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RESEARCH ARTICLE

COMPARISON OF THE NUTRIENT COMPOSITION AND PHYSICAL CHARACTERISTICS OF NIGERIAN LOCAL VEGETABLE COWPEA VARIETIES (*VIGNA UNGUICULATA*. Walp) AND EXOTIC ONES

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ABSTRACT

Vegetable cowpeas are integral components of the Nigerian traditional diet. They are relished for their delicious flavor and complement carbohydrate staples, supplying proteins, vitamins and minerals. The aim of this research work was to provide scientific information the nutrient composition (pods containing seeds and seeds alone) and physical characteristics of two local vegetable cowpea varieties Akidi-ani (AKA) and Akidi-enu (AKE) consumed in Nigeria, in comparison with nine exotic varieties. Physical methods were used to measure the pod dimensions. Nutrient composition of whole pods and seeds were determined using standard AOAC methods (AOAC, 1990).The proximate composition, mineral and phytochemical contents were determined. The pod length of AKE ranked 3rd when compared with other vegetable cowpea varieties, while its pod width ranked 2nd. The two local cowpea varieties contained significant amounts of crude protein (28% and 32.5% for AKE and AKA respectively), crude fiber 3.4% and 4.4% for AKA and AKE respectively), and ash. AKA also contained relatively high amounts of iron (1.8mg/g) and phosphorus (1.1mg/g) and was found to be richer in alkaloids (1.6mg/g) and tannins (1.5mg/g) than other vegetable cowpeas. The findings provide scientific data required for genetic modification of local cowpeas. It also highlights the need to diversify their utilization.

INTRODUCTION

The term "Vegetable cowpeas" refers to varieties of cowpeas grown for their immature succulent pods. While some cowpea varieties are grown for their seeds, others are utilized as immature pods (Ojimelukwe, 2002). Some traditional Nigerian varieties of cowpeas are eaten with carbohydrate staples such as yam, maize and cassava products. International Institute for tropical Agriculture (IITA) new has developed new vegetable cowpea varieties which will diversify the utilization of this legume. (Redden, 1981). The physicochemical and functional properties of some Nigerian cowpea varieties were studied by Chinma *et al.* (2008). Several researchers have also studied the effects of processing methods on cowpeas (Olapade *et al.*, 2005; Mbah and Silas, 2007; Oduro *et al.*, 2007). However, detailed nutrient composition of these developed hybrids is not available in literature. The nutrient composition of the local varieties has not also been determined. The present research seeks to improve knowledge data base on the composition of two local Nigerian vegetable cowpea cultivars (*Akidi-ani and Akidi-enu*) in comparison with nine other newly developed varieties. The physical characteristics of the vegetable cowpeas will also be evaluated since they provide vital processing data.

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METHODS

Sample preparation

Vegetable cowpeas were grown in the Agricultural Research Farm of Michael Okpara University of Agriculture Umudike (longitude 07^0, 33E, latitude 05^0 29N, altitude 122m) on sandy loam utisol (Agboola, 1979) Eleven vegetable cowpeas were used. Nine were obtained from International Institute for Tropical Agriculture (IITA) while two local varieties were obtained from subsistence farmers in Nsukka, Enugu State, Nigeria. Vegetable cowpeas were harvested (after two months of planting) as immature pods and preserved in a refrigerator overnight before use.

Figure 1. Mature local Nigerian vegetable cowpeas

Proximate analyses

Proximate analyses were carried out using standard AOAC methods (AOAC, 2000). Determinations were carried out on the whole pos as well as the seeds. Moisture, ash, protein, fat, crude fibre were determined. Carbohydrate content was estimated by difference. Calcium and phosphorus were determined by the EDTA Versanate Complexometric method. Potassium and phosphorus were determined using Spectrophotometric methods (Pearson, 1976). Alkaloids were determined using the method of tannin was determined using the method of Bohm and Kocipai- Abyzan (1994). Hydrogen cyanide was determined using AOAC methods (AOAC, 2000). Physical characteristics of vegetable cowpea seeds were determined using the micro meter screw gauge and the Vernier Calipers.

Statistical Analysis

Statistical analysis was carried out as a one way analysis of variance in a complete randomized block design. Significant means were separated using Duncan's multiple range tests. Data was analyzed using the SPSS package (Version 2000).

