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Physicochemical and Sensory Analysis of Fermented Flour "Kumkum" from Three Improved and One Local Cassava Varieties in the Adamawa Province of Cameroon

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Abstract: Physicochemical properties and sensory evaluation of fermented flours "kumkum" obtained from three improved and one local cassava varieties were carried out. The varieties were from five localities of the Adamawa province, namely: Simi, Tibati, Tignère, Lokoti and Ngaoundal. Moisture, ash, crude fiber, starch content, cyanogenic glucosides and swelling ability were studied. The results showed that variety 8017 had higher moisture content than varieties 4115, 2425, and the local variety "gangbadaa". Variety 8017 had the highest ash content while the local variety had the lowest. On the other hand, the local variety had the highest starch content while varieties 4115 and 2425 had approximately the same. Variety 4115 was richer in crude fibre than the varieties 8017 and 2425. Variety 4115 had the highest water retention capacity and consequently the highest swelling ability. The "gangbadaa" had a low water retention capacity, a low swelling ability and the lowest bulk density. Variety 2425 had the highest cyanide content than all the other varieties. On the other hand variety 4115 had the lowest cyanide content. The sensory evaluation test indicated a significant difference ($p<0.05$) between the different varieties in terms of taste, colour, odour, and texture. The "gangbadaa", the local variety, was highly appreciated for its colour, texture and flavour. Variety 4115 was the least appreciated for the above parameters. This may be a clear indication that even though the improved cassava varieties are disease resistant and have high yield potentials, the local population may not appreciate them as they are bound to their food habits.

Key words: Fermented cassava, food habits, sensory analysis, flours, starch, cyanide

Introduction

Cassava is widely grown in Africa and some other parts of the world. It plays a central role in the diets of most Africans. In Cameroon's Adamawa Province, it occupies 29,0000 ha and is grown on some 270,000 farms (Akoroda, 1992). It furnishes about 24 to 88% of caloric intake in Cameroon (Favier *et al.*, 1971). Traditionally, cassava roots are processed by a variety of methods into many different products depending on local customs. Fermented cassava flour is one of the most important cassava products in Africa. In Africa it is known by different names in different countries (Nweke, 1994). In Cameroon, it is commonly called "kumkum". Work on cassava in Cameroon has focused largely on attempts to increase production (Akoroda, 1992; Ngeve, 1991). The selection of cassava clones derived from improved populations introduced by the International Institute of Tropical Agriculture (IITA) Ibadan, Nigeria has continued in Adamawa Province, Cameroon by the Institute of Agricultural Research for Development (IRAD). Presently, three cassava clones have been screened for tolerance to diseases and pests, high root yield and adaptation to local conditions. While the improved cassava varieties may possess disease resistant and high yield characteristics, it is not known to what extent these characteristics can affect or alter the quality of traditional products processed from them, such as cassava "kumkum".

In this study, the physiochemical properties of "kumkum" made from three improved cassava varieties and one local variety "gangbadaa", were determined. The sensory analysis of "kumkum" from the four varieties of cassava was also examined.

Materials and Methods

Sample collection and preparation: Four cassava varieties (8017, 4115, 2425 and "gangbadaa") were randomly collected from 5 different locations in the Adamawa Province, namely: Tibati, Tignère, Simi, Lokoti, and Ngaoundal. The tubers were peeled and soaked in water for 6 days. The soft-fermented tubers were washed and the visible fibres removed. The wet paste was pressed to reduce the water content and sun dried. The samples were then ground into flour.

Table 1: The ash content of kumkum: varieties versus sites

Variety	Site				
	Simi	Tibati	Lokoti	Tignère	Ngaoundal
8017	0.54 ± 0.01	ND	0.54 ± 0.07	0.79 ± 0.18	0.99 ± 0.07
4115	0.89 ± 0.01	0.29 ± 0.04	0.59 ± 0.01	0.54 ± 0.03	0.59 ± 0.03
2425	0.45 ± 0.07	0.89 ± 0.07	0.59 ± 0.08	0.75 ± 0.07	0.75 ± 0.01
Local	0.19 ± 0.02	0.25 ± 0.01	0.20 ± 0.07	0.85 ± 0.02	0.63±0.08

These values are expressed in % Significant difference (P<0.05)

Table 2: The total fiber content of kumkum: varieties versus sites

Variety	Site				
	Simi	Tibati	Tignère	Lokoti	Ngaoundal
8017	1.34 ± 0.89	ND	2.44 ± 1.03	1.5 ± 0.45	0.57 ± 0.25
4115	3.49 ± 1.60	4.62 ± 3.14	2.39 ± 0.86	1.84 ± 0.64	2.83 ± 0.20
2425	2.80 ± 0.50	3.22 ± 1.72	1.63 ± 0.60	1.42 ± 0.89	1.72 ± 0.67
Local	0.75 ± 0.33	2.78 ± 0.56	2.17 ± 1.12	1.66 ± 0.40	1.17 ± 0.26

