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Research Article

Quality Characteristics of Fermented Cassava Flour (*Lafun*) Produced Using Backslopping Method

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Abstract

This study was conducted to determine the effect of backslopping on the quality attributes of fermented cassava flour (*lafun*). Cassava roots were obtained from Ojuwoye market, Mushin, Lagos, Nigeria. The roots were peeled and fermented using traditional method. The controlled sample was made using the traditional fermentation process while backslopping method involving the use of fermenting liquor from previous batch was adopted for the experimental sample. Both samples were coded as IJK and BOD respectively. Proximate composition, physicochemical and pasting properties of the samples were carried out. The results showed that carbohydrate, protein, crude fibre and moisture content were 89.75 ± 0.12 and 89.75 ± 0.23%, 3.32 ± 0.31 and 2.29 ± 0.63%, 0.74 ± 0.03 and 1.37 ± 0.16%, 4.22 ± 0.31 and 3.49 ± 0.07% respectively. Results of bulk density (g/cm^3), water absorption capacity (%), residual cyanide and pH were 31.00 ± 1.41 and 35.50 ± 0.71, 6.62 ± 0.87 and 3.27 ± 0.09, 0.24 ± 0.03 and 0.33 ± 0.02, 6.03 ± 0.02 and 5.78 ± 0.07 respectively while peak viscosity, final viscosity, pasting temperature and peak time were 80.17 ± 2.82 and 273.79 ± 2.88RVU, 111.15 ± 0.49 and 257.10 ± 1.60 RVU, 7.55 ± 0.78°C and 5.63 ± 0.13°C, 95.35 ± 1.20 and 79.85 ± 1.06 min respectively. This study showed that most of the analyses carried out on *lafun* were within the recommended limits and the result on pasting characteristics showed that back slopping method had a very good effect on the product.

Keywords: *Quality; Fermented; Cassava; Flour; Backslopping; Pasting*

Introduction

Cassava (*Manihot esculenta Crantz*) is a plant cultivated for its tuberous roots. It is a rich source of carbohydrate as well as essential and beneficial minerals required by the body for healthy living [1]. It is one of the leading food and feed plants in the world and it is the staple crop particularly among the developing countries where several fermented products are obtained from it including *fufu*, *gari*, and *lafun*. It has also been estimated that cassava provides food for over 500 million people in the world [2]. Nutritionally, it is a major source of calorie in the form of starch and can be consumed in various forms. However, the roots of the cassava contain cyanogenic glycosides that can potentially release cyanide ions [3] which is toxic to man as they interfere with the functioning of certain organs and enzymes [4].

Fermented cassava flour (*lafun*), as it called in Nigeria, is an African fermented product from cassava obtained by soaking peeled cassava chunks in water, at ambient temperature (28 - 32°C) for 2 - 5days [5]. The cassava chunks are later sun-dried and milled. During the fermentation process, different biochemical changes occur such as degradation of cyanogenic compounds; formation of flavour compounds;

and softening of the roots. The degree of root softening is the most important criterion to determine the end of *lafun* fermentation. In this respect, the activities of pectinolytic enzymes such as pectin methyl esterase and pectate lyase have been reported to occur. However, like other traditional fermented products, *lafun* is spontaneously fermented and its microbiological composition is of mixed nature [6].

Backslopping is a fermentation process that can be used to ferment *lafun*. Backslopping involves the use of a starter culture which makes use of samples of a previous batch of a fermented product as inoculants [7]. The inoculation belt used in traditional fermentations in West Africa serves as a carrier of undefined fermenting micro-organisms, and is one example of an appropriate starter culture.

This study was conducted to determine the quality characteristics of fermented cassava flour (*lafun*) produced using backslopping method.

Materials and Methodology

Raw material: Cassava was purchased from Mushin market, Lagos, Nigeria.

Preparation of fermented cassava flour: The cassava roots were peeled manually with a knife. The peeled cassava roots were washed and diced. These were divided into three batches. The first batch was steeped for 72 hours (3 days) to ferment. The water used in steeping the first batch of cassava for 3 days was then used to ferment the second batch of cassava and this water stands as a starter culture for fermenting subsequent batches of cassava. The steeped cassava was oven dried and milled to get the fermented cassava flour (*lafun*).

Proximate analysis

Moisture content: This parameter was determined according to the methods of AOAC [8].

Crude protein determination: The crude proteins in the samples were determined by the routine semi-micro Kjeldahl procedure [8].

Ash content: The method of AOAC (2000) [8] was used.

Crude fibre: The crude fibre was determined using AOAC (2005) [9].

Carbohydrate content: Carbohydrate content was determined by difference [10].

