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EFFECT OF THE LEAVES OF *FLEURYA AESTUANS* ON THE FOOD QUALITY OF THE CORM OF COCOYAM (*XANTHOSOMA SAGITTIFOLIUM(L)* SCHOTT)

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ABSTRACT

The proximate composition, mineral elements and anti-nutritional factors of the leaves of *Fleurya aestuans* (family: urticaceae) and Cocoyam *(Xanthosoma sagitttifolium)* under different cooking conditions were determined. The leaf of *F. aestuans* contained appreciable amounts of fat, moisture, ash, fibre and carbohydrates but less protein. The leaf was found to be rich in soduim; calcuim, magnesium, iron, zinc, and copper. Cadmium, cobalt, manganese and lead were found in trace amounts. The leaf was also rich in oxalate and tannins.

Result of analyses showed general increases in moisture, ash and crude protein in the Cocoyam sample cooked with the leaves of *F.aestuans*. Mineral elements showed general decreases in the cooked samples. There was a 20% reduction in calcium concentration from 26.67mg/100g dry matter (DM) in P_1 to 19.33mg/100g DM in P_3 and similar trend was observed from sodium, potassium and magnesium. The cocoyam corm became richer in phosphorus after cooking with *F. aestuans.* There was a general reduction in the level of anti-nutrients after cooking the corm with the leaves. The food quality improved with respect to the level of anti-nutrients but reduced with respect to the mineral elements although those could be supplemented from other sources usually eaten with the cooked cocoyam. However, undesirable properties of *X. sagittifolium* particularly acridity caused by oxalates and other factors were considerably reduced by the use of the leaves.

KEY WORDS: Proximate composition, Phytochemicals, *F. aestuans*, cocoyam, acridity.

INTRODUCTION

Cocoyam, a monocot, is an edible aroid of the family Araceae. It has two major varieties in Nigeria: *Colocasia esculenta*(L) Taro, Schott and *Xanthosoma Ssggittifolium*(L)Schott, Tannia. Cocoyam has the potential of meeting the fundamental requirement of the body being very rich in nutrients notably carbohydrates, proteins, Vitamins and minerals (Bradbury and Holloway, 1988). Due to its high nutrient content, it is highly consumed by both the rich and poor. The cormeis of tannia cocoyam are highly superior to taro cocoyam in energy and protein although they contain much less calcium, magnesium, zinc, and trypsin inhibitor than taro cocoyam. (Bradbury and Holloway 1988). Fresh cormel of tannia contains 20-30% starch and 1-4% proteins (Bradbury and Holloway, 1988). Nearly all calcium present is in form of calcium oxalate (Onwene, 1978;Bradbury and Holloway, 1988). Cocoyam consumption has been affected by the presence of acridity factors, which cause sharp irritation and burning sensation in the throat and mouth. Over the years, numerous researches have been directed at isolating and evaluating the exact substance(s) responsible for this acrid taste or sharp irritating taste. So far, calcium oxalate (Agboola, 1987), a protease called "taroin", proteinase inhibitors (Harmmer, 1987), prussic acid (Arene, 1987), diglucoside – 3,4 dihydroben –2- aldehyde (Tang and Sakai, 1983) among others have been implicated, although the exact mechanism of action of some of these factors are not yet known. Meanwhile, prolonged cooking together with certain chemical compounds has been found useful for the removal, reduction or suppression of acridity in cocoyam. As part of the efforts to find solution to the itching problems associated with some species of cocoyam especially that of *xanthosoma,* some consumers incorporate the leaves of *F.aestuans* during cooking. This is believed to reduce the itching effect experienced when these factors are present. There is no report on either the chemical composition of *F.aestuans* or the chemical basis for this action. This paper reports on the chemical composition of the leaves of *F.aestuans* and the effects of the leaves on the nutrient and anti-nutrient contents of *xanthosoma saggittifolium* on cooking.

MATERIALS AND METHODS

Collection and treatment of samples.

Fresh leaves of *F.aestuans* were collected from Ikot Okubo, Offot, in Uyo, Akwa Ibom State, Nigeria, between the months of September and December, 2000. The leaves were separated from the stalks, washed in distilled water and air

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dried. They were then cut into small sections and further dried to a constant weight in a hot air circulating oven at 60°C for 4 days. The dry leaves were ground into fine powder (0.02mm) using mesh and electric blender and stored in an air-tight container for analysis. Fresh samples of the cocoyam corms *(xanthosoma sagittifolium)* were harvested from a farm in Uyo metropolis. Cocoyams grown in this area are generally known to cause throat irritation even when thoroughly cooked. The corn were peeled, washed, and cut into pieces and divided into three equal portions (50g each) designated P_1, P_2 and P_3. The raw corm (50g) was cooked for 2 hours without the leaves and with 5.0g of the processed leaves of *F.aestuans* respectively. Sample P_1 was the raw corm dried in an oven at 60°C to constant weight and then ground into powder and stored in a dry air-tight container and kept in a refrigerator for analysis. After the cooking, samples P2 and P3 were dried, cooled, re-weight, ground into powder and stored for analysis while the cooking water was discarded.

