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Proximate Composition and Nutrient Analysis of Six Selected Leaf Vegetables of Southwest Nigeria

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Abstract

The Proximate and nutrient composition of six selected underxplored leaf vegetables, Basella alba L., Crassocephalum crepidoides (Benth) S. Moore, C. biafrae (Oliv. and Heirn) S. Moore, Lactuca taraxacifolia Shum ex Hornemann, Solanum nigrum L. and Celosia trigyna were studied. The crude protein (CP), Nitrogen free extract (NFE) and Ether extract (EE) were highest in S. nigrum while the ash and crude fibre (CF) contents were highest in C. crepidoides and L. taraxacifolia, respectively. The highest dry matter content was recorded in C. biafrae. The phosphorous (P), Potassium (K), Calcium (Ca) Magnesium (Mg) contents were highest in C. crepidiodes while the nitrogen (N) and Iron (Fe) contents were highest in S. nigrum and C. biafrae, respectively.

Introduction

Of about twenty leaf vegetables consumed in Southwest (SW) Nigeria, only about eight are routinely cultivated. Fewer than six are actually grown for commercial purposes, while some others grow wild and are underexplored. The research programmes on leaf vegetables in Nigeria cover only the routinely cultivated ones such as *Amaranthus spp* L., *Solanum macrocarpon L., Celosia argentea* L., *Corchorus olitorius* L., *Telfaria occidentalis* (f). Hooks and *Hibiscus sabdarifa* L. (NIHORT, 1988).

Succulent leaves of the leaf vegetables together with other ingredients such as pepper, locust bean, onion and tomato make very palatable stew and soup. It is a common knowledge that vegetables and fruits are the richest sources of vitamins and minerals, and some can also provide adequate quantities of carbohydrate and protein (Asian Vegetable Research and Development Centre (AVRDC), 1984). The malnutrition problems in Nigeria although different in magnitude and severity among different areas are due to protein, vitamins, Iron, and other minerals

deficiency. To solve these problems, Ologunde *et al.* (1992) stressed the need for identifying novel, high quality but cheap sources of protein and energy in the Third World Countries, especially Nigeria because of the dwindling returns from existing sources. This therefore called for identifying a broader range of plant species which have potential as major food sources and for developing these for efficient food production in the Nigerian economy.

In Nigeria, there have been several reports on chemical studies of leaf vegetables (Oke, 1966, 1968; Oyenuga, 1968; Ologunde *et al.* (1992), Badifu and Okeke, 1992) however, there has not been any report on chemical studies of the six leaf vegetables that were used in this study. This study therefore investigated the proximate and nutrient composition of six selected local leaf vegetables of SW Nigeria.

Materials and Methods

Fresh samples of six locally consumed leaf vegetables: *Basella alba* L – Basellaceae, *Crassocephalum crepidoides* (Benth) S. Moore – Compositae, *C. biafrae* (Olive. & Heirn) S. Moore – Compositae, *Lactuca taraxacifolia* Schum ex Hornmann – compositae, *Solanum nigrum* L. – Solanaeeae, and *Celosia trigyna* L. – Amaranthaceae that were planted under farmer – managed condition in three adjacent villages: Ajebandele, Fashina and Kajola, in Ife district, Osun State were collected during the rainy season of 1995. Samples were taken from 2m x 2m dimension plots for each vegetable species. Each village served as a replicate.

Only the succulent shoot parts of the vegetables which are eaten were cut, bagged separately and taken to the laboratory. The samples were washed in 0.1% Omo detergent solution followed by immediate rinsing with distilled water to remove all spray residues and contaminants on the leaves. Samples were thereafter air-dried for one hour and 500g fresh weight of each vegetable sample was measured out in duplicate for analysis.

Samples were put in oven at 80°C for 72 hours to determine the dry matter (DM) contents. The dried samples were ground separately in a Wiley microhammer stainless steel mill. The ash content was determined by igniting 2.0g of the ground sample (in duplicate) in muffle furnace at 500°C for two hours (AOAC, 1984). The crude fibre (CF) content was determined by digesting 2.0g of the ground samples (in duplicate) in boiling 1.25% H_2SO_4 and 1.25% NaOH (AOAC, 1984). The ether extract[1] (EE) was determined by soxhlet extraction technique. The Crude Protein (CP) content was determined by first determining the nitrogen (N) content by micro-Kjeldahl method and multiplying the N value by 6.25 (AOAC,

1. Either extract is interchangeably used with fact in this paper

1984). The nitrogen free extract (NFE) was determined by summing up the percentage ash, CF, EE, and CP and deduct from 100. (IITA, 1984).

