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Nutritional Importance and Micronutrient Potentials of Two Non-Conventional Indigenous Green Leafy Vegetables from Nigeria

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Abstract: Fruits and vegetables are good sources of micronutrients, especially minerals and vitamins. *Colocassia esculenta* and *Ocimum gratissimum* green leaves, used indigenously fresh as vegetables were studied for their nutrient and anti-nutrient composition and micronutrient potentials. Samples of fresh leaves were studied using standard methods of analyses of AOAC. The results revealed that 100 g portion of the fresh leaves of *Colocassia esculenta* and *Ocimum gratissimum* contained 82.8 and 93.9 g moisture, 3.4 and 3.0 g protein, 5.8 and 4.0 g crude fibre, 31.2 and 23.9 Kcal gross energy, 6.0 and 11.3 mg sodium, 850 and 30.7 mg potassium, 240 and 15.7 mg Ca, 51.0 and 39.3 mg P, 3.0 and 0.6 mg Fe, 691 and 571.6 μg β-carotene and 89.2 and 36.5 mg ascorbic acid, respectively. The levels of phytates, oxalates, tannins and saponins in the fresh leaves were very low and could not cause any health hazard even when consumed in large quantity. *Colocassia esculenta* and *Ocimum gratissimum* leaves were rich in β-carotene and ascorbic acid, the micronutrients of nutritional importance because of their antioxidant properties. Their low sodium, carbohydrates and gross energy content qualify them as good vegetables for the hypertensive, diabetics, obese and normal people. Their antioxidant properties may have health-promoting benefits.

Key words: Non-conventional vegetables, *Colocassia esculenta* leaf, *Ocimum gratissimum* leaf, micronutrient potentials

INTRODUCTION

Vegetables are succulent plants grown mainly in gardens and consumed as a side dish/soup with starchy staples, especially among some Nigerian tribes. They are of special nutritional importance being sources of fat and water soluble vitamins (β-carotene, ascorbic acid, riboflavin, thiamine and niacin), minerals and fibre. They increase variety, add flavour and zest to diets and constitute important common foodstuff and component of most meals in Nigeria. They form concentrated source of nutrients in the home diet and are used as food supplement. In tropical Africa countries, Nigeria inclusive, vegetables are the cheapest and most valuable source of important proteins, vitamins and essential amino acids (Guarino, 1995).

Cocoyam belongs to the family of *Araceae Colocassia* and *Xanthosoma* species and is grown vegetatively in form of corm and leaf throughout the tropical and subtropical regions as one of the root and tuber crops. The tender leaf can be used for spinach and vegetable meal, while the older leaf can be used for wrapping prepared food. The protein and mineral content of *colocassia esculenta* leaf were studied by Dako (1981) and Barminas *et al.* (1998), while protein, calcium, phosphorus, iron and some vitamin values of Taro (family of cocoyam) leaves were reported by Ihekoronye and Ngoddi (1985).

Basil, a member of the mint family is well known for its starring role in the Italian dish, pesto and the herb is widely used in many cooked dishes and salads. The green aromatic leaves are used fresh and dried as flavorings or spices in sauces, stews, salad dressings, vegetables, poultry, vinegar and confectionery products. It has been used as a medicinal plant in treatment of some illnesses such as headaches, coughs, diarrhoea, constipation, worms and kidney malfunctions. It was also, reported to protect against and reduce stress, increase the body's efficient use of oxygen, boost the immune system, reduce inflammation, stems rapid ageing, supports the heart, lung and liver (Mbata and Saikia, 2006; Alabi *et al.*, 2005). It is also a rich source of antioxidants.

Ocimum gratissimum L. (Tree basil), is a perennial woody basil with lime-green leaves scented like pennyroyal and has a powerful clove scent. Its leaf and the whole herb are popular treatment for diarrhoea and a

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tea of its leaves is used for colds and fevers (Agomo, 1992) while the leaves are burned to repel mosquitoes (http://www.uvm.edu/pss/ppp/articles/basil.htm). The plant is rich in volatile oil which contains up to 75% of thymol, the antimicrobial activity of which is well known (Ntezurubanza *et al*., 1984; Adilson *et al*., 2004; Alabi *et al*., 2005; Mbata and Saikia, 2006).

Alabi *et al*. (2005) reported some chemical, selected vitamins and amino acids, as well as mineral composition of *Ocimum gratissimum* leaf; while Edeoga *et al*. (2006) reported the chemical composition, some selected minerals and antinutritional factors of the dried leaf.