Physio-chemical analysis *lafun*

Water absorption capacity: Water absorption capacity was carried according to AOAC [8].

Determination of residual cyanide: This was determined as described by O' Brien., *et al* [11].

pH determination: The pH of the flour samples was determined with a pH meter (Hanna Instruments, Model 18521) at 20˚C [8].

Bulk density: This was done in accordance with AOAC [8].

Titratable acidity (% lactic Acid): Titratable acidity was determined using AOAC [8].

Determination of residual cyanide: This was determined as described by O' Brien *et al* [11].

Pasting analysis: Pasting properties were determined using Rapid Visco Analyzer (RVA) (Newport Scientific Instruments) Warriewood, Australia.

Data analysis

Data were used to estimate means of triplicates ± standard deviation. Duncan multiple range tests was used to compare significant differences between the means ($p \leq 0.05$). For this analysis IBM SPSS Statistics (version 21.0) was used.

Result and Discussion

Table 1 showed the results of carbohydrate content of the samples. There was no significant difference ($p \leq 0.05$) between the values obtained and the values were within the range of the percentage of mass dried cassava roots which were in agreement with the findings of Montagnac., *et al* [12]. The protein content of the samples were within the range of 1 to 3% of protein content in cassava [13] but high compared to other cassava flour such as cassava starch. The increase in the protein content of cassava flour may be due to some fermenting microorganisms which degrade cassava. The microbial biomass in the form of single cell proteins may be responsible for the increase in the protein content [14]. The values for the crude fibre content of cassava flour were lower than 4% reported by some researchers [15]. The percentage of ash is the indicator of mineral content of the flour. The results obtained for the samples were similar to that of Wheatley., *et al* [16].

Samples	Protein (%)	Carbohydrate (%)	Fat (%)	Ash (%)	Moisture (%)	Crude Fibre (%)
IJK	3.32 ± 0.37^a	89.75 ± 0.12^a	0.30 ± 0.08^b	1.67 ± 0.11^a	4.22 ± 0.31^a	0.74 ± 0.03^b
BOD	2.92 ± 0.63^b	89.75 ± 0.23^a	1.10 ± 0.49^a	1.37 ± 0.14^b	3.49 ± 0.07^b	1.37 ± 0.16a

Table 1: *Proximate composition of fermented cassava flour (lafun) using backslopping method and traditional fermentation.*

Values represented as mean ± standard deviation. Mean value with different superscript in the same column are significantly different (p < 0.05). IJK = Traditional fermentation; BOD = Backslopping method

Meanwhile, the moisture content of any product determines the shelf stability or the storage life of the product. The results of the moisture content for the samples were with 8 - 10% reported by Dziedzoave., *et al* [17]. It was also observed that sample BOD will be more shelf stable than IJK while the two samples had very low content of fat due to the fact that cassava has low fat content.

Physio-chemical Analysis

The pH of cassava flour is a good indicator of quality. Table 2 showed the results of the physicochemical properties of the samples. It was observed that there is significant difference in pH of the samples at ($p < 0.05$). The IJK had higher pH than BOD making BOD more acidic. However, both samples were still within the range of pH of 6-7 for cassava flour. The values were in agreement with the report of Dziedzoave., *et al* [17]. The cyanide content of IJK and BOD were very low compared to the safe level of 10 mgHCN/kg cassava flour by FAO/WHO (2000). This showed the samples were well processed and good for consumption hence validating the objective of this study.

Samples	pH	WAC (%)	Bulk density (g/cm^3)	TTA (%)	Residual Cyanide (mg/kg)
IJK	6.03 ± 0.02^a	6.62 ± 0.87^a	31.00 ± 1.41^b	1.41 ± 0.06^a	0.24 ± 0.03^b
BOD	5.78 ± 0.07^b	3.27 ± 0.09^b	35.50 ± 0.71^a	1.21 ± 0.03^b	0.33 ± 0.02^a

Table 2: *Physio-chemical properties of the fermented cassava samples.*

Value represented as mean ± standard deviation. Mean value with different superscript in the same column are significantly different (p < 0.05). TTA means titratable acidity, WAC: water aborption capacity; IJK= Traditional fermentation; BOD = Backslopping method

Water absorption capacity and swelling contributions to aylipectin-amylose phase separation and crystallinity loss which in turn promotes the leaching of amylase to the inter-granular space [18]. The results of water absorption capacity of the samples showed that sample IJK had more water absorption capacity than BOD. The results of titratable acidity for the samples showed that they were both acidic in nature due to the role of the lactic acid bacteria during fermentation of the cassava root [19]. The bulk density indicates the filling weight of samples and this result showed that BOD had more filling weight than IJK.