Tripartite mixture of HNO_3, H_2SO_4 and $HClO_4$ was used for digesting the samples prior to chemical analysis. The phosphorus (P) content was determined by Vanadomolybdate yellow colour method, Iron (Fe) was determined by Orthophenathroline colorimetric method, K by flame photometry while calcium (Ca) and magnesium (Mg) were by atomic absoption spectrophotometer (Jackson, 1960 and Piper, 1956).

All data collected were subjected to analysis of variance based on the standard method for the randomised complete block design (Steel and Torrie, 1980) and means were separated using the Duncan's Multiple Range Teat at 5% level of probability.

Result and Discussion

Tables 1 and 2 show that the site of sampling (replicate) did not significantly affect the proximate composition and nutrient content, of the vegetables ($P < 0.05$). However, the main effects of the vegetables (Tables 1 and 2) significantly affected the proximate and nutrient composition ($P < 0.05$).

The proximate composition of the vegetables on percent dry matter basis is shown in Table 5. The dry matter content of *C. biafrae* is significantly higher than for *B. alba, C. crepidoides* and *S. nigrum* by 41.3%, 45.5% and 27.8%, respectively.

The crude protein (CP) content of *S. nigrum* is significantly higher than for other vegetables except *L. taraxacifolia.* Comparison showed the CP content of *S. nigrum* was 23.3%, 16.3%, 16.3% and 14.4% more than for *C. biafrae, B. alba* and *C. crepidoides,* respectively. The ether extract (fat) content of the vegetables followed closely the pattern of CP content. The highest fat content of *S. nigrum* is 91.3% higher than the least of *C. biafrae.* The highest nitrogen free extract content (58.2) of *S. nigrum* is 44.1% higher than the least (40.4) of *L. taraxacifilia.* Also, the highest crude fibre content of *B. alba* (16.4) is 56.2% higher than the least of *C. biafrae* (10.5).

The ash content of *C. crepidoides* was significantly higher than for other vegetables studied. Comparison showed 54.6% more ash in *C. crepidoides* than *L. taraxacifolia* and *B. alba.*

The results of proximate composition generally agreed with those reported by Oke (1966) for *Heinsia pulchelia, Gynura amplexcaulis, Solanum nodiflorum* and *Myrianthus arboreus.* The slight difference obtained particularly with respect to nitrogen free extract (carbohydrate) and CP may be due to genetic differences between the vegetables used by Oke (1966) and those used in this study. However, apart from the

genetic difference, Oke (1968) showed that the age at sampling has an effect on the proximate composition of vegetables as the DM, CP, CF and ash content increased with age in *Corchorus, olitorius, Celosia argentea, Solanum incanum* and *Solanum macrocarpon.* Also, Purseglove (1987) reported that the nutrient composition of plant materials vary with the age, cultural practices, environment, the season and the varieties.

The CP, NFE and fat are consistent with those reported by Ologunde *et al.* (1992) for grain amaranth. The values obtained by Ologunde *et al.* (1992) are found to be consistent with the United States Recommended Dietary Allowance (RDA). It could therefore be inferred that some proportion of the dietary protein, fat and carbohydrate requirements of man could be met by these vegetables if a sufficiently large amount is eaten.

Table 4 shows the nutrient composition of the vegetables on percent of drymater basis. Statistical analysis shows that *C. crepidoides* contained significantly higher amount of P, K, Ca, Mg than other vegetables. In contrast, *S. nigrum* contained the least amount of P, K, Mg and Fe. The Fe content was highest in *C. biafrae* while the N content was highest in *S nigrum* and least in *C biafrae.* The significantly higher P, K, Ca, and Mg obtained for *C. crepidoides* may be related to its high ash content compared with other vegetables studied. The elemental compositions of plant materials have been shown by some workers to be directly related to the ash content (Oke, 1966, Afolabi and Oke, 1981, Ologunde *et al.*, 1992). The high Ca content obtained in this study may be of profound importance in solving the problem of growth retardation and rickets. However, when giving consideration to Ca, emphasis should be placed on Oxalate (antinutritional factor) which is capable of binding Ca in the digestive tract and render the Ca unutilized for animal and man (Oke, 1968). To reduce this risk, Badifu and Okeke (1992) recommended blanching of lettuce.

