

Effect of length of fermentation on the functional characteristics of fermented cassava 'fufu'

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Abstract

Cassava clones 30572 was fermented to 'fufu' for different period of time ranging from zero hour to 96 hours. The quality of the 'fufu' produced as a result of different duration of fermentation was assessed. The fermentation processes were characterized with acid production but the level of acidification increased with the duration of fermentation. The yield of 'fufu', the bulk density and the dispersibility increased with increasing period of fermentation. When subjected to sensory evaluation, the preference of the panelists for the characteristic 'fufu' texture and odour increased with increased length of fermentation. Except for the 'fufu' made without fermentation (0 h), there was no significant difference in the colour of the 'fufu' fermented for different length of time. For all the attributes rated (texture, odour, colour, overall acceptability), there was no significant difference between the 'fufu' fermented for 72 hours and 96 hours. A fermentation period of 72 hours was recommended for the production of good quality 'fufu' when using the cassava clone TMS 30572.

Introduction

Cassava (*Manihot esculenta* Crantz) is a very popular root crop in West Africa (Oyewole and Odunfa, 1992). Fermentation is an important unit operation for the processing of cassava for human consumption in Africa (Mahungu et al., 1987). Common fermented cassava products of West Africa include 'gari', 'fufu', lafun' among others. (Oyewole, 1991). Among these fermented cassava products, 'fufu' is unique because in the traditional processing, the product is not subjected to any other processing after fermentation before cooking.

One major problem with 'fufu' processing is that the quality of the product varies from one processor to the other and from one processing batch to the other by the same processor (Oyewole, 1991). In an earlier survey on the constraints involved in the processing of cassava to 'fufu' (Oyewole and Sanni, 1995), it was found that local processor ferment their cassava for different length of time during 'fufu' production. Earlier studies on the effect of length of fermentation have been concentrated on cyanogen removal (Ayerbor, 1985; Akingbala et al., 1991; Blanshard *et al.*, 1994) and nutritional changes (Oyewole and Odunfa, 1989). Studies have also been carried out on the effect of some processing variables on the fermentation of cassava to 'fufu' (Oyewole and Odunfa, 1992). Information is not available on the effect of varying length of fermentation on the functional properties of 'fufu'. Such information is necessary for commercializing traditional food processing technology.

This work reports on the effect of varying length of fermentation on some functional and sensory qualities of 'fufu'.

Materials and Methods**Cassava root used:**

Cassava roots of the variety TMS 30572 were obtained from the University Farm of the University of Agriculture, Abeokuta, Nigeria. The roots were from 10 - 12 months old plants.

Fermentation of cassava root to 'fufu'

The method described by Oyewole and Odunfa (1989) was followed. Cleaned, hand-peeled roots were soaked submerged in fresh water in a plastic container for the fermentation process under ambient condition ($30^{\circ}\text{C} \pm 2^{\circ}\text{C}$). The duration of fermentation was varied to last for 0h, 24h, 48h, 72h and 96 h for different fermentation tanks. The resulting retted roots were hand-pulverized and wet-sieved to obtain the sedimented wet cassava mash called 'fufu'.

Physico-Chemical Analysis

The pH, and the Total Titratable acidity (TTA) of the fermenting roots were determined as earlier described (Oyewole and Odunfa, 1992). A 10g portion of the root was homogenized in 100 ml, sterile distilled water. The pH of the resulting suspension was measured using a Kent pH meter (Kent Ind. Measurement, Surrey, UK) model 7020 equipped with a glass electrode. The TTA was determined by titrating 25 ml of the decanted homogenate samples used for the pH determination, against 0.1N NaOH to pH 8.30. Soluble sugars were extracted with 80% ethanol under reflux (Southgate, 1976) and measured using the phenol-sulphuric acid procedure of Dubois et al., (1956). The method of Clegg (1956) was used for extracting the starch, which was determined as described by Hassid and Nuefield (1964). The percentage 'fufu' yield was calculated from the weight of fufu obtained from known amount of peeled cassava roots used.

Functional Properties

The Bulk Density was determined by the fraction of the weight of 'fufu' sample over the volume of same in a graduated measuring cylinder as described by Wang and Kinsella (1976). The Dispersibility was assessed by vigorously shaking 10g of 'fufu' samples in 100ml. distilled water in a measuring cylinder before allowing it to rest for 3 hours. The volume of the settled 'fufu' particles was used as the index of Dispersibility as described by Kulkarni *et al.*, (1991). The water retention was measured by weighing 4 g of the 'fufu' sample with 20 ml distilled water into a 50 ml. centrifuge tube. The

mixture was stirred occasionally with a glass rod for 30 min. after which it was centrifuged at 15000g for 15 minutes. The amount of water retained by the 'fufu' sample was calculated from the difference in volume of the initial amount of water added to that decanted after centrifugation as described by Beuchat (1977).

