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*Short Communication*

# Amino acid profile of two non-conventional leafy vegetables, *Sesamum indicum* and *Balanites aegyptiaca*

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**The leaves of *Sesamum indicum* and *Balanites aegyptiaca* are popularly consumed in Adamawa State of Nigeria largely by the rural communities. They were analyzed to determine proximate nutrient content, amino acid composition and antinutritional factors. Data obtained for proximate composition showed protein content of 18.59 and 15.86% for *S. indicum* and *B. Aegyptiaca*, respectively. These values are high compared to those for some common Nigerian vegetables. Leaves of both plants had high percentages of crude fibre (27.58 and 30.75%). Carbohydrates, lipid, moisture and ash contents were within the range expected for dry leafy vegetable. Seventeen (17) amino acids were found in varying proportions in the protein of both vegetables. The anti-nutritional factors analyzed; tannins, oxalates and phytates, in the vegetables were lower than the range of values reported for most vegetables.**

**Key words:** *Sesamum indicum*, *Balanites aegyptiaca*, amino acid, nutrients, antinutrients, vegetables.

## INTRODUCTION

*Sesamum indicum* is an annual plant belonging to the Pediliaceae family. It is one of the world's most important oil crops grown in developing countries by small holders (FAO, 1993). Its oil, seed and leaves have been ascribed several medicinal and other desirable properties and young shoots are used as vegetables in soups (Bokhari and Ahmed, 1999). *S. indicum* grows flamboyantly with good seedling property. It is grown as leafy vegetable in family home gardens and contributes to house hold food security. It also serves as a source of income to families (Rubahaiyo, 1994).

*Balanites aegyptiaca*, commonly known as desert date, is a small evergreen tree reaching a height of 6 – 12 m. It belongs to the Zygophyllacea family and produces fruits, which are edible. Fresh new shoots, which are always growing during the dry season, are commonly used as animal forage but in periods of food shortage, people cut the newly growing succulent shoots with the leaves, cook and eat them. The plant is commonly found wild in Borno and Adamawa States of Nigeria.

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Green leafy vegetables constitute an indispensable constituent of the human diet in Africa generally and West Africa in particular (Oguntona, 1986). It has been estimated that over 60 species of green leafy vegetables are consumed in Nigeria alone (Okoli et al., 1985). In Nigeria and other developing countries, as a result of food shortage and high cost of cultivated green leafy vegetables, wild and semi-wild food resources are frequently consumed as the dominant source of leafy vegetables especially in the rural communities (Barminas et al., 1998). These non-conventional leafy vegetable play an important role in every day cooking especially in the rural areas. In addition, the vegetables supply calories and nutrient during dry season when there is shortage of cultivated green vegetable and other food resources. Many of such plants have been identified but lack of data on their chemical composition has limited the prospect of their utilization (Baumer, 1995). *S. indicum* and *B. aegyptiaca* fall in the category of such plants. Both are popular among certain communities in Adamawa state of Nigeria. By learning more about their nutritional and anti-nutritional composition, one can better assess their importance in the well being of the communities that consume them.

This work is designed to examine the leaves of *S. indi-*

**Table 1.** Proximate composition of the leaves of *S. indicum* and *B. aegyptiaca* (g/100 g, dry weight).

| Parameter | *S. indicum* | *B. aegyptiaca* |
|---|---|---|
| Moisture | 7.83 ± 2.12 | 13.11 ± 0.50 |
| Ash content | 10.30 ± 1.08 | 9.26 ± 0.47 |
| Lipids (fats) | 1.66 ± 0.24 | 2.90 ± 0.07 |
| Crude fibre | 27.58 ± 0.50 | 30.75 ± 1.83 |
| Crude protein | 18.59 ± 0.82 | 15.86 ± 0.56 |
| Carbohydrate | 34.04 ± 0.43 | 32.38 ± 0.10 |

Values are means ± SD for three (3) determinations.

