96% dry matter as the easiest and most valuable methods to process Jackbean (JB). JB was cultivated and harvested in hotel garden of the researcher, specifically for this study Standard essay techniques were adopted to determine the parameters selected for use, Relative to the control, germination and fermentation had good protein, fat, crude fibre and carbohydrate levels. For the processed seeds, GDCJB had the highest protein (31.67), least fat, least fibre and second higher carbohydrate. For the fermented group, the DF2CJB had the highest protein (28.37), followed by the DF_3G/B. Fermentation and germination appeared (to be a promising food processing method for improving the nutrient content of jackbean flours*

INTRODUCTION

Jackbean (*Canavalia ensiformis*) is one of the lesser known legumes in Nigeria. The legume is grown in marginal soils and in arid/semi arid regions not suitable for common legumes such as Phaxeohtx and *Vigna* species. Its deep penetrating root system enables it to withstand very dry conditions (Akpapunam and Sefer - Dedeh, 1997). The production may be as high as 4600kg per hecter (Bressani *et al*., 1987). The protein content ranges from 23.4 to 34.8%. It is low in oil and high in total carbohydrate. It is also a good source of starch containing between 29.5 and 34.9% on dry weight basis (Purseglove, 1977; Rodrigues and Torne, 1991). Jackbean is a good source of phosphorus, calcium, magnesium, zinc, copper and nickel (Rodrigues and Torne, 1991), Jackbean showed nutritionally adequate levels of most essential amino acids (EAA) with the exception of sulphur amino acids (methionine and cystine)(Molina and Bressani, 1973; FAO/WHO, 1973, Akpapunam and Markakis, 1981). Like other legumes it contains toxic and antinutritional factors like hemagglutinin, phytates, tannins, saponins and trypsin inhibitors. These affect digestibility and food value (Bressani *et al*.,1987; Babaretal., 1988; Udedibie and Carlini, 1998).

There is still little information available on the processing and use of jackbean. Despite its high nutritional qualities, jackbean food potentials remain largely under exploited. The reasons were due to inherent presence of antinutrients, food toxicants, long cooking time required to prepare the beans and regional food habits that do not include it as part of the common diet (Akpapunam and Sefa - Dedeh, 1997). The high fibre content may reduce the texture and digestibility of the beans or products made from it

This preliminary study evaluates the comparative effect of cracking, soaking, dehulling, germination of whole grain, fermentation, cooking and drying on the nutritional quality of jackbean (*Canavalia ensiformis*) Hours which could then serve as a protein supplement to cereals, starchy roots and tubers in infant foods.

Materials and Methods

Jackbean seeds used for this study was cultivated and harvested by the researcher from the hotel garden and certified by the Crop Science Department, University of Nigeria Nsukka. The beans were thoroughly cleansed. A portion was only hammer milled and served as the control (WRJB). About 2kg of cleaned grains were cracked with an adjusted domestic hand grinder and soaked for 30 minutes for quick dcluilling. The dehulled seeds were divided into five equal portions. One portion was dried (DRJB), another portion was cooked at 100^0C until soft enough for human consumption (DOB). The remaining three portions were put into containers, the ratio of water to seed was 1:3 (W/V) and allowed to ferment by the natural inherent microflora of the seeds for 24, 48 and 72h, respectively, at 28 ± 2^0C .After fermentation, each portion was boiled separately al 100^0C until judged soft enough for human consumption. All the treated grains were dried in a laboratory dryer, hammer milled into fine powder (70mm mesh screen), package separately in polythene bags, labelled with designated names and stored frozen for chemical analysis.

Another portion of jackbean seeds were washed and soaked in deionised water for 8h in a ratio of 1:3(W/V) at 28 ± 2^0C. The soaking water was drained, the seeds were evenly spread on moistened muslin cloth for at least 120h to germinate or until the sprouts were at least 2 -inches high. The seeds were washed every I2h with

deionised water to prevent growth of moulds. Al the end of germination, the grains were washed and dehulled- They were cooked until soft enough for human consumption, dried in a laboratory dryer, and hammer milled into fine powder (70mm mesh screen). The flour was packaged in polythene bag, labelled with designated name and stored frozen until required for chemical analysis.

Laboratory Analysts

Moisture, protein, fat, ash, crude fibre and carbohydrate were analysed according to the standard procedures of AOAC (1995). AH analyses were performed in triplicate. Residual moisture was determined by the hot air oven method. This was necessary because of possible hygroscopic effect of the flours during storage. About 2g of each sample were weighed into porcelain dishes and placed in the oven operated at 100^0C for 24h. The dishes were removed from the oven repeatedly until constant weights were attained. Percentage moisture was calculated as follows:

$$\text{Percent moisture} = \frac{\text{moisture content}}{\text{weight of sample}} \times \frac{100}{1}$$

Protein was determined by automated micro-Kjeldal method- One gramme of each sample was weighed into the micro-Kjedahl flask. After digestion, distillation and titration, the crude protein was calculated by multiplying the total nitrogen (TN) by 6.25 (conversion factor). Fat was estimated by exhaustively extracting two grammes of each sample with petroleum either using Tecator Soxhlet apparatus according to the manufacturers instructions. Ash was estimated by weighing 2g of each sample into a weighed crucible. The contents were incinerated at 600°C for 3h in a muffle furnace until ash was obtained.

$$\text{Percentage of ash} = \frac{(\text{weight of crucible + ash}) - (\text{weight of crucible})}{\text{weight of sample}} \times \frac{100}{1}$$

Crude fibre was estimated by using all the residue from the other extraction (that is the residue in the soxhlet thimble) After boiling, with sulphuric acid and sodium hydroxide solution, it was , filtered through Geech crucible prepared with asbestor, then with 100ml 1% hydrochloric acid and finally hot water The residue was dried in crucible to constant weight, the content of crucible was Ignited in muffle furnace at dull red heat (550 - 600^0C), cooled and weighed again.

$$\text{Percent crude fibre} = \frac{\text{loss of weight from incineration}}{\text{weight of sample}} \times \frac{100}{1}$$

Carbohydrate was obtained by difference.

