



Production of Cassava Bread Using Indigenous Microflora and Improved Cultivars

by

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Abstract

An important commitment to eliminate hunger and malnutrition in developing countries is the development of methods for utilizing local agricultural resources to design new food products. This research involved the production of a bread specialty from 100% cassava flour using starter cultures selected from dominant epiphytic microflora in spontaneously fermented cassava flour, genetic modification of cassava to produce low cyanide, and high flour yielding, quality protein cassava cultivars for breadmaking in Nigeria.

Introduction

Microorganisms necessary in food fermentations may be added as pure single or mixed cultures. Although in some instances, no cultures may be added if the desired microorganisms are known to be abundantly enough in the original raw material. Even then, research shows it is better to use starter cultures as there are usually other numerous, sometimes undesirable and competing microorganisms. The use of controlled starter cultures drastically reduces the period of fermentation, sometimes more than half depending on the amount of starter used and its viability. Research on the use of starter cultures also shows that microorganisms develop niches where they thrive and to transplant an organism from one natural environment to another is not a good formula for success.

Bread is an important staple food in Nigeria. Its consumption is steadily increasing. It is however, relatively expensive; being made from imported wheat that is not grown extensively in the country for climatic reasons. In time past, there has been research on the use of composite flours for breadmaking taking into consideration the natural resources of the geographical region involved (Yañez et al. 1981, Chauhan et al. 1992, Hounhouigan et al. 1993, Shalini and Sudesh 2004). Materials grown in the tropics include cereals (maize, sorghum and millet), starchy tubers (cassava, sweet potato and yam), while oil seeds (from soybean, bean/cowpea and groundnut) can be used as protein quality improvers. The use of cassava flour for bread

making will reduce the import of wheat, and increases the production of cassava in the country. More than 35 million t of cassava, which is basically a carbohydrate food, is produced in Nigeria annually.

Many African foods are fermented before consumption and a variety of microorganisms are widely used as starter organisms in these food fermentations because they convert sugars into organic acids, ethanol, aldehydes, ketones, diacetyl and others, thus improving the organoleptic and rheological properties of the products. It is known that fermentation may enrich foods in protein by removing part of the fermentable carbohydrate as documented in fermented foods made from cassava such as gari and foofoo (Okafor 1977, Oyewole and Odunfa 1990). This work was therefore aimed at producing cassava bread from 100% cassava flour using indigenous micro-flora.

Materials and Methods

Collection and processing of samples Flour was produced from two cassava clones grown for 12 to 15 months, which were selected as most suitable for bread-making by the Root and Tuber Improvement Program of the International Institute for Tropical Agriculture (IITA, Ibadan, Nigeria). The low cyanide, high flour yielding cassava clones were processed into flour using the method described and illustrated by IITA (1990).

Microbiological analyses Cassava flour was prepared for natural fermentation by mixing equal amounts of each cassava flour type with sterile tap water (to avoid inoculating other organisms besides those originating from the flour) and allowing the mixture to ferment at room temperature for 48 h or until the pH fell to a stabilized level. From appropriate 10-fold dilutions, the pour plate technique was used to isolate microorganisms by the method of Meynell and Meynell (1970). Colony-forming units (cfu) were determined on the following media, temperatures and incubation periods: de Mann Rogosa Sharpe (MRS) medium for lactic acid bacteria (Oxoid, U.K.) at 37°C for 48 h, Saboraud dextrose agar (SDA) medium for yeast and moulds (LAB M, idg plc, U.K) at 30°C for 72 h, plate count Agar (PCA) medium for total bacterial counts (Oxoid, U.K.) at 37°C for 72 h. MRS and one set of PCA plates were incubated anaerobically in anaerobic jars using Oxoid gas generating kit. Starter cultures were then selected from the purified and characterized isolates and used for cassava bread-making.

Analysis of fermented cassava flour The functional properties of the cassava flours [physico-chemical and visco-elastic (by the automatic viscoanalyzer, AVA)] were determined by standard procedures.

Baking procedure The two flour samples were used in baking cassava bread. The amounts of other ingredients per 100g of cassava flour were: 10 g baking fat, 30 g sugar, 0.5 g salt, 0.1 g ascorbic acid, 1 ml starter culture (containing 106 to 107 cells per ml) and 120 ml water. All ingredients were weighed in a bowl and mixed (Philips hand mixer Type HR 1453) for 10 min. at high speed. The mixture was allowed to stand for 4 h at room temperature for batter development with gentle mixing for another 5 min, after which the batter was scaled (batter weight = 150g) into greased baking pans. Baking was at 160°C to 180°C for 35 min in a Moulinex OPTICHEF Oven Model BH5 with timer. After baking, the loaves were left for about 10 min in the oven. They were then quickly removed from the pans, arranged in trays and returned to the oven for 1 h before for analysis. Analyses were carried out after the baked loaves had attained room temperature or internal crumb temperature was about 35±2°C. The effect of using indigenous micro-flora as starter cultures for cassava bread was assessed with bakers' yeast-leavened bread serving as control.