*cum* and *B. aegyptiaca* for proximate nutrient content, amino acid composition, and anti-nutritional factors. The report would provide necessary information on both vegetables and provide basis for their wider utilization.

## MATERIALS AND METHODS

### Collection and treatment of samples

Leaves of *S. indicum and B. aegyptiaca* were sampled randomly from farmlands in Yola, Adamawa State, Nigeria in the month of September 2005. The leaves were plucked and air dried in a closed room, that is, away from sunlight. They were then grounded into fine powder using pestle and mortar (stainless steel) and stored in screw capped containers.

### Proximate analysis

The samples were analyzed for proximate composition (moisture, crude fat, fibre, carbohydrate and protein). Moisture and lipid were determined by Cocks and Pede (1996) method. The method of Nielson (1994) was adopted for the determination of ash and crude fibre. Determination of crude protein was by the micro-Kjedahl procedure. The carbohydrate content was obtained by difference.

### Amino acid analysis

The amino acid profile was determined using the method described by Sparkman et al (1958). Each sample was dried to constant weight, defatted, hydrolyzed, evaporated and loaded into the techno sequential multi-sample amino acid analyzer (TSM). following the steps described below: 2 g of the dried sample was weighed into extraction thimble and the fat extracted with chloroform : methanol (2:1) mixture using soxhlet extraction apparatus (AOAC, 1990). Then, 1 g of the defatted sample was weighed into glass ampoule. 7 ml of 6 N HCl were added and oxygen expelled by passing nitrogen into the ampoule. The glass ampoule was sealed and placed in an oven preset at $105^0$C for 22 h. The ampoule was allowed to cool before breaking open at the tip and the content filtered. The filterate was then evaporated to dryness and the residue dissolved with 5 ml acetate buffer (pH 2.0) and stored in plastic specimem bottles. 10 µl was dispensed into the cartridge of the analyser which is designed to seperate and analyse free, acidic, neutral and basic amino acids of the hydrolysate. The amount of each amino acid present in the sample was calculated in g/100 g protein from the chromatogram produced. Table 2.

**Table 2.** Amino Acid composition of the leaves of *S. indicum* and *B. aegyptiaca* (g/100 g protein).

| Amino acid | *S. indicum* | *B. aegyptiaca* |
|---|---|---|
| Lysine | 4.90 | 4.51 |
| Threonine | 3.61 | 2.88 |
| Cysteine | 0.10 | 0.79 |
| Valine | 4.92 | 4.07 |
| Methionine | 1.08 | 0.73 |
| Isoleucine | 3.73 | 3.50 |
| Leucine | 8.66 | 6.23 |
| Tyrosine | 3.26 | 3.16 |
| Phenylalanine | 5.00 | 4.80 |
| Histidine | 2.61 | 2.83 |
| Arginine | 4.66 | 4.20 |
| Aspartic acid | 8.11 | 7.86 |
| Serine | 2.02 | 2.01 |
| Glutamic acid | 10.02 | 10.80 |
| Proline | 2.96 | 1.85 |
| Glycine | 0.85 | 9.65 |
| Alanine | 2.11 | 1.80 |

### Determination of anti-nutrients

Tannin content was estimated using the vanillin-HCl method modified by Price and Butler (1977). Oxalates were analyzed using the method of Ukpabi and Ejidon (1999). The Reddy and Love method (1999) was adopted for the estimation of phytates.

## RESULTS AND DISCUSSION

The proximate composition of *S. indicum and B. aegyptiaca* are given in Table 1. The results of the analysis showed high protein content for *S. indicum* (18.59%) and *B. aegyptiaca* (15.86%). These values are higher than those for some common vegetables such as *Amaranthus hybridus* (4.6%) and *Telferia occidentalis* (4.3%) but lower than *Cochorus olitoris* (27.4%) as reported by Fafunso and Bassir (1977) and Ifon and Bassir (1979). Crude fibre in the vegetables were relatively high (27.58% and 30.75%) for *S. Indicum* and *B. Aegyptiaca*, respectively. This implies that in the diet, the two vegetables will perform the important role of promoting softer stools with increased frequency and regularity of elimination as is characteristic of fibre-rich diets (Okaka et al., 2000). Lipids, ash and carbohydrate contents of the samples were within the range expected for dry leafy vegetables (Osagie and Offiong, 1998).