RESULTS

Proximate Composition of Whole Immature Vegetable Cowpea Pods Containing the Seeds

The proximate composition of immature vegetable cowpea pods containing seeds is shown in Table1. Moisture content of samples ranged from 12.9-30.2%. Ash content was between 3.8 to 7.3%. Protein content ranged from 26.4 to 32.0% while fat content was between 1.3 and 2.7%. The protein content of local vegetable cowpea varieties compared well with the exotic ones. AKA ranked 3rd in protein content. There was no significant difference in the fat content ($p > 0.05$) of vegetable cowpeas. Crude fiber ranged between 1.6 and 4.4%.

Proximate Composition of Vegetable Cowpea Seeds

Table 2 shows the proximate composition of the immature vegetable cowpea seeds without the pods. The local vegetable cowpea seeds contain low amounts of moisture when compared with the new IITA hybrids. The high protein contents of the seeds without the pods indicate that seeds contribute most of the protein content of the whole pod. Moisture content ranged from 7-24.8%; ash content ranged from 4.7 to 6.0%; protein content ranged from 26.5 to 33.35% .while fat ranged from 0.7 to 2.5%. The vegetable cowpea seed samples contained 0.6 to 3.1% crude fiber. The low crude fiber content of seed samples indicates that the pods contained more of the fiber.

Table 1. Proximate Composition of Immature Vegetable Cowpea Pods

Type of vegetable cowpea	Moisture (%)	Ash (%)	Protein	Fat (%)	Crude Fiber (%)	Carbohydrate (%)
Akidi-ani*	18.1^{h}±0.1	6.5^{b}±0.0	32.5^{c}±0.1	2.6. ± 0.1	3.4^{c}±0.1	36.9^{d}±0.2
IT-835-899	20.2^{g}±0,0	6.3^{c}±0.0	32.8^{a}±0.1	1.2 ±0.1	3.9^{b}±0.1	35.6^{f}±0.1
IT-971-147-3	25.3^{e}±0.2	3.6^{h} ±0.1	30.3^{f}±0.2	1.6 ±0.1	2.2^{f}±0.0	37.0^{c} ±0.1
IT-93K-915	30.2^{b}± 0.1	2.4^{i}±0.9	28.8^{h}±0.0	2.7 ±0.1	1.6^{g}±0.2	34.2^{g}±0.2
IT-86F-2062-5	28.8^{d}±0.2	4.2^{f}±0.2	26.4^{i}±0.1	1.8 ±0.1	2.6^{e}± 0.1	34.3^{f}±0.2
IT-810-1228-14	18.5^{h}±0.1	6.7^{b}±0.2	29.4^{g} ±-.0	2.5 ±0.1	2.9^{d}±0.0	40.0^{b}± 0.1
IT86F-2014-1	29.2^{c}±0.2	5.5^{d}±0.1	31.1^{e}± 0.1	2.0 ±0.1	3.4^{c}±0.1	28.9^{h}±0.1
Akidi-enu*	21.8^{e}±0.1	7.3^{a} ±0.1	28.4^{i} 0.1	1.7 ± 0.1	4.4^{a} ±0.1	36.4^{e}±0.1
IT81D-1228-10	25.5^{e} ±0.1	3.8^{g}±0.1	31.0^{e} ±0.2	1.6 ±0.1	4.4^{a}±0.1	36.4^{e}±0.2
IT86D-880	36.0^{a}±0.1	4.2^{f}±0.1	32.9^{b}±0.1	2.3 ±0.1	2.9^{d}±0.1	44.2^{a} ±0.2
IT835-898	12.9^{i}±0.2	4.8^{e}±0.1	32.9^{b}±0.1	2.3±0.1	2.9^{d}±0.1	44.2^{a} ±0.1
$LSD_{0.05}$	0.91	0.12	0.03		0.03	0.05

*local vegetable cowpeas Values with different superscripts are significantly different ($p < 0/05$) from one another.