Pasting analysis

The results of pasting characteristics of samples are presented in Table 3. The samples were significantly different ($p < 0.05$). When the temperature of heated paste rises above gelatinization temperature, the starch granules begin to swell and viscosity increases on shearing. The temperature at the onset of rise in viscosity is referred to as pasting temperature. It is the minimum temperature required to cook a given sample of food [20-22]. This gives an indication of the quantity of heat required to cook the flour. It has been reported that high amylose content of starch increases the pasting temperature. This is because the presence of high amylose in a starchy food delays starch gelatinization and affects normal cooking properties [23].

Samples	Peak (RVU)	Trough (RVU)	Breakdown (RVU)	Final Viscosity (RVU)	Setback (RVU)	Peaktime (mins)	Temp (°C)
IJK	80.17 ± 2.82^b	63.60 ± 1.27^b	13.76 ± 0.13^b	111.15 ± 0.49^b	49.00 ± 2.83^b	7.55 ± 0.78^a	95.35 ± 1.20^a
BOD	73.79 ± 2.88^a	186.51 ± 1.07^a	85.77 ± 0.33^a	257.10 ± 1.60^a	69.85 ± 0.46^a	5.63 ± 0.13^b	79.85 ± 1.06^b

Table 3: P*asting properties of the fermented cassava samples.*
Values represented as mean ± standard deviation. Mean value with different superscript in the same column are significantly different (p < 0.05). IJK = Traditional fermentation; BOD = Backslopping method

The final viscosity is the resistance of the paste to shear force during stirring. It also indicates the ability of a material to form viscous paste or gel after cooking and cooling [22,24]. The result of final viscosity of IJK was lower than that of BOD. The variation in the final viscosity of the samples might be due to simple kinetic effect of cooling on viscosity and re-association of starch (especially amylose) molecules in the samples.

At pasting temperature, large increase in viscosity is usually experienced. This is referred to as peak viscosity. Peak viscosity is the ability of starch to swell freely before their physical breakdown [25]. The peak for IJK was lower than that of BOD. High peak is an indication of high starch content and is related to the water binding capacity of starch. It is closely associated with the degree of starch damage [23].

The measure of reduction in viscosity that occurred from peak viscosity to trough is referred to as breakdown viscosity. The breakdown viscosity is the measure of the stability of starch or the ease with which the swollen granules of starch can be disintegrated. It is an important parameter in predicting the behavior of food during processing. Higher breakdown viscosity values indicate lower ability of the sample to withstand heating and shear stress during cooking [20,21] and this shows that IJK will with stand more heating and shear stress than BOD.

Starch paste re-associates upon cooling, a process referred to as setback or retrogradation. It is the difference between final viscosity and hot paste viscosity [22]. The amylose content of starch has been reported to be responsible for retrogradation and low setback value indicates higher resistance to retrogradation. The results obtained from this showed that BOD will retrograde faster than IJK.

During the hold period of a typical pasting test, the sample is subjected to a period of constant heating at 95°C and mechanical stress. This further disrupts starch granules. Amylose molecules generally leach out into the solution and align in the direction of the shear, the period is called trough due to accompanying breakdown in viscosity. The trough, which is the minimum viscosity in the constant temperature phase of the RVA profile, measures the ability of paste to withstand breakdown during cooling [26]. The trough value for BOD was higher than that of IJK. This implies that BOD will have better keeping quality after cooking than IJK.

The peak time of the samples which is a measure of the cooking time was found to be higher in IJK than BOD. This made BOD cook faster than IJK. The pasting temperature was higher in IJK than BOD [27].

Conclusion

The results had shown that the effect of backslopping on fermented cassava flour cannot be overemphasized. The method helped to reduce fermentation time which was achieved by using the fermented liquor of previous batch. It also reduced the cyanide content to a safe level compared to the recommended value.

Finally, results obtained from proximate and physicochemical properties showed that the samples had almost the same values but pasting analysis established that BOD (fermented cassava flour using backslopping method) was of better quality compared to IJK. All the results were within the values reported from previous studies.

