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Effect of Scent Leaf (*Occimum viridis*) on Cyanide Content of Fermented Cassava and the Sensory Quality of its Fufu Meal

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Abstract: One kilogram of freshly harvested cassava samples were fermented with varying amounts (1.0, 2.0, 3.0, 4.0 and 5.0 g) of scent leaf (*Occimum viridis*), for one to five days. The effect of fermentation with these amounts of the spice on the loss of cyanide present in cassava, and the organoleptic acceptability of the resulting fufu meal prepared from fermented product was investigated. It was observed that cassava fermentation with the spice enhanced detoxification by increasing cyanide loss during fermentation in a manner that correlates positively with the amount of spice. However, the organoleptic properties of the fufu meals were improved only at low amounts of the spice (1.0-3.0 g of the spice/kg soaked cassava). At high amounts of spice (4.0-5.0 g spice/kg soaked cassava), the fufu meals were not very much acceptable. Thus, scent leaf mills can be used to ferment cassava at amounts not exceeding 3.0 g/kg cassava to reduce cyanide content and improve acceptability of product. Since scent leaf is also a vegetable, the protein and micronutrient compositions of the fufu meal should be determined in order to assess its suitability in nutrient interventions.

Key words: Cassava, cyanide, detoxification, fermentation, fufu, scent leaf

INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is widely cultivated in the tropics and is one of the most important food crops grown in Africa (De-Bruijn and Fresco, 1989). It provides a major source of calories for about 500 million people globally (Cock, 1985). Cassava product in Africa is projected to grow at about 3% per year in the next 20 years (FAO, 2002).

Processing of cassava roots improves palatability, reduces or eliminates potential toxicity, transforms raw cassava into other preservable forms beneficial to man. In Africa, common cassava processing operations include boiling, roasting and fermentation. Fermentation is by far the most common method of processing the cassava crop in Africa (Okafor *et al.*, 1984).

Traditional food processing in Africa demands intensive cooking which promotes loss of the required micronutrient and traditional food system in Africa is a mono-diet culture where the diet is largely cereal or tuber/root crop-based, with little or no other foods beyond these. The cassava is known to be composed largely of carbohydrates with very little amounts of proteins and micronutrients (Nweke *et al.*, 2002).

Traditional processing of cassava in West Africa has been found adequate for detoxifying cassava (Vasconcelos *et al.*, 1990), but the age-old traditional methods employed in traditional fermentation processes have not enhanced palatability and nutritional quality of fermented cassava products. Cassava traditional processing needs to be improved in order to increase palatability and nutritional qualities of its products. Efforts made to improve the protein contents of cassava products include the fermentation of cassava with protein-enriching bacteria and moulds (Raimbault *et al.*, 1985; Daubresse *et al.*, 1987), direct supplementation of fermented cassava products with the flours of protein-rich legumes (Akinrele, 1967), co-fermentation of cassava with cowpea and soyabean (Oyewole, 1992). The co-fermentation of cassava with some vegetables has been observed to increase the micronutrient contents of cassava fermented products (Hedren *et al.*, 2002; Chadha and Oluoch, 2003).

This study investigates the effect of a local spice – *Occimum viridis* (Scent leaf) on cassava detoxification during fermentation and the acceptability of the fufu meal – a co-fermented product. Scent leaf is a traditional vegetable condiment used to enhance food flavour. Thus, this study evaluates the sensory quality of the fufu meal obtained from cassava fermented with scent leaf.

MATERIALS AND METHODS

Laboratory centre and study period: The study was conducted in the Nutrition Research Laboratory, Department of Biochemistry, Delta State University, Abraka, Nigeria, in the month of October 2007.

Spice preparation: Fresh succulent scent leaves were harvested, spread on a tray and dried in an oven (Gellenhamp) at 65ºC for 48 hours. The dried leaves were then milled into powder with an electric blender (SMB 2898: SUPER MASTER, JAPAN).

Preparation of cassava samples: Fresh harvested cassava samples were peeled, washed and cut into small

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pieces of about 5 g each. One kilogram each of the sample was put into six different plastic buckets labelled 1-6 and 1 L of water was added into each bucket. To the first five (1-5) plastic buckets; 1.0, 2.0, 3.0, 4.0 and 5.0 g of the powdered scent leaf were respectively added.

The 6th bucket served as control. The soaked cassava roots were left to ferment for 5 days.