Table 2. Proximate Composition of Vegetable Cowpea Seeds

Type of vegetable cowpea	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Crude Fiber (%)	Carbohydrate (%)
Akidi-ani*	7.0^{j}±0.1	6.9a±0.2	26.5^{i}±0.0	2.4^{c}±0.2	2.8^{b}±0.1	54.4^{c}±0.1
IT-835-899	13.3^{e}±0.1	6.1^{e}±0.1	31.9^{c}±0.0	0.7^{j}±0.0	0.8^{f}±0.0	47.2^{d}±0.0
IT-971-147-3	11.2^{f}±0.0	6.2^{c}±0.0	28.2^{g}±0.1	1.3^{i}±0.1	3.1^{a}±0.1	50.0^{b}±0.1
IT-93K-915	15.3^{d}±0.1	5.2g±0.1	28.4^{f}±0.1	2.8^{a}±0.1	1.2^{e}±0.2	47.0^{d}±0.0
IT-86F-2062-5	17.6^{b}±0.1	4.8h±0.2	28.6^{e}±0.1	2.3^{d}±0.0	0.9^{f}±0.1	45.8^{e}±0.2
IT-810-1228-14	24.8a±0.0	5.9^{f}±0.0	26.8^{h}±0.1	1.7^{f}±0.1	2.2^{c}±0.0	38.7^{g}±0.1
IT86F-2014-1	24.8^{a}±0.2	4.7^{i}±0.2	33.4^{a}±0.0	1.9^{e}±0.2	1.0^{f}±0.1	34.4^{h}±0.0
Akidi-enu*	7.2^{h}±0.1	6.2^{c}±0.1	28.4^{f}±0.1	1.4^{h}±0.1	0.6^{h}±0.1	54.8^{a}±0.1
IT81D-1228-10	15.5^{c}±0.1	4.7^{i}±0.0	30.6^{d}±0.0	1.5^{g}±0.2	3.2^{a}±0.2	44.5^{f}±0.2
IT86D-880	7.1^{i}±0.0	6.4^{b}±0.1	28.6^{e}±0.1	1.7^{f}±0.1	1.6^{d}±0.1	54.8^{a}±0.1
IT835-898	11.1^{g}±0.1	4.7^{i}±0.0	33.3^{b}±0.1	2.5^{b}±0.2	1.0^{f}±0.2	47.5^{c}±0.1
$LSD_{0.05}$	0.02	0.03	0.02	0.01	0.24	0.03

*local vegetable cowpeas Values with different superscripts are significantly different ($p < 0/05$) from one another

Mineral Content of Whole Vegetable Cowpea Pods

Table 3. Mineral Content of Vegetable Cowpea Pods

Type of vegetable cowpea	Iron (mg/g)	Phosphorus (mg/g)	Potassium (mg/g)	Calcium (mg/g)
Akidi-ani*	1.8^{a}±0..0	1.1^{a}±0.1	1.5^{a}±0.0	1.3^{a}±0.2
IT-835-899	1.0^{f}±0.1	0.6^{f}±0.0	1.1^{b}±0.1	0.9^{d}±0.2
IT-971-147-3	0.7^{g}±0.1	0.8^{e}±0.1	1.1^{b}±0.1	0.9^{d}±0.2
IT-93K-915	1.3^{e}±0.2	1.0^{b}±0.0	0.7^{f}±0.1	0.6^{f}±0.1
IT-86F-2062-5	1.4^{d}±0.0	0.9^{c}±0.1	0.9^{d}±0.1	1.0^{c}±0.2
IT-810-1228-14	1.1^{e}±0.1	0.7^{c}±0.0	1.4^{c}±0.0	0.7^{e}±0.2
IT86F-2014-1	1.6^{b}±0.0	0.9^{c}±0.1	1.4^{c}±0.0	0.8^{e}±0.1
Akidi-enu*	1.6^{b}±0.2	0.9^{c}±0.1	1.0^{e}±0.0	1.2^{b}±0.2
IT81D-1228-10	1.6^{b}±0.1	0.5^{g}±0.2	0.5^{g}±0.1	0.7^{f}±0.2
IT86D-880	0.7^{f}±0.0	0.9^{b}±0.1	1.1^{b}±0.1	0.7^{f}±0.1
IT835-898	1.5^{c}±0.1	1.0^{a}±0.1	1.1^{b}±0.1	0.9^{d}±0.2
$LSD_{0.05}$	0.03	0.03	0.02	0.04

*local vegetable cowpeas
Values with different superscripts are significantly different (p < 0/05) from one another

Table 3 shows the mineral composition of immature vegetable cowpea pods containing the seeds. Iron content ranged between 0.7-1.8mg/g. Vegetable cowpea pods contained 0,5-1.1 mg/g phosphorus and 0.7 to 1.5mg/g potassium. The calcium content of samples ranged from 0.6 to 1.3mg/g. Akidi-ani was found to be the best source of iron. It was also found to be the best source of phosphorus (1,1mg/g) followed by two IITA hybrids (IT 93K-915) and IT 835-898). Akidi-ani was also the richest source of potassium (1.5mg/g) while IT81D-1228-10 had the lowest amount of potassium. Calcium contents of IT 93K-915;IT 81D-1228-10 and IT86D-880 were relatively low.