ND = not determined. These values are expressed in %. Significant difference (P<0.05)

Biochemical and physicochemical analysis: The moisture content was determined by drying about 5g of each sample of the already sun dried samples in a convection oven at 105°C to a constant weight (Audigie *et al.,* 1980). The determination of the ash was carried out by first treating the samples with nitric acid and heating at 550°C for 48 hours (Wolf, 1968). The method of Wolf (1968) was used in determining the crude fibre. The swelling ability was evaluated by adding warm water onto a known volume of "kumkum" and reading the increase in volume after thirty minutes. The method described by Ewers (1965) was used for the determination of the starch. The total cyanide content of "kumkum" was extracted with 0.1M H_3PO_4 and analyzed according to Oyewole and Odunfa (1992) method.

Sensory analysis: A panel of 12 trained persons was selected to evaluate the sensory quality of "kumkum" prepared from the five cassava varieties. Many trials were made to obtain "kumkum" that fits the consistency by most persons in the "kumkum" eating zones. This was standardized: that is the quantity of flour to water was fixed for all the varieties. Cooking time was also fixed. An evaluation form was designed for the panelist to fill. The different varieties were evaluated for their taste, colour, odour, and texture. The evaluation was based on a 6-hedonic scale (Steel and Torrie, 1960).

Statistical analysis: Experimental results were subjected to analysis of variance (ANOVA) and differences between means were assessed by Duncan's new multiple range test as described by Steel and Torrie (1960).

Results

The moisture content of "kumkum" produced from the four different cassava varieties from five different sites are shown in Fig. 1. There was great variation ($p< 0.05$) in the moisture content of "kumkum" of the different varieties of cassava and also in the five different sites. Variety 8017 appeared to have overall highest moisture content than the rest of the varieties. The ash content, which is a clear indication of the mineral content of "kumkum", was significantly different ($p<0.05$) with respect to site and variety. As shown in Table 1, variety 8017 of Ngaoundal had the highest ash content while the "gangbadaa" had the lowest.

It was observed that there was a significant variation ($p<0.05$) of the crude fibre content for the different sites and varieties. Varieties 4115 and 2425 had the highest crude fibre content as compared to the local variety and variety 8017 (Table 2). The results of the starch content showed variation between sites and variety. However, the starch content of "gangbadaa", the local variety in Simi and Ngaoundal had higher values than others. It was observed that variety 4115 had the highest swelling ability value. This was followed by 2425, 8017 and then "gangbadaa". There was a significant difference ($p<0.05$) in the swelling ability from one locality to another. The values of cyanide levels determined showed significant variation ($p<0.05$) between varieties and sites. Variety 2425 had the highest cyanide content level followed by "gangbadaa", then 8017 and 4115.

The sensory evaluation test indicated a significant difference ($p<0.05$) between the different varieties in terms of flavour, colour, odour, and texture. "Gangbadaa" was highly appreciated for its colour, texture and flavour. Variety 4115 was the least appreciated for the same parameters.

Discussion

Fermentation of cassava is an important processing technique used in different parts of the world. Fermentation is known to bring about vast changes in the physicochemical and functional properties of the tubers. Great variation of the moisture content was

Table 3: The swelling ability of kumkum: varieties versus sites

Variety	Site				
	Simi	Tibati	Lokoti	Tignère	Ngaoundal
8017	122.5 ± 3.53	ND	120.0 ± 7.06	112.5 ± 3.53	115.0 ± 7.07
4115	120.0 ± 14.14	117.5 ± 3.53	120.0 ± 2.66	115.0 ± 7.07	120.0 ± 10.96
2425	117.5 ± 3.53	121.25 ± 5.30	120.0 ± 5.66	110.0 ± 0.0	120.0 ± 9.43
Local	112.5 ± 3.53	111.25 ± 5.30	120.0 ± 8.5	110.0 ± 0.18	110.0 ± 6.17

ND = not determined. Significant differences (P<0.05).