Determination of cyanide contents in the soaked cassava sample: The cyanide contents in the day 1-5 fermented cassava samples were determined by the alkaline titration method (AOAC, 1990). The cassava distillate obtained by steam distillation (Distiller: DZ-5, B. Bran; Scientific and Instrument Company, England) was titrated with 0.02M silver nitrate ($AgNO_3$) solution, after mixing with 0.02M sodium hydroxide, 6 M ammonia and 5% potassium iodide solutions. The $AgNO_3$ titre volume was used to calculate the cyanide content. $1cm^3$ $AgNO_3$ = 1.08 mgHCN. The cyanide content of each sample was calculated from the average of two close titre values.

The chemicals used were AnalaR Grade chemicals supplied by BDH, Poole, England.

Determination of moisture content: Twenty grammes of each sample (fresh and fermented: (1-5 days) was weighed (Tripple Bean Balance: MB-2610 g) and dried in an oven (Gallenhamp) at 100ºC for 6 h. The dried sample was cooled in a desiccator and re-weighed on cooling. The moisture content was estimated by subtracting the weight of the dried sample from that of the wet.

pH determination: The pH of the fermentation medium was determined using a pH meter (PHS-3C) throughout the 5-day fermentation period.

Preparation of fufu: After the 5 day fermentation period, the soft cassava roots were mashed in clean water, sieved and allowed to stand. The water was then decanted and the paste obtained was put into a cloth bag, tied and pressed to obtain a semi-solid paste. This paste was then rolled into balls and cooked in boiling water. After which, the paste was pounded in a mortar to obtain the final paste known as "fufu".

Sensory evaluation of the fufu meal: Ten judges were invited to assess and score the characteristic colour, texture, flavour, taste, appearance, firmness, mouldablity, cohensiveness and acceptability of the fufu meal on a 5-point scale as follows: very desirable 10, desirable 8, fairly desirable 6, undesirable 4, very undesirable 2. Codes were used to designate the samples during the evaluation exercise. This practice is important in order to have fair assessment that is not bias.

Statistics: ANOVA was used to compare group data, followed by Tukey-Kramer Multiple Comparison Test and level of significance was established at the 5% probability level.

RESULTS

Table 1, shows the changes in cyanide content of cassava samples soaked with different amounts of milled scent leaf. The results (Table 1) indicate that fermentation of cassava with scent leaf increased the detoxification of cassava by enhancing cyanide loss in a manner that depends on the amount of scent leaf. In general, the higher the amount of scent leaf, the higher the loss of cyanide. Day 5 sample had significantly reduced cyanide content ($p<0.05$) when compared with the day 1 sample, but the content of cyanide for cassava samples fermented with varied amounts of scent leaf did not differ significantly ($p>0.05$) from the control value at the end of the 5-day fermentation period.

Table 2 shows the hardness and moisture content of the cassava samples, and the pH of the fermentation medium. Observe that in Table 2, the cassava samples became softer as fermentation progressed and these daily changes reflected in the moisture content of the soaked cassava roots. The pH of the fermentation medium became more acidic as soaking period continued (Table 2). The cyanide lost from the cassava roots may have been leached into the bulk water and this could be partly responsible for the observed increase in the acidity of the fermentation medium in addition to the activities of acid fermenting microorganisms.

Table 3 shows the attribute scores of fufu, a fermented product of cassava roots. The fufu meals prepared from the soaked cassava samples at the end of the 5day fermentation period showed variations in their sensory qualities and evaluation (Table 3). All the fufu meals were accepted with the fufu prepared from cassava soaked with 2.0 g scent leaf being the most accepted. However, fufu prepared from cassava soaked with 4.0 g and 5.0 g scent leaf were the least accepted.

Statistical analysis of the total sensory scores of the fufu meals showed significant ($p<0.05$) difference between the fufu meals prepared from cassava soaked with 1.0, 2.0 and 3.0 g of scent leaf with the control value.

DISCUSSION

Fermentation of cassava with the local spice, scent leaf, enhanced detoxification of cassava by increasing cyanide loss during fermentation. The organoleptic properties of the fufu meals prepared from cassava fermented with scent leaf at low concentration (1.0 -3.0 g) were improved (Table 3), but at high amounts (4.0 and 5.0 g) of scent leaf, the resulting fufu meals were not very much desired. Evidence (Table 1-3) indicates that cassava fermentation with 1.0-3.0 g scent leaf /kg represents an improvement of the traditional cassava processing. Improved traditional cassava processing has been reported to enhance nutritional quality of fermented products (Oyewole and Asagbra, 2003).