There is search for novel source (s) of micronutrients to combat micronutrient deficiency. Fruits and vegetables are good sources of micronutrients, especially minerals and vitamins. Literature information is scanty on the nutrient and anti-nutrient composition as well as micronutrient potentials of fresh *Colocassia esculenta* and *Ocimum gratissimum* L. leaves. This study therefore aimed at providing information on the nutrient and anti-nutrient composition and the potentials of these leaves as good sources of micronutrients.

MATERIALS AND METHODS

Tender cocoyam leaf was obtained from a farm in the North Campus of The Polytechnic, Ibadan and *Ocimum gratissimum* leaf was obtained from Institute of Agricultural Research and Training, Obafemi Awolowo University, Moore Plantation, Ibadan, both in Nigeria. The samples were analyzed for moisture, crude protein, lipid and fibre; ash, minerals, vitamins and antinutritional factors.

Chemical analyses: The two samples were analyzed in triplicate for moisture, crude protein, crude lipid, crude fibre and ash using standard methods of Association of Official Analytical Chemists (AOAC, 1995). The carbohydrate content was obtained by difference. Potassium and sodium were determined using modified method of Bonire *et al*. (1990) by digesting the ash of the leaves with perchloric acid and trioxonitrate (V) acid (HNO_3) and readings taken on Jenway digital flame photometer/spectronic 20. Phosphorus was determined by vanado-molybdate colorimetric method. Calcium, magnesium, iron, zinc and manganese were determined spectophotometrically using Buck 200 atomic absorption spectrometer (Buck scientific, Norwalk) (Essien *et al*., 1992) and compared with absorption of standards of these minerals.

Ascorbic acid in the two leaf samples was determined by titration with 2, 6-dichlorophenol-indophenol solution, while riboflavin was extracted using 5 mL of 5M HCl and 5 mL of dichloromethane and measurement made with fluorometer. Standard solutions of riboflavin were prepared by dissolving 50 mg of riboflavin in 500 mL of distilled water and further dilution of 5 into 150 and 5 mL of this solution diluted into 100 mL and readings taken. The leaf riboflavin was then obtained through calculation. β-carotene was determined through ultraviolet absorption measurement at 328 nm after extraction with chloroform. Calibration curve of β-carotene was made and the leaf β-carotene concentration estimated as microgram (μg) of β-carotene.

Oxalate of the leaves was determined by extraction with water for about three hours and the absorbance read on spectrophotometer (spectronic 20) at 420 nm. Standard solutions of oxalic acid were prepared (10, 20, 30, 40 and 50 ppm) and their absorbance read on spectrophotometer (Spectronic 20) at 420 nm. The amount of oxalate was then estimated. Phytate was determined by titration with iron (III) chloride solution (Sudarmadji and Markakis, 1977). The tannin content was determined by extracting the leaf with a mixture of acetone and glacial acetic acid for 5 h. Their absorbance was measured and compared with the absorbance of standard solutions of tannic acid at 500 nm on spectronic 20 (Griffiths and Jones, 1977). Saponin was determined by comparing the absorbance of the leaf extracts with the standard at 380 nm (Makkar and Becker, 1996).

RESULTS AND DISCUSSION

The proximate chemical composition of the two vegetables is as shown in Table 1. The two vegetable leaves were very high in moisture. These values were in agreement with the range of values reported for fresh vegetables (Ihekoronye and Ngoddy, 1985; Edeoga and Gomina, 2000). High moisture content in vegetables is indicative of its freshness as well as easy perishability (Tressler *et al*., 1980). *Ocimum gratissimum* is slightly higher in moisture content than *Colocassia esculenta,* but the difference was not statistically significant ($p>0.05$).

The two leaves were very low in crude protein and crude lipid. However, these values were comparable with those of baobab and okra leaves and higher than that of okra fruit (Ihekoronye and Ngoddi, 1985). Vegetables and fruits are generally poor sources of protein (Tull, 1996). They were also low in carbohydrate and gross energy, but fairly high in crude fibre and ash. The low gross energy value of the leaves could have resulted from their low crude protein, lipid and carbohydrate contents.

