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Nutritive and Anti-Nutritive Properties of *Boerhavia diffusa* and *Commelina nudiflora* Leaves

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Abstract: Aqueous leaf extracts of *Boerhavia diffusa* and *Commelina nudiflora* were evaluated for nutritional and anti-nutritional compositions. The results showed that both vegetables contained saponins, alkaloids and flavonoids. The proximate and vitamin compositions of *B. diffusa* and *C. nudiflora* included mainly moisture (82.22% and 88.63%), carbohydrate (10.56% and 5.67%), vitamin C (44.80 and 41.60mg/100g dry weight), vitamin B_3 (97.00 and 66.20mg/100g) and vitamin B_2 (22.00 and 8.70mg/100g) respectively. The mineral contents of the defatted leaf extracts were found to be Na (162.50 and 75.55mg/100g), Ca (174.09 and 240.00mg/100g) and Mg (8.68 and 6.63mg/100g) for *B. diffusa* and *C. nudiflora* respectively. Iodine was detected at 0.002mg/100g in *B. diflusa* leaf extract only. The proximate, vitamin and mineral compositions obtained suggest that the leaves, as cheap sources of vitamins C, B_3 and B_2, as well as other macro-and micro-nutrients, can be incorporated into human and animal diet to meet their recommended daily allowances. The content of flavonoids and vitamin C in the leaf extracts also suggests possible anti-oxidant effects of these leafy vegetables.

Key words: *Boerhavia diffusa*, *Commelina nudiflora*, proximate and chemical compositions

Introduction

Vegetable is basically any part of a plant, be it leaves, roots, seeds or fruits that can be eaten. This food of plant origin contains many bioactive compounds and thus serves as an important source of minerals, vitamins and certain hormone precursors in addition to protein and energy sources (Cho *et al*., 2004). This was why the early man survived primarily on diet of plant food with little animal flesh. However, the bioavailability of these essential nutrients could be reduced by the presence in these plants of some anti-nutritional factors such as oxalates and cyanogenic glycosides (Akindahunsi and Salawu, 2005). These not withstanding, leafy vegetables have continued to provide populations with limited access to meat or fish, a rich source of proteins and micronutrients essential for pregnant and lactating mothers, as well as young and growing children (Penny *et al*., 2002). Studies have shown that vegetarians are less susceptible to diseases, live longer, healthier and more productive lives with stronger immunity (Akindahunsi and Salawu, 2005). However, there has been a growing reduction in the consumption of vegetables with each passing decade (Aranceta, 2004).

Commelina nudiflora and *Boerhavia diffusa* are wide species of vegetables that are relatively underutilized and in most cases neglected. Thus are seen as weeds in farms (Keary and Hepper, 1985). *C. nudiflora*, called *Obogwu* by the Ibos of southeastern Nigeria, is a succulent, mucilaginous plant that resists desiccation resulting in its fanciful common name 'God will die before I die'. The leaves are cooked and eaten as vegetable. Domestic livestock also grazes the plant especially during famine. It has an advantage of providing significant amounts of animals' water requirement. *C. nudiflora* has varied medicinal importance. In southern Nigeria, it is made into a poultice for sore feet. The plant sap is used in East Africa for ophthalmia, sore throat and burns. And in Lesotho, it is made into a medicine to counter barrenness in women, while in India it is said to be beneficial in the treatment of leprosy (Keary and Hepper, 1985).

B. diffusa, commonly called hog weed, is known as *erimmirii* (which literally means water-food) by the Ibos of southeastern Nigeria. The leaves are cooked and eaten as vegetable. The plant is used in folkloric medicine to treat convulsions and as a mild laxative and febrifuge (Adesina, 1979). The roots and leaves are considered to have an expectorant action, to be emetic and diuretic in large doses and are used in the treatment of asthma. The thick roots, softened by boiling are applied as a poultice to draw abscesses and to encourage the extraction of guinea worm (Keary and Hepper, 1985).