Table 1: Changes in cyanide content of cassava samples fermented with varied amounts of scent leaf

	Amount of scent leaf (g)/kg of fermented cassava					
	0.0	1.0	2.0	3.0	4.0	5.0
Fermentation period (days)	Changes in cyanide contents⁺ (mgHCN/100 g cassava wet weight)					
1	7.02	7.02	7.02	7.02	7.02	7.02
2	4.32	5.13	3.78	3.24	1.89	1.89
3	3.51	2.97	3.24	2.43	1.89	1.89
4	2.70	2.70	2.16	2.16	1.62*	1.62*
5	1.62*	1.35*	1.08*	1.08*	1.08*	1.35*

*p<0.05 when compared with day 1 value, ⁺Each value was calculated from the average of two close titre values

Table 2: Changes in hardness and moisture content of soaked cassava and pH of the fermentation medium

	Amount of scent leaf (g)/kg of soaked cassava tubers						
		0.0	1.0	2.0	3.0	4.0	5.0
Fermentation period (Days)	Changes in hardness, moisture (g) and pH						
1	Hardness	Hard	Hard	Hard	Hard	Hard	Hard 58.10
	Moisture (g)	58.10	58.10	58.10	58.10	58.10	4.68
	pH	5.50	5.45	5.44	5.22	4.74	Hard
2	Hardness	Hard	Hard	Hard	Hard	Hard	Hard
	Moisture (g)	58.55	57.60	59.00	60.50	60.15	60.25
	pH	4.78	4.69	4.48	4.52t	4.45	4.38
3	Hardness	Fairly soft	Fairly soft	Fairly soft	Fairly soft	Fairly soft	Fairly soft
	Moisture (g)	60.40	60.45	60.40	61.55	61.10	61.05
	pH	4.41	4.41	4.33	4.24	4.20	4.18
4	Hardness	Soft	Very soft	Very soft	Very soft	Very soft	Very soft
	Moisture (g)	61.65	62.65	62.10	62.95	60.95	61.55
	pH	4.12	4.04	4.06	4.01	4.07	4.01
5	Hardness	Very soft	Very soft	Very soft	Very soft	soft	soft
	Moisture (g)	63.05	63.35	63.65	63.85	62.85	62.80
	pH	3.61	3.62	3.48	3.25	3.20	3.14

Table 3: Mean scores of the organoleptic and sensory attributes of fufu meal

	Amount of scent leaf (g) used to ferment 1kg of cassava for fufu meal					
	0.0	1.0	2.0	3.0	4.0	5.0
Attributes	Score of fufu meal (n=10)					
Colour	6.0±0.6	8.2±0.4	7.4±0.3	7.4±0.3	5.8±0.4	4.8±0.7
Appearance	6.2±0.8	8.0±0.6	8.2±0.5	8.2±0.4	5.4±0.5	5.2±0.7
Texture	7.0±0.5	7.6±0.7	7.8±0.6	7.4±0.5	5.8±0.6	6.0±0.06
Firmness	7.4±0.7	8.6±0.5	8.5±0.4	8.6±0.4	6.6±0.4	5.8±0.5
Taste	7.2±0.6	7.6±0.6	7.8±0.7	7.8±0.7	7.8±0.6	6.6±0.7
Flavour	6.4±0.6	6.8±0.6	7.8±0.4	8.0±0.4	7.2±0.5	7.6±0.6
Mouldability	6.2±0.8	6.2±0.7	8.2±0.4	8.2±0.6	6.4±0.7	5.6±0.6
Cohesiveness	6.6±0.4	7.4±0.7	8.0±0.6	8.2±0.5	5.8±0.6	6.2±0.6
Acceptability	7.6±0.3	7.8±0.6	7.8±0.7	7.8±0.7	6.6±0.5	6.3±0.5
Total score (%)	60.6±1.8	70.2±1.8*	71.6±1.6*	71.6±1.6*	57.4±1.6	54.0±1.9

Values are expressed as Mean ±SD for 10 assessments from panel members, *: Significantly different when compared with control ($p<0.05$)

Nutritional insecurity in Africa manifests itself in the form of micronutrient deficiencies in the diet. In order to help many people in Africa, there is need to develop nutritional strategies to implement the various micronutrient and flavour-enhancing interventions of cassava fermented products. Our data add to the accumulating information required for household processing interventions.

