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Nutrient composition of some lesser known green leafy vegetables in Nsukka Lga of Enugu State

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Abstract

Plants, including some lesser known vegetables (LKVs), have been implicated to be of several health benefits to mankind. Although LKVs are regular components of traditional meals, their nutritional and health benefits were orally handed down from one generation to another. The results of this study show that *Mucuna pruriens* had the least ash content of 0.14% while *Myrianthus arboreus* had the highest ash content of 6.61%. The protein composition of the vegetables varied from 9.87 to 17.42%. Fat was least in *Ficus capensis* and highest in *Pterocarpus santalinoides*. *Pterocarpus santalinoides* also, had the highest fibre content of 14.73% while *Ficus thonningii* had the least (5.96%). Moisture content of the vegetables was least in *Vitex doniana* (21.14%) and highest in *Myrianthus arboreus* (57.92%). *Myrianthus arboreus* recorded the least amount of carbohydrate (14.31%) while *Videx doniana* had the highest amount of 47.42%. Vitamin A and C were least in *Videx doniana* (0.53mg/100g) and *Pterocarpus santalinoides* (9.34mg/100g) respectively; while *Ficus capensis* and *Videx doniana* had the highest Vitamin A and C values of 6.25mg/100g and 91.28mg/100g respectively. Mineral analysis results showed that *Ficus thonningii* and *Videx doniana* had the least iron and calcium contents of 0.51 and 9.52mg/100g respectively. However, *Pterocarpus santalinoides* and *Ficus capensis* had the highest iron and calcium contents of 5.08 and 158.58mg/100g respectively. Vitamin A, carbohydrate, vitamin C, iron and calcium decreased when cooked and increased when shade dried in most of the vegetables.

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Introduction

Vegetables are the fresh and edible portions of herbaceous plants, which can be eaten raw or cooked (Dhellot *et al*, 2006). They are not only cheap sources of nutrients but are also common sources (Okafor (1983). Specifically, green leafy vegetables occupy an important place among the food crops, as they provide adequate amounts of many vitamins and minerals for humans. They are a rich source of carotene, ascorbic acid, riboflavin, folic acid and minerals (Sheela, 2004).

There are many underutilized greens of promising nutritive value, which can nourish the ever increasing human population. Many of them are resilient, adaptive and tolerant to adverse climatic conditions. Most of them have remained underutilized due to lack of awareness, popularization of technologies for utilization (Sheela, 2004) and poor nutrition education (Udofia and Obizoba, 2005).

Some wild forest vegetables which were utilized frequently in the past are becoming lesser known these days. Their leaves are fresh and more abundant in the dry season when conventional ones become scarce. The leaves of *Ficus capensis* (Akokoro) were reported to be used in preparing pottages of yam and cocoyam in Ngwo village, Udi local government area of Enugu state. They used other wild vegetables like *Pterocarpus santalinoides* (Nturukpa) leaves in preparing soups like ogbono and egwusi (melon soup). Leaves of *Vitex doniana* (Uchakiri) were used in soup preparation and for pottages of yam and cocoyam as well. The leaves were boiled and the water decanted and used fresh for pottages or dried for soups. When the leaves of *Ficus thonningii* (Ogbu) were plucked, the whitish exudates were applied to boils and other injuries. In the same area, *Mucuna pruriens* (Agbara) leaves were not used in food preparation but were squeezed and the juice obtained, drunk to cure anaemia/to boost blood. The roots are bitter, stimulants, purgative and diuretic (Manyham *et al*, 2004). Leaves of *Myrinthus arboreus* (Ujuju) served as vegetable in soups.

Seasonality is a major constraint to utilization of green leafy vegetables in the dry season (Oguche, 2011). This usually leads to poor consumption of the vegetables and subsequent poor intake of micro nutrients from vegetables during the period. *Ficus capensis* (Akokoro), *Pterocarpus santalinoides* (Nturukpa), *Vitex doniana* (Uchakiri), *Ficus thonningii* (Ogbu), *Mucuna pruriens* (Agbara) and *Myrianthus arboreus* (Ujuju) are wild lesser known vegetables which are abundant in the dry season. This study was therefore, designed to investigate the nutrient composition of these lesser known green leafy vegetables in Nsukka L.G.A of Enugu state.