Analysis

The phytochemical analysis was done following the methods outlined by Trease and Evans (1989). The proximate, elemental and hydrocyanic acid compositions of both the F.aestuan leaves and cocoyam were determined following the recommended methods of AOAC (1980) while total oxalate was determined by the method of Dye (1956). Phytic acid was determined by the method of McCannce and Widdowson (1953). Tannins were determined following the method of Burns (1971). All analyses were done in triplicates and average results with standard deviations reported. The data were also subjected to analysis of variance.

RESULT AND DISCUSSION

Table I shows the proximate composition of

Table 1: Proximate, mineral and anti-nutrient composition of F.aestuans and *Xanthosoma sagittifolium* under different cooking conditions.

CONSTITUENTS	CONTENTS*			
	F.aestuans	P_1	P_2	P_3
Proximate values(g/100g Dry matter DM				
Moisture (wet weight)	79.29+1.39	633.84+0.272	65.88+0.99	65.08+1.96
Crude protein	2.67+0.08	6.13+0.75*	6.05+0.79*	11.38+0.37
Curde fat	12.00+0.03	0.16+0.25*	0.18+0.24*	0.15+0.02
Crude fibre	2.88+0.74	1.58+0.99	1.16+0.90	1.62+0.98
Ash	16.70+0.12	1.12+0.62*	1.16+0.19*	2.20+0.12
Carbohydrate	68.63+0.97	92.59+2.61	92.51+2.12	86.27+1.49
Caloric value (Kcal/100g)	393.20	396.32	376.25	391.95
Minerals (mg/100g				
Sodium	66.15+0.06	36.84+0.02	24.35+0.72	28.42+0.29
Potassium	0.86+0.02	906.5[illegible]+0.05	550.96+0.03	580.30+0.67
Magnesium	90.03+0.54	32.67+0.42	22.22+0.51	27.10+0.17
Calcium	570.70+5.80	26.57+0.07*	26.37+0.05*	19.33+0.27
Iron	14.18+0.70	0.96+0.02	1.26+0.02	1.44+0.94
Phosphours	60.41+0.02	58.01+0.27	56.02+0.12	66.01+0.49
Zinc	26.25+0.28	0..72+0.03	0.51+0.13	0.15+0.08
Manganese	0.72+0.45	0.66+0.07	0.42+0.22	0.25+0.52
Copper	1.41+0.13	0.44+0.32	0.37+0.16	0.28+0.33
Lead	0.79+0.07	ND	ND	ND
Cobalt	0.21+0.01	ND	ND	ND
Cadmium	0.11+0.12	ND	ND	ND
Anti-nutrients (mg/100g)				
Total oxalate	953.33+1.17	118.10+0.07	112.20+0.77*	84.90+1.48
Soluble oxalate	506.27+2.12	110.12+2.10	89.16+0.37	64.70+0.99
Hydrocyanic acid	ND	21.60+0.01	20.83+0.12	12.80+0.12
Tannic acid	635.12+5.56	469.26+0.02	395.20+1.37	42.12+1.98
Phytic acid	ND	150.01+2.01	140.03+0.75	120.00+0.15

P1= Uncooked cocoyam, P2= Cocoyam cooked without leaves, P3= Cocoyam cooked with F.aestuans leaves.
ND = Not detectable.
* Mean of 3 determinations + Standard Deviations (S.D.).
* Showed no significant difference (P<0.05)