Result and Discussion

The proximate composition of whole, dehulled, cooked, germinated and fermented jackbean flours are shown in the table below. The crude protein values ranged from 27.26 to 41.06%. The higher protein content of the raw samples (the WRJB and DRJB) (41.06 and 31.73%) except for the germinated dehulled and cooked jackbean (GDCJB) 31.67%), closely agreed with earlier reports (Udedibic, 1990; Okah, 1998). This observation might be due to presence of non protein nitrogen - a commonly observed phenomenon (Udedibie, 1990). The decreases in crude protein of fermented products could be attributed to continuous hydrolytic enzymes (Wu and Wall, 1980; Sathe and Salunke, 1981) or could be due to increase in the number of microflora, which use protein for metabolism (Nnam and Obiakor, 2003).

The activities of the proteolytic bacteria could result in improved digestibility and availability of protein because of the breakdown by the proteases of the protein-tannin, tannin - enzyme, and protein - phytate complexes to make the nutrient more available for digestion and utilization (Kazanas and Fields, 1981). The higher protein for the GDCJB sample as compared with the other treated samples could be attributed to net synthesis of enzymic protein by the germinating seeds (Luhila and Chipulu, 1987, Nnam, 2000).

The proximate analysis of dehulled, cooked, germinated and fermented jackbean flours.

Sample	% Protein	% Fat	% Ash	% Fibre	% Carbohydrate
DRJB	41.06 ±0.08	6.48±0.04	3.63±0.26	11.29±0.17	37.54
DOB	31.73±0.16	5.49±0.04	2.77±0.09	4.19±0.04	55.82
GDCJB	27.26±0.13	3.26±0.02	7.22±0.19	3.37±0.07	58.89
DF^1CJB	31.39±0.14	1.17±0.02	4.15±0.08	3.30±0.07	59.71
DF^2CJB	27.39±0.07	3.79±0.05	5.45±0.06	5.87±0.06	57.50

DF^3CJB	28.37±0.16	2.09±0.04	3.70±0.13	5.63±0.13	60.21
DRJB	27.99±0.06	3.24±0.01	4.67±0.13	4.78±0.12	59.32

Mean ± SDM of triplicate determinations
DR-IB: Dehulled raw jackbean flour
DCJB: Dehulled and cooked jackbean flour
GDCJB: Germinated, dehulled and cooked jackbean flour
DF'CJB: Dehulled, 24h fermented and cooked jackbean flour
DF2CJB: Dchulled, 48h fermented and cooked jackbean flour
DF3CJB: Dchulled, 72h fermented and cooked jackbean flour
Based on residual moisture,

Cooking and fermentation lowered the lipid content of jaekbean Hours. The decreases might be due to breakdown of lipids to fatty acids during fermentation (Murata *el al.*, 1967). These free fatty acids serve as sources of flavour of the products (Obizoba and Atii, 1991). Germination decreased the lipid level of the Hour The observed decrease might be due to the increased activities of the lipolylic enzymes during germination (Rahma and Aal. 1980), which hydrolyzed fats to fatty acid and glycerol. The simpler products might be used for synthesis of carbohydrate and protein or as a source of energy for the developing embryo. The decrease is in line with the reports of other workers (Obizoba and Alii, 1994; Nnani, 2000).

The higher ash values particularly for the DCJB (7.22%) sample as compared with the control (WRJB) (3.63%) is an indication that domestic food processing technique increases ash (mineral). This is possibly due to the destruction of the vegetative parts of the food and the release of more ash containing minerals. Another possible reason could be gelation of starch due to cooking, hydrolysis of bonds between protein - antinutrient - enzymes by activated enzymes due to germination and microflora enzymes due to fermentation which released more minerals for utilization and antinutrients leached into cooking, germination and fermentation media (Aworth, 1993; Nnam, 1994).

The high crude fibre contents for the control (WRJB) was due to the hull The slightly higher crude fibre values for the fermented flours might be due to hydrolysis of the complex carbohydrate to simpler absorbable sugars by microflora enzymes. The lower crude fibre values for the cooked and germinated Hours might be that activated enzymes from germination were not enough to hydrolyse complex carbohydrate to produce more crude fibre - a commonly observed phenomenon (Bencini, I986)

The similarity in carbohydrate (55.82 - 60 21%) and higher carbohydrate values for all treated samples than the control (55.82 60.21 Vs 37.54%) might be due to unhydrolysed complex carbohydrate. Bencini (1986) had similar observations with raw and processed chickpea.

Conclusion

The results of this study shows that fermentation and germinaton of jackbean caused variations in the protein, fat. ash and fibre nutriture. These changes could be of" great importance in Nigeria especially with the increasing reliance on local staple as the sole source of nutrients.

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