Table 4: The cyanogenic glucosides of kumkum: varieties versus sites

Variety	Site				
	Simi	Tibati	Tignère	Lokoti	Ngaoundal
8017	2.75 ± 0.23	ND	1.93 ± 0.19	2.04 ± 0.36	2.03 ± 0.25
4115	0.54 ± 0.01	1.32 ± 0.56	1,14 ± 0.70	1.28 ± 0.17	1.45 ± 0.06
2425	2.71 ± 0.04	4.52 ± 1.99	2.66 ± 0.02	1.98 ± 0.63	1.26 ± 0.29
Local	2.02 ± 0.03	1.38 ± 0.44	2.90 ± 0.03	1.97 ± 0.15	1.75 ± 0.16

These values are expressed in ppm (mg/kg). ND = not determined. Significant difference (p<0.05)

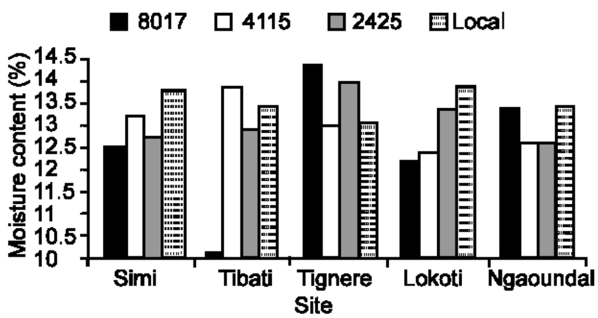

Fig. 1: The moisture content of kumkum four varieties at the different sites. Significant difference (p<0.05).

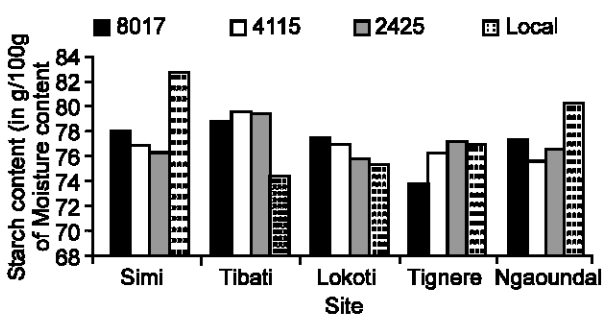

Fig. 2: The starch content of "kumkum" : varieties verses sites

observed between varieties and sites of the different "kumkum". The different sites are within the same geographical zone. The flours were all dried in the Savannah sun. The normal moisture content of flour is 14% (Roa and cock, 1973). Except for variety 8017, the other varieties were below the normal value.

The ash content, which is a clear indication of the mineral content of "kumkum", had great variation with respect to sites and variety. Favier (1977) determined the normal ash content of simple boiled cassava to be 2%. In general, all the samples in the various sites had values much lower than 2% (Table 1). The 2% ash determined by Favier (1977) was not for fermented cassava flour. The process of soaking for a number of days and washing before drying cause nutrient loses (Djuikwo and Tanya, 1998).

The samples were given the same treatment of washing and removing all the visible roots. The differences observed in the crude fibre content could be as a result of the variety or the site. Fibre has many physiological functions in the human diet. The normal crude fibre content of cassava flour is about 3% (Favier, 1977). During the process of fermentation, most of the soluble fibre is lost (Tanya *et al.*, 1997). There was variation observed in the starch content for the various varieties and sites (Fig. 2). Oyewole and Afolami (2001) determined the starch content of cassava flour to be 77 to 78%. In the present study the values of starch were much lower. The swelling rate may be related to the amount of starch in the flour. Variety 4115 had the highest value of starch. This does not hold for the local variety, which did not swell proportionately with the amount of starch. The level of amylopectin could be responsible for the swelling ability of the starch granules (Cheftel and Cheftel, 1977). Thus the variety with the lowest swelling ability might have had a low level of amylopectin.

Cyanogenetic glucoside is the principal toxic substance found in different proportions in cassava (FAO/WHO, 1991). The values determined showed significant variation (p<0.05) between varieties and sites. The cyanide content of cassava is closely linked to its genetic makeup (Silvestre and Arraudeau, 1983). Fermentation of cassava is known to reduce the cyanide content of cassava. The length of fermentation has an effect on the level of detoxification. The samples in this study were each soaked for 6 days to get them soft. This is the normal practice by the local population.

"Kumkum" prepared from the local variety, "Gangbadaa", was highly appreciated for its colour, texture and flavour. Variety 4115 was the least appreciated for the above parameters. This may be a clear indication that even though the improved cassava varieties are disease resistant and have high yield potentials; the local population may not appreciate them as they are bound to their food habits.

Conclusion: The present study has clearly shown some physicochemical and functional properties of three improved and one local (gangbadaa) cassava varieties in the Adamawa Province. There is great variation as to site and variety of the different parameters studied. The sensory analysis proved that even though the improved varieties have high yields and are also disease resistant; they may not produce good quality "kumkum". People of the Adamawa certainly have their preference as to what they want their "kumkum" to taste and look like. The local cassava variety was preferred over the three improved varieties because it had a whiter colour, a firm elastic texture and a sweet odour as most panelists described. It is therefore necessary for plant breeders to use these factors to produce new cassava varieties that satisfy local tastes.

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