Materials and methods

Materials

The leaves of *Ficus capensis* (Akokoro), *Pterocarpus santalinoides* (Nturukpa), *Vitex doniana* (Uchakiri), *Ficus thonningii* (Ogbu), *Mucuna pruriens* (Agbara) and *Myrianthus arboreus* (Ujuju) were used for the study. Their local names are listed in Table 1 below:

Table 1. Local names of the lesser known green leafy vegetables analyzed

Vegetable	English	Igbo	Yoruba	Hausa	Fulani	Edo
V. doniana	Black plum	Uchakiri	Oori-rila	Dinya	-	-
F. capensis	Bush fig	Akokoro	Opoto	Uwaraya	Rima bichei	Obada
F. thonningii	Strangler/wild fig	Ogbu	Odan	Chediya	-	-
M. pruriens	Co-witch/velvet bean	Agbara	Werepe	Karara	-	-
M. arboreus	-	Ububu/ujuju	Obisere	-	-	-
P. santalinoides	-	Nturukpa	Gbengbe	Gunduru/gyadar kurmi	-	-

Collection of samples

Green leafy vegetable samples were harvested from different parts of Nsukka Local Government Area of Enugu State. *Ficus capensis* (Akokoro) was obtained from Green House gate, University of Nigeria, Nsukka. *Pterocarpus santalinoides* (Nturukpa), *Vitex doniana* (Uchakiri) and *Mucuna pruriens* (Agbara) were obtained from Hill-Top gate University of Nigeria, Nsukka. *Ficus thonningii* (Ogbu) and *Myrianthus arboreus* (Ujuju) were obtained from Odim; all within Nsukka Local Government Area. The vegetables were identified at the plant science and biotechnology department of the school.

Preparation of samples

Three kilograms each, of the fresh green leafy vegetables were handpicked to remove foreign particles and rinsed in de-ionized water to remove dust and dirt. Each of the vegetables was then divided into three equal parts of one kilogram each. One part was washed, drained and spread on the laboratory benches to shade dry at room temperature for seven days. After drying, the vegetables were grinded into powder and labeled as shade dried. The second part was washed, drained, cut and blended to a uniform pulp in the laboratory mortar and was labeled as raw. The third part was washed, drained, cut and cooked for five minutes without any seasoning.

Nutrient analysis

The proximate composition of the GLVs *(Psychotria sp, C. aconitifolius and T. occidentalis*) was determined using AOAC (2000) procedures. Moisture Content was determined using weight loss before and after drying. Ash content was determined at 550^{o}C and left at this temperature for 2 hours until a white or light ash appeared. Crude fibre was also determined from loss in weight after incineration x100 and divided by the original weight of the sample was the percentage of crude fibre. Fat content was determined using soxhlet apparatus while crude Protein was estimated using micro-Kjeldahl method (2000). Available Carbohydrate was done by difference method. The summation of all the proximate values was subtracted from 100%.

Vitamin C was determined titrimetrically using the Institute of Public Analyst of Nigeria (2005) method. Vitamin A was determined using the method of Pearson (1976). Five grammes (5 g) of the samples were weighed into a 100 ml volumetric flask and 2.5 ml of 20% metaphosphoric acid stabilizing agent was added. The mixture was diluted to volume with distilled water. Ten milliliters (10 ml) of the solution was pipetted into a volumetric flask and 2.5ml acetone was added. The absorbance reading was taken at 264nm wave length using UV spectrophotometer.

Statistical Analysis

The design of the work was completely randomized design (CRD). Fisher's least significant difference (FLSD) was used to compare the different means at $p<0.05$

Results

Table 2 shows the result of mean nutrient composition of the lesser known leafy vegetables. *Mucuna pruriens* had the least ash content of 0.14% while *Myrianthus arboreus* had the highest ash content of 6.61%. The protein composition of the vegetables varied from 9.87 to 17.42%. Fat was least in *Ficus capensis* and highest in *Pterocarpus santalinoides*. *Pterocarpus santalinoides* also, had the highest fibre content of 14.73% while *Ficus thonningii* had the least (5.96%). Moisture content of the vegetables was least in *Vitex doniana* (21.14%) and highest in *Myrianthus arboreus* (57.92%). *Myrianthus arboreus* recorded the least amount of carbohydrate (14.31%) while *Videx doniana* had the highest amount of 47.42%. Vitamin A and C were least in *Videx doniana* (0.53mg/100g) and *Pterocarpus santalinoides* (9.34mg/100g) respectively; while *Ficus capensis* and *Videx doniana* had the highest Vitamin A and C values of 6.25mg/100g and 91.28mg/100g respectively.

Mineral analysis results showed that *Ficus thonningii* and *Videx doniana* had the least iron and calcium contents of 0.51 and 9.52mg/100g respectively. However, *Pterocarpus santalinoides* and *Ficus*

capensis had the highest iron and calcium contents of 5.08 and 158.58mg/100g respectively.