F.aestuans and cocoyam under different cooking conditions. The result reveals that the leaves contain low level of protein with reasonable quantities of ash and fat. The leaves also contain high levels of oxalate and tannins while hydrocyanic and physic acids were not present in detectable quantities. Elemental analyses shows that sodium, calcium, magnesium, zinc and iron were present in high concentrations. The levels of trace metals like cadmium, copper and maganese were low. High levels of tannins and oxalates have been reported to cause itching in cocoyam (Agboola, 1987), while the presence of metals, which are precipitating agents of oxalate, phytate and tannins, may partially justify the use of this leaf in the suppression of acridity in cocoyam. The moisture contents of the cocoyam samples P_1-P_3 (63.84-65.88%) compares favorably with that reported (63-85%) for taro (Oyenuga, 1968). The ash and crude protein contents increased in P_3 probably due to contributions from the leaves or releases from complex in the cocoyam by leaf. The protein content of P_2 was lower than P_1. The protein value of the uncooked sample compared well with 6.88% earlier reported (Oyenuga, 1968). Cocoyam contains higher level of protein (5.25%) compared to other staple foods like cassava (1.99%) and potatoes (4.76%) (Oyenuga, 1968). The fat level in cocoyam is generally low and was reduced on heating from 0.16% in the uncooked (P1) to 0.13% in P2 but in the presence of the leaves in P3 the reduction (0.15%) was not absolute showing that the retention of fat on cocoyam while heating could be controlled by the leaf extracts. However, the low level of fat in cocoyam may be beneficial for weight control. The ash value also increased after cooking corm with the leaves. The elemental composition of both *F.aestuans* leaves and cocoyam subjected to different cooking conditions are shown in Table1. These mineral elements increased after cooking the corm with the leaves. Minerals seem to be present in a form that cannot be easily leached by cooking solution but introduction of leaves causes about 20% reduction during cooking. This loss was also observed for Na, K and Mg. Corm became enriched with P after cooking with leaf. Calcium contents decreased from 26.67mg/100g dry matter (DM) in $P_1$to 19.3mg/100g DM in P_3. This shows that *xanthosoma* is not very rich in calcium. This value is however higher than 8.5mg/100mg reported *Spp* (Bradbury and Holloway, 1988). Calcium is involved in muscle contraction, and its deficiency has been implicated in muscle spasm, cramps and a number of neuropathic disorders. (Eka 1985) phosphorus level was however higher in P3 than P1. This may be attributed to its release from phytin compex by heat or leaves. The value of 58.01mg/100g dry matter (DM) reported here compare well with 53mg/100g reported by Bradbury and Holloway (1988) for *xanthosoma*. Other elements showed similar behaviour to heat and leaf treatments with reductions in the levels of nutrients. The trace elements were not detected in the cocoyam sample but only in the leaves of *F.aestuans*. The anti-nutrient levels are also included in Table1. The oxalate contents of the uncooked cocoyam are below the lethal dose of 2-5g of soluble oxalate for man (Oke, 1966), although higher than 5.57mg/100g reported by Nwieke (1992) for taro. The level of oxalates in the leaf is below the lethal dose but consumption of large amounts of oxalate-rich foods or foods not properly processed may be risky. Oke (1969) reported that between 0.8 and 1.6g of oxalate might be consumed by a western Nigerian per day. Various methods of preparation such as cooking, frying, roasting can remove or reduce the level of soluble oxalate (Nwieke, 1992). The level of hydrogen cyanide in the sample is below the lethal dose of 35mg/100g(Oke,169). The level in the processed cocoyam was very low. Hydrogen cyanide content of food is usually reduced during processing by heat. It is known to inhibit cytochrome oxidase, one of the enzymes in the respiratory chain (Akpanyung et al, 1995). Phytic acid was also detected in varying amounts and like oxalic acid; it is known to limit the availability of calcium, magnesium, iron and phosphorus by the formation of insoluble complex with the minerals (Eka, 1985). The tannin levels decreased to a very low value in P3. Tannins bind irreversibly to protein forming soluble complexes and rendering them unavailable (Eka, 1985). It is evident from table1 that heat treatment and the leaching action of water during cooking reduced the levels of the anti-nutrients in cocoyam. Thus the food quality improves with respect to the level of anti-nutrients but reduces with respect to the level of the mineral elements although these could be supplemented from other sources usually eaten with the cooked cocoyam. However, undesirable properties of *xanthosoma* particularly acridity caused by oxalates and other factors are considerably reduced by the use of the leaves. The samples cooked with and without the leaves were in addition to chemical analysis subjected to sensory evaluation to determine the extent of reduction of itching after treatment. Reports by twenty (20) consumers showed a significant reduction (p0.05) in throat irritation when eaten especially in the sample cooked with leaves (P_3). In view of the economic hardship and alarming increase in the cost of some common food items especially in the developing countries, it is hoped that if cocoyam is properly processed and new cultivars developed, it could be put to multivarious uses including livestock and fish feeds. They could also serve, as cheap and readily available sources of carbohydrate just like the more expensive cassava and yam.

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