The high P, Fe and Mg contents of the vegetables will serve great purpose in metabolism and skeletal growth, blood haemoglobin formation and enzyme system activities respectively in man (AVRDC, 1984).

In general, all the six vegetables studied compare favourably both in terms of nutrient and proximate composition with *S. macrocarpon, T. occidentalis, A. cruentus, C. argentea. C. olitorius* and *H. Sabdarifa* which are routinely cultivated and have been reported by NIHORT (1988) and AVRDC (1984). The leaf yields of *B. alba* (30.8 tons/ha) used in this study compare with *S. macrocarpon* (27 2 tons/ha), while those of *C. biafrae* (40.8 tons/ha), *C. crepidoides* (25.4 tons/ha) *L.* taraxacifolia (28.6 tons/ ha) and *C. trigyna* (27.6 tons/ha) compare favourably with *T. occidentals* (40.4 tons/ha), *A. cruentus* (26.8 tons/ha), *C. argentea* (24.6 tons/ha) and *H. sabdarifa* (28.4 tons/ha), respectively as reported by NIHORT (1988).

Conclusion

The proximate and nutrient composition of the vegetables studied meet the Recommended Dietary Allowance (RDA) standard and are thus capable of meeting the nutritional need of the poor people who cannot pay for milk, egg and meat but depend on cheap vegetables as the main source of their dietary needs. The leaf yields obtained are also encouraging and compare favourably with the other vegetables that are included in research programmes. It is suggested that these vegetables should be included in Native vegetable research, especially for improvement/breeding.

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Table 1: **Analysis of variance mean squares for the proximate composition of six leaf vegetables**

	DF	CRUDE PROTEIN	ETHER EXTRACT	CRUDE FIBRE	NITROGEN FREE EXTRACT	ASH	DRY MATTER
TOTAL	17						
Replicate (site)	2	0.055	0.005	0.060	0.003	0.095	0.17
Vegetables	5	4.940*	2.374*	22.376*	174.086*	15.714*	12.280*
Error	10	0.086	0.002	0.071	0.225	0.080	0.065

*Significant at 5% level of probability

Table 2: **Analysis of variance mean squares for the nutrient composition of six vegetables**

	DF	N	P	K	Mg	Ca	Fe
TOTAL	17						
Replicate (site)	2	0.008	0.005	0.060	0.003	0.007	52.06
Vegetables	5	0.126*	0.284*	6.380*	174.086*	0.282*	3313.69*
Error	10	0.004	0.002	0.006	0.003	0.003	47.190

*Significant at 5% level of probability

Table 3: **Proximate Composition of six leaf vegetables of Southwest Nigeria***

	% DM	% CRUDE PROTEIN	% NFE	% ETHER EXTRACT	% CRUDE FIBRE	% ASH
			EXPRESSED AS % DRY MATTER			
B. alba	10.4d	12.3cd	57.6a	2.9co	16.4a	10.8e
C. crepidoides	10.1d	12.5c	57.3a	2.8cd	10.7c	16.7a
L. taraxacifolia	13.6b	14.3ab	40.4c	4.3ab	16.3a	11.1d
S. nigrum	11.5c	15.0a	58.2a	4.4a	11.6b	10.8e
C. biafrae	14.7a	11.6d	48.2b	2.3d	10.5c	12.7c
C. trigyna	14.3ab	13.6b	45.1d	3.9abc	11.7b	11.5c

* Each value is a mean of six analyses (Duplicate sample x 3 replicates) Means followed by different alphabets in each column are significantly different at 5% level of probability

Table 4: **Nutrient Composition of Six leaf Vegetables of Southwest Nigeria***

	% N	% P	% K	% Ca	% Mg	% Fe (ppm)
			EXPRESSED AS % DRY MATTER			
B. alba	1.97c	0.16d	2.34d	1.04e	0 37c	183d
C. crepidoides	2.00b	0.96a	5.53a	1.86a	0.81a	291c
C. biafrae	1.86c	0.43b	4.18b	1.43b	0.67b	475a
L. taraxacifolia	2.29a	0.25c	2.47c	1.05e	0.40c	222c
S. nigrum	2.39a	0.15d	1.65e	1.19d	0.23d	171d
C. trigyna	2.17b	0.22c	2.41dc	1.29c	0.46b	359b

* Each value is a mean of six analyses (Duplicate sample x 3 replicated) Means followed by different alphabets in each column are significantly different at 5% level of probability