The result of nutrient composition of the lesser known leafy vegetables is presented in Table 3 below. Processing had an effect on the nutrient content of the vegetables. Ash significantly increased when shade dried and decreased when cooked. A similar trend was observed for protein content of the vegetables. Fat content of the vegetables were also observed to increase when shade dried and decrease when cooked. An exception was however, noticed in *Ficus capensis* (Akokoro), whose fat content remained constant for the raw and shade dried forms. There was a significant increase in the fibre content of the other vegetables at their dried forms and a decrease in their cooked forms. Apart from vitamin A, carbohydrate, vitamin C, iron and calcium decreased when cooked and increased when shade dried in most of the vegetables. Table 4 below shows the mean nutrient composition of the lesser known vegetables at different forms of processing. Apart from moisture and vitamin A, there was a significant increase and decrease in the nutrient content of the vegetables at their shade dried and cooked forms respectively.

Table 2. Mean nutrient composition of the lesser known leafy vegetables in Nsukka L.G.A

Veg. Species	Ash %	Protein %	Fat %	Moisture %	CHO %	Vit. A (mg/ 100g)	Vit. C (mg/ 100g)	Fe (mg/ 100g)	Ca (mg/ 100g)
F. capensis	4.78	9.87	0.06	45.70	32.76	6.25	42.29	0.69	158.58
F. thonningii	3.77	11.49	2.57	41.59	34.63	1.82	59.69	0.51	102.23
M. arboreus	6.61	12.49	1.32	57.92	14.31	1.06	40.23	3.47	50.58
M. pruriens	0.14	17.42	1.99	41.09	27.29	2.47	30.84	3.67	97.49
P. santalinoides	4.88	15.09	6.26	32.83	26.20	2.81	19.34	5.08	51.84
V. doniana	6.21	13.85	2.29	21.14	47.42	0.53	91.28	1.32	9.52
LSD	0.15	0.02	0.04	0.29	2.12	0.08	0.03	0.01	0.71

Table 3. Nutrient composition of the lesser known leafy vegetables in Nsukka L.G.A at their cooked, raw and shade dried forms.

Vegetable	Processing	Ash %	Protein %	Fat %	Fibre %	Moisture %	CHO	Vit. A (mg/ 100g)	Vit. C (mg/ 100g)	Fe (mg/ 100g)	Ca (mg/ 100g)
	Cooked	4.38	6.54	0.02	5.60	60.22	26.24	6.24	21.44	0.62	135.00
F. capensis	Fresh	4.18	8.25	0.03	6.21	55.13	26.21	12.24	40.07	0.56	153.00
	Shade dried	5.77	14.82	0.13	1.70	21.75	45.83	9.26	67.24	0.88	187.73
	Cooked	2.68	8.14	1.89	3.76	51.30	32.23	0.98	33.03	9.38	97.10
F. thonningii	Fresh	3.14	9.8	1.90	4.81	50.04	30.32	4.26	64.20	9.42	91.33
	Shade dried	5.49	16.50	3.92	9.32	23.42	41.36	0.21	81.82	0.73	118.24
	Cooked	5.28	9.78	0.97	5.16	76.17	2.65	0.84	19.69	3.03	51.53
M. arboreus	Fresh	6.73	10.17	0.91	5.90	64.07	12.23	2.18	38.20	2.91	50.00
	Shade dried	7.83	17.32	2.08	11.20	33.52	28.05	0.16	62.80	4.47	50.20
	Cooked	0.07	13.97	1.30	8.42	53.08	23.17	1.30	16.81	3.18	92.80
M. pruriens	Fresh	0.11	13.76	1.28	9.22	48.58	25.06	5.25	25.65	3.10	87.65
	Shade dried	0.39	24.10	3.39	14.83	21.60	35.68	0.88	50.07	4.73	112.03
	Cooked	4.23	11.20	11.20	11.76	42.57	19.03	1.93	9.27	4.54	46.33
P. santalinoides	Fresh	4.69	3.05	2.92	13.32	37.95	28.07	6.27	17.51	4.47	41.37
	Shade dried	5.73	21.02	4.66	19.10	17.97	31.51	0.23	31.25	6.22	67.83
	Cooked	4.35	10.17	1.92	5.21	33.03	45.33	0.25	54.79	0.24	7.25
V. doniana	Fresh	4.97	11.67	1.84	6.90	18.20	52.17	1.25	96.72	0.23	8.67
	Shade dried	9.33	19.70	3.12	10.89	12.19	44.77	0.09	122.30	3.48	12.66
LSD		0.26	0.06	0.07	0.12	0.50	3.66	0.06	0.05	0.04	0.06

Table 4. Mean nutrient composition of the lesser known vegetables at different forms of processing