The neglection of these vegetables coupled to the growing reduction in consumption of vegetables prompted this study. It is aimed at evaluating the levels of some macro and micronutrients and as well screen for phytochemical compositions of *C. nudiflora and B. diffusa*. It is hoped that this study will increase interest in them.

Table 1: Phytochemical Compositions of *B. diffusa* and *C. nudiflora*

Phytochemical	*B. diffusa*	*C. nudiflora*
Saponins	++	++
Tannins	-	-
Alkaloids	++	++
Flavonoids	+	+
Cyanogenic glycosides	-	-

Key: ++ = Highly present; + = slightly present; - = Absent

Table 2: Proximate Compositions (%) of *B. diffusa and C. nudiflora*

Composition	*B. diffusa*	*C. nudiflora*
Protein	2.26±0.02	1.69±0.04
Fat	1.61±0.06	1.44±0.03
Moisture	82.22±4.16	88.63±5.21
Ash	0.96±0.01	1.07±0.01
Carbohydrate	10.56±0.12	5.67±0.08
Fibre	2.40±0.03	1.50±0.01

Values are mean±standard deviation of triplicate determinations

Materials and Methods

Collection and preparation of plant materials: Whole plant of *C. nudiflora* and *B. diffusa* were collected from a farm in Ifite Okoh in Orumba North Local Government Area, Anambra State of Nigeria. Dr. S.E. Okeke of the Department of Plant Science and Biotechnology, Imo State University Owerri, Nigeria graciously identified them. Apparently healthy leaves of both plants were removed from plant stalk, rinsed in clean water and dried to a constant weight at 60°C using laboratory oven. The dried plant samples were ground to fine powder with an electric grinder, packaged in glass jars and stored at 4°C until analysis.

Phytochemical analysis: The Phytochemical analysis for the presence of saponins, tannins, alkaloids, flavonoids and cyanogenic glycosides were carried out according to the methods described by Harborne (1973) and Trease and Evans (1983).

Proximate analysis: The proximate analysis of the leaf extract for moisture, ash and carbohydrate contents were determined as described by AOAC (1990). Crude protein, fibre and fat contents were determined using the methods described by Pearson (1976). Total ash content was determined by furnace incarnation using the method of James (1995). All determinations were done in triplicates.

Analysis of vitamins and minerals: The vitamins C and B contents of the vegetables were determined using High Performance Liquid Chromatography (HPLC). Iodine and iron contents were determined spectrophotometrically (HACH, 2000 Spectro-photometer). The other minerals, sodium, potassium, calcium, magnesium, manganese, copper, zinc and aluminium were estimated by the used of an atomic absorption spectrophotometer (Buck Scientific Atomic Absorption Spectrophotometer 200A).

Statistical analysis: Data obtained were presented in mean±standard deviation and analyzed by simple percentages.

Results and Discussion

Higher contents of saponins and alkaloids than flavonoids were observed in both vegetables (Table 1). Saponin is a known anti-nutritional factor, which reduces the uptake of certain nutrients including glucose and cholesterol at the gut through intra-lumenal physicochemical interaction. Hence, it has been reported to have hypocholesterolemic effects (Price *et al.*, 1987) and thus may aid in lessening the metabolic burden that would have been placed on the liver. Alkaloids are beneficial chemicals to plants with predator and parasite repelling effects. However, they inhibit certain mammalian enzymic activities such as those of phosphodiesterase, prolonging the action of cyclic AMP. They also affect glucagons and thyroid stimulating hormones, while some forms have been reported to be carcinogenic (Okaka *et al.*, 1992). It is noteworthy that at the concentration of these chemicals in edible vegetables, they are usually non-toxic. Furthermore, steaming or boiling reduces their levels in plant extracts (Piorreck *et al.*, 1984). These vegetables also contain flavonoids, which are phenolic compounds that serve as flavoring ingredients of spices and vegetables (Enwere, 1998). They have been found to have anti-oxidation effects in animals.

