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CASSAVA TAPIOCA MEAL FROM EASTERN NIGERIA: ITS PROCESSING AND CHARACTERISTICS

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Abstract

Traditional processing of cassava roots into the ready-to-eat 'tapioca' meal was investigated, using two improved clones. Tapioca meal was composed mostly of starch (80%-84%), with fibre (1.30%-1.70%) and low protein contents (0.16%-0.86%). Tapioca meal made from clone TMS 4(2)1425 had a higher swelling capacity and was more viscous and more stable than that made from clone TMS 30572. Tapioca meal made from TMS 30572, however, was easier to cook. The traditional processing method typical of eastern Nigeria is discussed.

Introduction

Conventionally, in western Africa, 'tapioca' refers to processed cassava starch, although the crop itself is called tapioca in some places (Cock 1985). Tapioca meal, which is also called tapioca foodstuff, is a partly gelatinized, dried cassava starch that appears as flakes or irregularly shaped granules, and is consumed in many parts of West Africa (Hallesman and Ates 1956). It is a ready-to-eat meal that is usually soaked in water and to which sugar and/or milk are added before consumption. In some areas, the dried tapioca granules are cooked with water into a pasty gruel to which sugar, salt, and/or milk may be added before consumption.

Tapioca (i.e., cassava starch) is also used in industry, for example, to produce ethanol (Srikanta et al. 1987), enzymes (Chandrasekaran and Dhar 1983), pharmaceutical powders (Okor and Obarisiagbon 1981), and glucose (Lages et al. 1978). Available information appears to be focused largely on the industrial uses of tapioca. Little or no information is available on its use as food, especially as tapioca meal. Neither is information available on the traditional processing of cassava into tapioca meal, nor on the suitability of new, improved cultivars for its production. This information would be useful in popularizing tapioca meal, which is one of a wide array of cassava food uses.

This paper reports on the traditional processing of cassava into tapioca meal and describes some compositional and pasting characteristics of tapioca meal made from two new, improved cultivars currently being promoted among farmers in Nigeria.

Materials and Methods

Cassava roots

Roots (11-12 months old) of the cassava clones 'TMS 4(2)1425' and 'TMS 30572' developed by the International Institute for Tropical Agriculture (IITA), Ibadan, were obtained from the University of Agriculture Farm at Abeokuta. The characteristics of clone TMS 4(2)1425 were reconfirmed to include a moderate canopy and whitish roots; while TMS 30572 clones possessed a wide canopy and brown roots, confirming the description given by Akoroda et al. (1989). Processing began within 60 min of harvesting.

Processing roots into tapioca meal

The traditional method used in eastern Nigeria for preparing tapioca meal was followed. Starch was first extracted from the roots, using the procedure described by Osunsami et al. (1989), with some modifications. Roots (50 kg) were peeled and washed in water, then grated with a commercial mechanical grater. The resulting pulp was immediately wet-sieved through a 35 US standard Tyler screen (70"), suspended in a big bowl of water, following the manual technique used in *fufu* production to separate fibrous roots and other coarse root materials from the starch pulp (Oyewole and Odunfa 1989). The pulp was allowed to settle for 4-6 days before being decanted.

To roast, the thick starch cake at the bottom of the bowl was broken up by hand into smaller particles before being placed in a flat hot pan and constantly stirred, as in *gari* production (Okafor 1977). The resulting mass of dried, irregular flakes and grains is known as tapioca meal.

Yield

The roots were weighed before processing. The products of each processing stage were weighed, and changes in weight in the subsequent processing step were used to calculate material yield at each step.

Analysis

Moisture, ash, fat, crude fibre, crude protein, pH, and total extractable acidity contents of the roots before and after processing were determined according to the Association of Official Analytical Chemists (Williams 1984). Soluble sugars were extracted with 80% ethanol under reflux (Southgate 1976) and measured, using the phenol-sulphuric acid procedure developed by Dubois et al. (1956). Starch content was determined, following Clegg's procedure (1956), while amylose was determined, using the method of Sowbhagya and Bhattacharya (1971).

Pasting properties

The pasting properties of the tapioca meal were determined, using a Brabender viscoamylograph. The sample was ground to be fine enough to pass through a 250-µm sieve and then suspended in distilled water (11.11% w/v). It was poured into the measuring vessel. The change in viscosity at 4,500 Hz was continuously recorded, using a 700-cm measuring cartridge. The sample was heated from 25 to 95 ^{o}C at 1.5 ^{o}C/min and maintained at this temperature for 20 min. It was then lowered to 50 ^{o}C in 30 min and maintained at this level for 25 min.