Sensory Analysis

The 'fufu' samples which were produced with varying length of fermentation periods were cooked as done traditionally, in a standardized procedure common for all samples. The acceptability of the cooked samples were assessed by a twenty member trained panel of 'fufu' consumers among the undergraduate students of the University of Agriculture, Abeokuta. The cooked 'fufu' samples were evaluated for quality acceptability (texture, odour, colour and overall acceptability) on a 9 point hedonic scale of 1 = extremely dislike and 9 = extremely liked. Analysis of variance of sensory evaluation was determined according to the procedure described by Larmond (1977). Least significance difference between samples was determined using Duncan (1955) multiple range test.

Results and Discussion

Table 1 shows the physico-chemical and functional characteristics of cassava 'fufu' produced through the fermentation of cassava clone TMS 30572 for different length of time. The fermentation process resulted in an increase in the acidity of the fermenting roots. The level of acidification increased with increasing period of fermentation. The sugar

content decreased with increasing time of fermentation. Mathew *et al.*, (1995) reported that the increasing acidity in cassava fermentation is due to the activities of microorganisms which convert the carbohydrates to organic acids. There was relatively low decrease in the starch content of the cassava during the fermentation process. This suggests that the amount of starch utilized or converted to sugars and organic acids during cassava fermentation is comparatively low. The fermented cassava product ('fufu') still has a high starch content.

The yield of 'fufu' increased with increasing period of fermentation. This observation is very important to 'fufu' producers. Cassava retting increased with increasing fermentation time. The bulk density of the fermented 'fufu' was not significantly different for the products fermented for less than 48 hours. Fermentation for over 48 hours resulted in products with increased bulk densities. The latter increase may be due to the increase in the fibre contents of the higher 'fufu' yield. Moorthy *et al.*, (1993) reported increase in the fibre content of 'fufu' as fermentation time increased. The increase in the dispersibility of the fermented product may be connected with the increased retting that aids 'fufu' particle extraction from the cassava. Kulkarni *et al.*, (1991) reported that dispersibility is associated with decreasing particle size of the food material. The water retention capacity of the 'fufu' particles was not significantly affected by the period of fermentation. This suggests that the microstructure of the extracted starch granules were not affected by the fermentation process. Ruales *et al.*, (1993) reported that the water retention capacity of a starch granule indicates the degree of exposure of the internal structure of the starch granules to water.

Table 1: Physico-chemical and functional characteristics of cassava 'fufu' fermented for different length of time

	Period of fermentation (hours)				
	0	24	48	72	96
pH	5.8±0.3	5.6±0.2	5.0±0.3	4.6±0.3	4.1±0.2
TTA (%lactic acid)	0.08±0.00	0.10±0.01	0.16±0.01	0.19±0.03	0.22±0.02
Total Sugars (%)	5.9±0.6	4.6±0.4	4.3±0.2	4.1±0.1	4.0±0.1
Total Starch (%)	79.0±3.0	78.2±2.3	77.8±2.5	76.4±2.4	76.0±0.7
'Fufu' Yield (%)	12.8	17.9	26.4	31.6	32.2
Bulk Density (g/ml)	0.42±0.02	.42±0.02	0.44±0.01	0.56±0.02	0.59±0.02
Dispersibility (%)	68±2	72±3	72±3	72±3	74±3
Water retention (g/g)	0.45±0.02	0.44±0.01	0.44±0.02	0.43±0.03	0.44±0.05

Table 2: Acceptability of cooked cassava 'fufu' fermented for different length of time

	Period of fermentation (hours)				
	0	24	48	72	96
Texture	2.9c	3.4c	6.9b	7.4a	7.8a
Odour	3.4c	3.6c	6.6b	7.2a	7.8a
Colour	3.4b	6.9a	7.1a	6.7a	6.8a
Overall Acceptability	3.2c	3.3c	6.9b	7.4a	7.7a

Key: Any two means followed by the same superscript letter for the same attribute are not significantly different at 5% level.

Table 2 shows the results of the sensory evaluation carried out on the cooked 'fufu' product made from cassava fermented for different length of time. The preference of the panelists for the characteristic texture and odour of cooked 'fufu' increased with the increasing period of fermentation. The length of fermentation therefore affected the perceived characteristic texture and odour of the products. The microbial activities which increased as the fermentation progressed may account for the perceived changes in the odour of the products fermented for different length of time. Oyewole (1990) reported that the yeast flora which population increased with increase in period of fermentation contributes significantly to the odour of fermented cassava. There was no significant difference in the colour of cassava subjected to submerged fermentation for 24 to 96 h. The panelist however noted that the colour of the 'fufu' produced from the cassava root that was not subjected to fermentation differ from others. The 'fufu' from unfermented root was found to be slightly dark coloured, when compared to the whitish colour of the fermented products.. 'Fufu' samples produced through fermentation cassava clone TMS 30572 for less than 48 h were least acceptable. For all the attributes rated (texture, odour, colour, overall acceptability), there was no significant difference between the cooked 'fufu' prepared from cassava root fermented for 72 hours and those made from the same root fermented for 96 hours.

In this work, we found that fermentation has effect on some functional characteristics of cassava. A fermentation period of 72 hours was recommended for the production of good quality 'fufu' when using the cassava clone TMS 30572.

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