The proximate compositions of *B. diffusa* and *C. nudiflora* are given in Table 2. The values showed that the vegetables contain high percentage composition of moisture (82.22% and 88.63% respectively). Their contents of fat (1.61% and 1.44%), protein (2.26% and 1.69%) and carbohydrate (10.56% and 5.67%) were low when compared to the values of 1.60%, 25.35% and 29.50% reported for a fairly neglected leafy vegetable, *Amaranthus hybridus* (Nwaogu *et al.*, 2006). However, the good distribution of nutrients in the vegetables may explain why domestic animals graze them (Keary and Hepper, 1985).

Some of the vitamin compositions of the vegetables are given in Table 3. *B. diffusa* was found to contain vitamin C (44.80mg/100g), vitamin B_3 (97.00mg/100g) and vitamin B_2 (22.00mg/100mg), while *C. nudiflora* found to also contain these vitamins has 41.60mg/100mg, 66.20mg/100mg and 8.70mg/100mg of the vitamins respectively. Vitamin B_3 (nicotinamide) helps in the breakdown of blood sugar, dilation of blood vessels and thus increases blood flow. Its daily-recommended allowance is 20mg/day (Trumbo *et al.*, 2004), thus a judicious intake of these vegetables will provide adequately the needed quantity per day. The vegetables also contain vitamin C (ascobate), the deficiency of which causes scurvy in humans. Vitamin C facilitates wound healing, production of collagen, formation of red blood cells and boosts immune system. The recommended daily allowance of vitamin C is 75mg/day

Table 3: Vitamin compositions (mg/100g) of *B. diffusa* and *C. nudiflora*

Composition	*B. diffusa*	*C. nudiflora*
Vitamin C	44.80±5.78	41.60±6.10
Vitamin B_3	97.00±8.01	66.20±6.85
Vitamin B_6	ND	ND
Vitamin B_1	ND	ND
Vitamin B_2	22.00±4.25	8.70±2.12

Values are mean±standard deviation of triplicate determinations; ND = Not detected

Table 4: Mineral Compositions (mg/100g) of *B. diffusa* and *C. nudiflora*

Composition	*B. diffusa*	*C. nudiflora*
Sodium	162.50±4.56	75.55±4.07
Potassium	0.91±0.07	0.78±0.08
Calcium	174.09±2.73	240.00±4.14
Iron	0.012±0.001	0.017±0.001
Magnesium	8.68±0.06	6.63±0.08
Manganese	0.43±0.02	0.14±0.01
Copper	ND	ND
Zinc	ND	ND
Iodine	0.002±0.00	ND
Aluminum	0.46±0.03	0.24±0.02

Values are mean±standard deviation of triplicate determinations. ND = Not detected

for women and 90mg/day for men (Monsen, 2000). *B. diffusa* has higher content of vitamin B_2 (riboflavin) than *C. nudiflora*. The vitamin is essential for energy production and in its co-enzyme forms (FMN and FAD), it serves as hydrogen transport systems (Mayes *et al.*, 2000). The results of the present study show that the vegetables are of high nutritional value and may help essentially in the control of physiological oxidative stress given their high content of vitamin C and flavonoids (Wright, 2005).

Some of the mineral constituents of the defatted leaves are given in Table 4. The sodium, calcium and magnesium contents of *B. diffusa* and *C. nudiflora* were high at 162.50 and 75.55, 174.09 and 240.00 and 8.68 and 6.63mg/100g dry weight respectively. Iodine was detected only in *B. diffusa* at 0.002mg/100g dry weight. The vegetables have fairly adequate concentrations of sodium and calcium, equivalent concentrations of magnesium, but with low contents of potassium and iron in comparison with those reported for *A. hybridus* leaf extract (Nwaogu *et al.*, 2006).

In conclusion, the study has revealed that leaves of *B. diffusa* and *C. nudiflora* are potential sources of nutrients and some essential macro and micronutrients needed by man. The importance of these nutrients cannot be over emphasized for effective and proper metabolism as well as the maintenance of good physiological state in man and animals.

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