Results and Discussion

Processing

The traditional processing of cassava into tapioca took an average of 4-6 h. Duration of processing affected the final product: tapioca that took more than 6 h was slightly dull in colour and possessed odours characteristic of fermented cassava products. Local tapioca producers avoid these undesirable characteristics by keeping the starch extraction process short. Duration of starch extraction was therefore identified as critical to the quality of tapioca meal. The moisture content of the final product ranged from 12% to 14%. During processing, 20%-25% of the harvested roots were lost as discarded peel, and another 10%-15% as fibre residues during sieving. These figures, which were obtained with the new, improved clones, are similar to those obtained with other cultivars (Ghilday and Lonsane 1990). The tapioca meal yields obtained after roasting the starch cake were similar for the two clones, ranging from 9% to 12% of the peeled roots used (dry matter basis).

Chemical composition

The compositional characteristics of tapioca meal produced from the two clones are shown in

Table 1. Starch comprises the major component of the tapioca meal (80%-88%). The starch content of the meal made from clone TMS 4(2)1425 was slightly higher than from the other. Tapioca meal made from both clones had low fat, ash, fibre, and protein contents. The addition of milk to tapioca meal, as is usually done, must surely compensate for the nutritional deficiencies of this food product as found in this study. The amylose content of tapioca meal is slightly lower than that obtained for other cassava products that have been examined (Kawabate et al. 1984). This may be because of the high heat treatment to which the starch is subjected to obtain the meal. High temperatures have been reported to reduce the amylose contents of other cassava products (Raja and Ramakrishna 1990).

Pasting characteristics

As tapioca meal is sometimes cooked before consumption, the paste property of the product from different cultivars is an important factor in determining the suitability of these improved clones for tapioca meal production. The pasting characteristics of tapioca meal made from the two clones are shown in Table 2. The temperatures required for initiating paste formation (45-46 ^{o}C) and for gelatinization (70-72 ^{o}C) were not significantly different. However, tapioca meal made from clone TMS 4(2)1425 exhibited a higher peak viscosity than that made from clone TMS 30572, indicating a faster swelling of the TMS 4(2)1425 tapioca meal. Meal made from TMS 4(2)1425 also exhibited higher viscosities at lower temperatures.

Tapioca meal from TMS 4(2)1425 was more viscous and more stable than that made from TMS 30572. But meal made from clone TMS 30572 was easier to cook (1.5 min) than that from clone TMS 4(2)1425 (3.0 min).

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p 152-154, 252, 420.

Table 1. Proximate composition (%) of tapioca meal made from two new, improved, cassava clones.

Component	Clone[a]	
	TMS 30572	TMS 4(2)1425
Starch	82.59 ± 2.18	87.14 ± 1.23
Sugar	0.6 ± 0.01	0.04 ± 0.01
Amylose	12.99 ± 2.10	12.63 ± 1.17
Fat	0.00 ± 0.00	0.03 ± 0.01
Ash	0.30 ± 0.01	0.20 ± 0.01
Crude fibre	1.70 ± 0.14	1.30 ± 0.12
Protein	0.16 ± 0.01	0.86 ± 0.13

a. Values obtained on a dry matter basis.

Table 2. Pasting viscosity of tapioca meal made from two new, improved, cassava clones, according to Brabender amylographs.

Characteristic	Clone	
	TMS 30572	TMS 4(2)1425
Initial pasting temp. (°C)	46.0	45.2
Temp. at maximum viscosity (°C)	72.2	70.0
Time to reach gelatinization temp. (min) (T_m)	32.6	31.4
Viscosity at 95 °C (BU)	280	539
Viscosity after 20 min at 95 °C (BU) (V_m)	206	372
Peak viscosity on heating (BU) (V_p)	445	620
Time to reach peak viscosity (min) (T_p)	34.2	34.4
Viscosity at 50 °C (BU) (V_h)	410	580
Viscosity after 20 min at 50 °C (BU)	460	625
Setback value (BU) ($V_h – V_p$)	-35	-40
Stability of starch (BU) (V_p - V_m)	239	248
Index of gelatinization (BU) (V_h - V_m)	204	208
Ease of cooking (min) (T_p - T_m)	1.6	3.0