Table 4. Antinutrients in Whole Vegetable Cowpea Pods

Type of vegetable cowpea	Alkaloids (mg/g)	Tannins(mg/g)	Hydrogen Cyanide (mg/g)
Akidi-ani*	1.6^{a}±1.0	0.5^{a}±0.1	0.1±0.1
IT-835-899	1.0^{d}±0.0	0.4^{b}±0.2	0.1±0.0
IT-97K-147-3	1.5^{b}±0.1	0.3^{c}±0.0	0.1±0.0
IT-93K-915	0.9^{e}±0.0	0.2^{d}±0.1	0.1±0.0
IT-86F-2062-5	0.3^{g}±0.2	0.2^{d}±0.1	0.1±0.0
IT-810-1228-14	1.1^{c}±0.1	0.5^{a}±0.0	0.1±0.0
IT86F-2014-1	0.8^{f}±0.0	0.4^{b}±0.0	0.1±0.1
Akidi-enu*	1.0^{d}±0.0	0.4^{b}±0.1	0.1±0.0
IT81D-1228-10	1.1^{c}±0.2	0.3^{c}±0.0	0.1±0.0
IT86D-880	1.1^{c}±0.1	0.2^{d}±0.1	0.1±0.0
IT835-898	0.2±0.1	0.2^{d}±0.2	0.1±0.0
$LSD_{0.05}$	0.18	0.01	

*local vegetable cowpeas
Values with different superscripts are significantly different (p < 0/05) from one another

Table 4 shows the anti nutritional factors in vegetable cowpea pods containing the seeds. Alkaloid content ranged from 0.2-1.6mg/g. tannin content ranged from 0.2-0.5mg/g. They contain only trace amounts of hydrogen cyanide. However, even small amounts of hydrogen cyanide may still have chronic toxicity effects if proper processing methods are not applied to eliminate this toxicant (Ernesto *et al.*, 2000). Tannins may decrease protein quality by decreasing digestibility, and palatability. Other nutritional effects which have been attributed to tannins include damage to the intestinal tract, toxicity of tannins absorbed from the gut, and interference with the absorption of iron, and a possible carcinogenic effect, (Butler, 1989). The nature of the alkaloids present should be known before a conclusive statement on their effects can be made. In addition, although many phytochemicals are regarded as anti nutrients, when present in foods in small amounts they possess health promoting properties. There is need to determine the bioavailability of nutrients and processing methods that reduce the anti nutrients in vegetable cowpeas.

Table 5. Dimensions of Vegetable Cowpea Pods

Type of vegetable cowpea	Pod Length (cm)	Pod Width (cm)
Akidi-ani*	12.4^{e}±0.1	1.4^{c}±0.1
IT-835-899	19.4^{b}±0.2	2.3^{b}±0.0
IT-971-147-3	16.8^{c}±0.1	2.9^{a}±0.1
IT-93K-915	17.5^{c}±0.2	2.2^{b}±0.1
IT-86F-2062-5	16.8^{c}±0.2	2.4^{b}±0.1
IT-810-1228-14	15.0^{d}±0.1	1.9±0.2
IT861-2014-1	11.6^{e}±0.0	2.0^{b}±0.1
Akidi-enu*	16.6^{c}±0.1	2.4^{b}±0.2
IT81D-1226-10	17.3^{c}±0.2	2.2^{b}±0.2
IT86D-880	14.7^{e}±0.1	1.7^{c}±0.1
IT835-898	21.9^{a}±0.2	2.4^{b}±0.2
$LSD_{0.05}$	1.01	0.38

*local vegetable cowpeas
Values with different superscripts are significantly different (p < 0/05) from one another

Table 5 shows the dimensions of vegetable cowpea pods used for the research work. IT83-899 was the largest in terms of size (with a pod length of 21.0cm and a width of. 2.4cm) while Akidi-ani (AKA) had the smallest size (12.4cm long and 1,4cm wide). The results indicate that grading machinery for the cowpea cultivars cannot be the same.

Conclusion

Comparison of these two local vegetable cowpea varieties with nine (9) exotic ones indicated that Akidi-ani was exceptionally rich in ash. (6.90%); iron (1.80mg/g); phosphorus (1.06mg/g); potassium (1.53mg/g) and calcium (1.30mg/g). its tannin alkaloid and hydrogen cyanide contents were also higher than that of other vegetable cowpea varieties (0.5mg/g;1.61mg/g and 0.14mg/g respectively). The findings suggest that AKA should be genetically modified to reduce anti nutrients and conserve the mineral content. It also indicates the need to assess the effects of processing methods on bioavailability of minerals from AKA.

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