Results and Discussion

Two cassava flour samples from different clones were tested for cassava bread making using indigenous micro-flora as inoculum. The final pH of the spontaneously fermented cassava flour was 4.2 and 3.7 for the flours A and B respectively. These values were lower than values obtained by previous workers (Assanvo et al. 2006). The visco-elastic properties of the flours are shown in Table 1 while the physico-chemical properties are given in Table 2.

**Table 1. Visco-elastic properties of fermented cassava flours
(The units are in RVA except where otherwise stated)**

Flour	peak	trough	breakdown	Final viscosity	Setback	Pasting time (min)	Pasting temperature (°C)
A	294.92	127.58	167.33	164.17	36.58	4.47	76.75
B	169.00	128.25	40.75	169.25	41.00	5.27	78.05

**Table 2. Physico-chemical properties
of fermented cassava flours**

Flour	Amylose (%)	WAC (%)	Swelling power (%)	Solubility (%)	Flour protein (%)
A	19.43	83.74	7.85	6.92	27.4
B	18.33	72.58	7.35	6.58	29.2

WAC – Water Absorption Capacity

It was observed that the pasting temperatures observed in this research were higher than those observed by Eggleston et al. (1993), whereas final viscosity, swelling power and solubility values were comparatively lower in this research. Total plate counts were in the order of 10⁵ to 10⁷ cfu g⁻¹ of flour (Table 3).

**Table 3, Total counts (cfu g⁻¹) of microbial
groups in fermented cassava flours**

Flour	PCA Counts	MRS Counts	SDA Counts
A	5.8 x 10 ⁷	3.6 x 10 ⁶	3.5 x 10 ⁵
B	5.5 x 10 ⁷	4.1 x 10 ⁶	3.7 x 10 ⁵

The range was quite comparable to those observed by previous workers (Eggleston et al. 1993; Assanvo et al. 2006). Yeast, lactic acid bacteria, aerobic and micro-aerophilic bacilli and other bacteria were isolated. This was not surprising as the trend for the fermentation of cassava products is generally the same. However, only yeast and lactic acid bacteria were selected and tested as starter cultures for cassava bread-making. *Lactobacillus plantarum*, *L. brevis*, *Leuconostoc dextranicum*, *Saccharomyces cerevisiae*, *Candida tropicalis* and *Schizosaccharomyces pombe* were selected and used as starters for cassava bread-making while bakers' yeast leavened bread served as control. The bread samples from lactic acid bacteria starters were sour in taste but quite acceptable to many of the consumers (51%) used for the acceptability test, though they were not considered to be bread but acceptable as a new snack in Nigeria. The yeast starters gave products comparable with the bakers' yeast leavened bread sample and were also acceptable (46%). A few of the consumers were indifferent to the bread samples (3%). It appears that more work is required to effectively determine which starter (s) will be best for this new bread specialty. This research has however shown that the baking quality of cassava flour was improved by using starter cultures selected from indigenous microflora of the cassava flour.

References

Assanvo JB, GN Agbo, YEN Behi, P Coulin, Z Farah (2006) Microflora of traditional starter made from cassava for attieke production in Dabou (Côte d'Ivoire). *Food Control* 17:37-41

Chauhan GS, RR Zillman, NA Michael Eskin (1992) Dough mixing and bread-making properties of quinoa wheat fl our blends Intl J Food Sci Tech 27:701-705

Eggleston G, PE Omoaka, AU Arowshegbe (1993) Flour, starch and composite bread-making quality of various cassava clones. J Sci Food Agric 62: 49-59

Hounhouigan DJ, MJ Robert-Nout, CM Nago, JH Houben, FM Rombouts (1993) Composition, microbiological and physical attributes of mawe, fermented maize dough from Benin. Intl J Food Sci Tech 28:513-517

International Institute of Tropical Agriculture (IITA) Ibadan (1990) Cassava into Bread. IITA, Ibadan, Nigeria. 6 pp.

Meynell GG,. E Meynell (1970) Theory and Practice in Experimental Bacteriology. 2nd ed. Cambridge Univ. Press, Cambridge. 347 pp.

Okafor N (1977) Microorganisms associated with cassava fermentation for gari production J Appl Bacteriology 41:279-284

Oyewole OB, SA Odunfa (1990) Characterization and distribution of lactic acid bacteria in cassava fermentation during fufu production. J Appl Bacteriology 68:145-152

Shalini H, J Sudesh (2004). Nutritional evaluation of wheat–fenugreek blends for product making. Plant Foods Human Nutr 59:149-154

Yañez E, D Ballester, H Wuth, W Orrege, V Gattas, S Estay (1981) Potato fl our as partial replacement of wheat fl our in bread. Baking studies and nutritional value of bread containing graded levels of potato fl our. J. Food Sci Tech 16:291-298