Processing	Ash %	Protein %	Fat %	Fibre %	Moisture %	CHO%	Vit. A (mg/ 100g)	Vit. C (mg/ 100g)	Fe (mg/ 100g)	Ca (mg/ 100g)
cooked	3.50	9.97	2.88	6.66	52.73	24.77	1.92	25.84	1.10	71.67
Raw	3.97	11.45	1.48	7.73	45.66	29.01	5.24	47.06	1.95	72.0
Shade dried	5.76	18.91	2.88	12.84	21.74	37.87	0.31	69.25	3.42	91.45
LSD	0.15	0.03	0.30	0.10	0.21	1.50	0.05	0.04	0.02	0.25

Discussions

In Nigeria, vegetables are the cheapest and most readily available sources of important proteins, vitamins and minerals (Thompson and Kelly, 1990). They contain valuable food ingredients which can be used as energy sources, body building, regulatory and protective materialS (Adeniyi, Ehiagbonare and Nwangwu, 2012).

An attempt to compare the lesser known vegetables analyzed in this study with well known vegetables in other studies showed that the lesser known green leafy vegetables of this study have high nutrient values. In their study, Adeniyi *et al* (2012) recorded protein values that ranged from 1.76 to 3.36%, crude fibre range of 2.56% to3.60% and carbohydrate that ranged from 2.93% to 12.33%. Interestingly, the lesser known vegetables of this study had higher amounts of protein, crude fibre and carbohydrate which ranged from 9.87 to 17.42%, 5.96 to 14.73 and 14.31% to 47.42% respectively. The study samples were also high in calcium (9.52 to 158.58mg/100g). Calcium is a major factor for sustaining strong bones and plays a part in muscle contraction and relaxation, blood clotting, synaptic transmission and absorption of vitamin B12 (Mensah, Okoli, and Obaju-Obodo, 2008; Lewis and Elvin-Lewis (1998). Generally vegetables contain some calcium and are rich sources of vitamin A (β-carotene) and vitamin C (Ihekoronye and Ngoddy 1985).

Vitex doniana (Uchakiri) had the highest amount of vitamin C and carbohydrate. Its high carbohydrate content makes it a valuable source of energy when used in food preparation. It is a good source of vitamin C which functions as an anti oxidant in the body. *Vitex doniana* has been reported to have anti diarrhoeal properties (Ukwuani *et al*, 2012) and is beneficial in treating several disorders like rheumatism, hypertension, cancer and inflammatory diseases (Sofowora, 1993). *Pterocarpus santalinoides* had the highest values of fat, fibre and iron. Utilization of its leaves in preparation of meals, especially vegetarian will help increase satiety, decrease transit time of food in the gastro intestinal tract and serve as a good iron source.

Moisture was the most abundant substance in all the vegetables. It is in line with the report of (Fayemi, 1999), that water is the most abundant component of all vegetables. However, the moisture content of these lesser known vegetables is low (in the range of 21.14 to 57.92%) compared to vegetables in other studies (Oduse, Idowu and Adegbite 2012; Adeniyi *et al*, 2012). This may be the reason why they thrive more in the dry season when most vegetables become scarce.

Apart from moisture, shade drying was observed to increase the nutrient content of most of the vegetables. The result of this work is similar to that of Oguche (2011) who reported that protein, ash, fat and fibre content of vegetables in her research were higher when shade dried. Drying is known to reduce moisture to improve the shelf life of foods and increase dry matter (Oguche, 2011).

Vitamin C was observed to decrease in the cooked vegetable samples of this study. Vitamin C is water soluble and volatile when heat treated (Oguche, 2011). This might have led to its loss during cooking.

On the other hand, shade drying increased the vitamin C content of the vegetables. This was however in contrast with the findings of Osunde and Musa (2007) who observed a high loss in vitamin C content of sun dried samples of the vegetables they studied. Shade drying reduces photo degradation of food nutrients and is a good method of preserving vegetables (Osunde and Musa, 2007). It has an edge over sun drying in retaining nutrients (Oguche, 2011).

Unlike vitamin C which increased when dried, vitamin A was observed to decrease on shade drying. Oguche (2011) is of the opinion that shade drying might lead to loss of Vitamin A as it is known to be volatile when exposed to mild heat.

Conclusion

The use of modern drugs and deforestation has led to a decreased use of wild forest green leafy vegetables. This in turn has reduced their awareness and made them lesser known. The vegetables analyzed in this study are used extensively in the past for therapeutic and culinary purposes. The findings of this study have revealed that they are rich in food nutrients. Most well known vegetables are scarce during dry seasons. These lesser known vegetables can serve as a good substitute for them. This would reduce the incidence of low consumption of green leafy vegetables experienced in the dry seasons.

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