The scheme for the co-fermentation of cassava with legumes to produce protein enriched fermented cassava products at the household level has been developed (Akinrele, 1967) and it has been reported that the co-fermentation of cassava with 20% cowpea and soyabean increased protein contents of the fermented cassava product from 1.8 to 5.5% and 8.2% respectively without affecting the organoleptic properties of the product (Oyewole and Aibor, 1992). Lactic acid fermentation (Westby and Cho, 1994) has been reported to reduce iodine deficiency disorders in the Central Africa Republic (Peterson *et al.*, 1995). Cassava can be processed while mixed with many micronutrient-rich vegetables (Chadha and Oluoch, 2003) and so, there is need to encourage the use of micronutrient-rich vegetables.

Having seen the effect of varying amounts of scent leaf on cassava detoxification during fermentation and the sensory evaluation of their cassava fufu meal, it becomes reasonable to suggest that well-milled scent leaf could be used to ferment cassava since it enhances detoxification and improves the quality and acceptability of the fufu meal. However, the amount of scent leaf should not exceed 3.0 g/kg cassava. In addition, the protein and micronutrient contents of the fufu meal should be determined, because being a vegetable; scent leaf may contain some amounts of proteins and micronutrients.

REFERENCES

Akinrele, I.A., 1967. Nutrient enrichment of gari. J. Biol. Appl. Chem., 10: 19-23.

Association of Official Analytical Chemists (AOAC), 1990. Official Methods of Analysis, 15th Edn., AOAC, Washington D.C.

Chadha, M.L. and M.O. Oluoch, 2003. Home based vegetable gardens and other strategies to overcome micronutrient malnutrition in developing countries. Food Nutr. Agric., 32: 17-21.

Cock, J.H., 1985. Cassava: New Potentials for a Neglected Crop. West View Press, Boulder, Colorado, USA.

Daubresse, P., S. Ntibashrwa, A. Gheysen and J.A. Meyer, 1987. A process for protein enrichment of cassava by solid substrate fermentation in rural conditions. Biotechnol. Bioeng., 29: 962-968.

De-Bruijn, G.H. and L.O. Fresco, 1989. The importance of cassava in world food production. Netherlands J. Agric. Sci., 37: 21-34.

FAO, 2002. Agricultural Statistics. http://faostat.fao.org/faostat/collections.

Hedren, E., G. Mulokozi and U. Svanberg, 2002. *In vitro* accessibility of carotenes from green leafy vegetables cooked with sunflower oil and red palm oil. Int. J. Food Sci. Nutr., 53: 445-453.

Nweke, F.I., S.C. Dunstan, D.S.C. Spencer and J.K. Lyman, 2002. The Cassava Transformation. University Press, Michigan State, U.S.A. pp: 272.

Okafor, N., B. Lioma and C. Oylu, 1984. Studies on the microbiology of cassava retting for “foo-foo” production. J. Appl. Bacteriol., 56: 1-13.

Oyewole, O.B., 1992. Cassava processing in Africa. In: Application of Biotechnology to Traditional Fermented Foods. National Research Council, National Academy Press, Washington, D.C., pp: 89-92.

Oyewole, O.B. and A.M. Aibor, 1992. Fermentation of cassava with cowpea and soyabean for an enriched fufu. Trop. Sci., 33: 9-15.

Oyewole, O.B. and Y. Asagbra, 2003. Improving traditional cassava processing for nutritional enhancement. 2nd International Workshop on Food-Based Approaches for a Healthy Nutrition. Ouagadougou, pp: 369-382.

Peterson, S., F. Legue, T. Tylleskar, E. Kpizingui and H. Rosling, 1995. Improved cassava processing can help reduce iodine deficiency disorders in the Central African Republic. Nutr. Res., 15: 803-812.

Raimbault, M., S. Revah, F. Pina and P. Villalobos, 1985. Protein enrichment of cassava by solid substrate fermentation using molds isolated from traditional foods. J. Ferment. Technol., 63: 395-399.

Vasconcelos, A.T., D.R. Twiddy, A. Westby and P.J.A. Reilly, 1990. Detoxification of cassava during gari preparation. Int. J. Food Sci. Technol., 25: 198-203.

Westby, A. and B.K. Cho, 1994. Cyanogen reduction during lactic fermentation of cassava. Acta Hortic., 375: 209-215.