Table 1: Proximate Composition of *Colocassia esculenta* (1) and *Ocimum gratissimum* (2) leaves (g/100g fresh sample)

Parameter	1	2
Moisture	82.8±0.04	86.9±0.0
Crude Protein	3.4±0.02	3.0±0.14
Crude Lipid	0.8±0.05	0.9±0.02
Crude Fibre	5.8±0.06	4.0±0.06
Ash	2.0±0.05	1.0±0.05
Carbohydrates	5.2±0.08	4.2±0.03
Gross Energy (kcal/100g)	31.2±0.20	43.9±0.26

Table 2: Selected Mineral and Vitamin Composition of *Colocassia esculenta* (1) and *Ocimum gratissimum* (2) leaves (mg/100g fresh sample)

Mineral	1	2
Sodium	6.0±1.40	11.3±1.53
Potassium	850±35.40	30.7±2.52
Calcium	240±14.14	15.7±1.15
Magnesium	175±21.21	14.3±1.15
Iron	3.0±0.43	0.3±0.00
Phosphorus	51.0±1.40	39.3±7.44
Zinc	0.9±0.07	3.7±0.20
Manganese	5.0±0.28	5.3±0.20
Copper	1.4±0.21	0.3±0.02
β-Carotene (µg/100 g)	691.0±2.80	571.6±2.11
Ascorbic acid	89.2±0.80	36.5±0.15
Niacin	0.8±0.03	0.3±0.04
Riboflavin	0.4±0.03	0.1±0.01

Table 3: Antinutritional Factors of *Colocassia esculenta* (1) and *Ocimum gratissimum* (2) Leaves (mg/100 g fresh sample)

Parameter	1	2
Phytates	0.47±0.02	0.63±0.03
Oxalates	1.38±0.05	1.04±0.02
Tannins	0.63±0.02	0.44±0.01
Saponins	0.93±0.04	0.92±0.03

The crude protein, crude fibre, ash and carbohydrate content of *Colocassia esculenta* leaf was slightly higher than that of *Ocimum gratissimum* while *Ocimum gratissimum* leaf had higher moisture, crude lipid and gross energy values. The two vegetables can be good sources of dietary fibre. Their low gross energy can be an advantage for their consumption by the obese and diabetics.

The mineral and vitamin profile of the two vegetables are as shown in Table 2. *Colocassia esculenta* leaf was very high in potassium, high in calcium, magnesium and iron; fairly high in manganese and phosphorus, low in copper and zinc and very low in sodium. *Ocimum gratissimum* leaf was very low in sodium, potassium, calcium, magnesium, iron and copper; slightly low in phosphorus, but high in zinc and manganese. *Colocassia esculenta* can be a good source of potassium, calcium and iron. The low sodium content of the 2 vegetables qualifies them as good vegetables for both normal and hypertensive people.

The leaves were very rich in β-carotene and this may have contributed in part to their green colouration (Edem *et al.*, 1984; Adepoju and Kareem, 2004). The high β-carotene value can qualify these vegetables as good sources of vitamin A - precursor; a micronutrient that is of great nutritional importance. The β-carotene value also qualifies them as good vegetables for the vegetarians as source of provitamin A.

The vegetables were also high in ascorbic acid and can serve as its good sources. However, they were low in niacin and riboflavin. Their high values of β-carotene and ascorbic acid qualify them as good sources of antioxidants, which are needed by the body to prevent or eliminate free radicals from carrying out their destructive activities. This antioxidant potential of *Ocimum gratissimum* confirms the fact that it is rich in antioxidants (Edeoga and Gomina, 2000). The nutrient composition of the two vegetables compared favourably well with that of conventional and popular *Amaranthus* sp. and *Moringa oleifera* vegetables (Adepoju *et al*., 2006).

The antinutritional factors of the 2 leaves are as shown in Table 3. The two vegetables were very low in all the anti-nutrients studied. The low levels of antinutritional factors in the leaves make them safe for consumption in high quantity.

The low carbohydrate, calorie and fairly high crude fibre content of the two non conventional vegetables can be advantageous to qualify them as good vegetables for consumption by all, especially the obese and diabetics. Their very low sodium content is of great nutritional importance as it qualifies them as good vegetables for the hypertension patients. Their high â-carotene and ascorbic acid content qualify them as good sources of antioxidants.

CONCLUSION

The potentials of these vegetables in preventing some forms of cancers need investigation, since they contain some antioxidant nutrients. The nutrient content of these vegetables with the low antinutritional factors may suggest their safe consumption in the diets.

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