Bibliography

1. Obanijesu EO and Olajide JO. "Trace Metal Pollution Study on Cassava Flour's Drying technique in Nigeria". *Appropriate Technologies for Developing World* (2009): 333-339.
2. AbuJ O., *et al*. "Effect of Crude palm-oil inclusion on some physicochemical properties of gari, a fermented cassava food product". *Journal of Food Science and Technology* 24.1 (2006) 73-79.
3. Cliff J., *et al*. "Konzo and continuing cyanide intoxication from cassava in Mozambique". *Food and Chemical Toxicology* 49.3 (2011): 631-635.
4. Rocha-e-Siliva RC., *et al*. "Cyanide toxicity and interference with diet selection in quail (Coturnix)". *Comparative Biochemistry and Physiology Part C: Toxicology and Pharmacology* 151.3 (2010): 294-297.
5. Adetan DA., *et al*. "Characterisation of some properties of cassava root tubers". *Journal of Food Engineering* 59 (2003): 349-353.
6. Padonou SW., *et al*. "The microbiota of lafun, an African traditional cassava food product". International *Journal of Food Microbiology* 133.1-2 (2009): 22-30.
7. Holzapfel W. "Appropriate starter culture technologies for small- scale fermentation in developing countries". *International Journal of Food Microbiology* 75.3 (2002): 197-212.
8. AOAC. Official Methods of Analysis of AOAC International, 17th ed. Published by the Association of Official of Analytical Chemists International Suite 400 2200 Wilson Boulevard, Arlington, Virginia 22201-3301 USA (2000).
9. AOAC. Official Methods of Analysis of AOAC International, 18th ed. Published by the Association of Official of Analytical Chemists International Suite 400 2200 Wilson Boulevard, Arlington, Virginia 22201-3301 USA (2005).
10. Abu-Salem FM and Abou-Arab EA. "Physico-chemical properties of tempeh produced from chickpea seeds". *Journal of American Science* 7.7 (2011): 107-118.
11. O'Brien GM., *et al*. "Improved enzymic assay for cyanogens in fresh and processed cassava". *Journal of the Science of Food and Agriculture* 56.3 (1991): 277-289.
12. Montagnac JA., *et al*. "Nutritional Value of Cassava for Use as a staple Food and Recent Advances for Improvement". *Comprehensive Reviews in Food Science and Food Safety* 8.3 (2009): 181-219.

13. Olugbemi TS., *et al*. "Effect of moringa (Moringaoleifera) inclusion in cassava based diets fed to broiler chicken". *International Journal of Poultry Science* 9.4 (2010): 363-367.

14. Akindahunsi AA., *et al*. "Effect of fermenting cassava with *Rhizopus oryzae* on the chemical composition of its flour and gari". *La Rivista Italiana Delle Sostanze Grasse* 76 (1999): 437-440.

15. Gill JL and Buitrago AJA. "LA yuca en LA alimentacion animal". In: Ospina B, Ceballos H, editors. La Yuca end el TercerMilenio: Sistemas Modernosde Produccion, Procesamiento, Utilizacion y Comercializacion, Cali, Colombia: Centro International due Agricultura Tropical (2002): 527-569.

16. Wheatley C., *et al*. "Adding Value to Root and Tuber Crops". *A manual on Product Development (GAT)* (1995): 3-4.

17. Dziedzoave NT., *et al*. "Training manual for the production of glucose syrup". *Booklet Food Research Institute, Accra, Ghana* (2003): 12.

18. Conde-Petit B., *et al*. "Perspective of starch in food science". *Chimia* 55.3 (2001): 201-205.

19. Oyewole OB and Odunfa SA. "Characterisation and distribution of lactic acid bacteria in cassava fermentation during fufu production". *Journal of Applied Microbiology* 68.2 (1990): 145-152.

20. Adebowale A A., *et al*. "Effect of texture modifier on the physico- chemical and sensory properties of dried fufu". *Food Science and Technology International* 11.5 (2005): 373-382.

21. Adebowale KO., *et al*. "Functional properties of native, physically and chemically modified breadfruit (*Artocarpus altilis*) starch". *Industrial Crops and Products* 21.3 (2005): 343-351.

22. Etudaiye H A., *et al*. "Quality of fufu processed from cassava mosaic diseases (CMD) resistant varieties". *African Journal of Food Science* 3.3 (2009): 61- 67.

23. Sanni LO., *et al*. "Quality of gari (roasted cassava mash) in Lagos State, Nigeria". *Nigerian Food Journal* 26.2 (2008): 125-134.

24. Maxiya- Dixon B., *et al*. "Targeting different end uses of cassava, genotypic variation for cyanogenic potential and pasting properties". *International Journal of Food Science and Technology* 42.8 (2007): 969-976.

25. Sanni LO., *et al*. "The influence of palm oil and chemical modification on the pasting and sensory properties of fufu flour". *International Journal of Food Properties* 7.2 (2004): 229-237.

26. Newport Scientific. "Applications manual for the Rapid Visco-Analyzer using thermocline for windows". Newport Scientific Pty Ltd., ½ Apollo Street, Warriewood NSW2102, Australia (1998): 2-26.

27. Singh J., *et al*. "Factors influencing the physico-chemical, morphology, thermal and rheological properties of some chemically modified starches for food applications – A review". *Food Hydrocolloids* 20 (2007): 1-22.

Volume 7 Issue 2 February 2017