Seventeen amino acids were found in varying proportions in both vegetables. Glutamic acid had the highest value for both vegetables, while the limiting amino acid in both samples was cysteine. All the essential amino acids were present in both vegetable.

A major factor limiting the wide use of many plants is the ubiquitous occurrence in them a range of natural

**Table 3.** Antinutritional content of *S. indicum* and *B. aegyptiaca* (mg/100 g).

| Antinutrient | *S. indicum* | *B. aegyptiaca* |
|---|---|---|
| Phytic acid | 10.90 ± 0.68 | 2.97 ± 0.43 |
| Tannins | 4.80 ± 1.47 | 4.10 ± 0.14 |
| Oxalates | 56.5 ± 0.06 | 75.0 ± 0.08 |

compounds capable of eliciting deleterious effects in man and animals. These compounds known as antinutrients are of different types and widely distributed in the animal kingdom (Osagie and Offiong, 1998). The anti-nutritional factors; tannins, oxalates and phytates were present in varying amounts in both vegetables (Table 3). Phytic acid has been reported to reduce the bioavailability of trace element and minerals (Apata and Ologhobo, 1989). The phytate content of both *S. indicum* and *B. aegyptiaca* were, however, below the range reported for most vegetables. Tannin content of *S. indicum* (4.8 mg/100 g) and *B. aegyptiaca* (4.10 mg/100 g) were low and therefore will not cause the deleterious effects of tannins, which is reduction in digestibility of nutrients. Oxalates are considered anti-nutrients as well as toxins. They render calcium unavailable by binding the calcium ion to form insoluble calcium oxalate complex. Oke (1969) has shown that on a dry weight basis, some of the Nigerian vegetables may be superior to milk as gross sources of calcium except that the calcium is not available due to the presence of oxalic acid and is bound as insoluble calcium oxalate. High oxalate diet can increase the risk of renal calcium absorption. Oxalate contents of *S. indicum* and *B. aegyptiaca* were, however, lower than those associated with renal problems (Marshal et al., 1967).

## Conclusion

This study has revealed that the vegetables, *S. indicum* and *B. Aegyptiaca*, consumed in Adamawa State can contribute useful amount of nutrients including amino acids to human diet. Interestingly, the anti-nutritional contents of both vegetables were low, much lower than is obtainable in most Nigerian vegetables. This implies that, the overall nutritional value of the vegetables will not be affected. Indeed, these vegetables consumed largely by the rural populace in Adamawa State are not inferior to the conventional popular Nigerian vegetables. There is need, however, to determine the vitamins and minerals present in the vegetables. Understandably, nutrient loss is of great concern during blanching and cooking of vegetables, therefore there is need to study the effects of cooking and processing procedures on nutrient availability of the vegetables. This will help to adequately establish their importance in human nutrition and provide basis for maximum utilization of the plants.

## REFERENCES


AOAC (Association of Official Analytical Chemist) (1990). Official methods of Analysis 15th Edition Washington DC, U.S.A.

Apata DF, Ologhobo AD (1989). Influence of Phytic Acid on the availability of minerals from selected tropical legume seeds. J. Sci. 23: 88-90.

Barminas JT, Charles M, Emmanuel D (1998). Mineral Composition of Non-Conventional leafy Vegetables. J Plant Foods Hum. Nutr. 55: 29-36.

Baumer M (1995). Food producing Trees and Shrubs of West Africa Series, Etudes – et – Recherches Senegal 15: 168-206.

Bokhari MH, Ahmed MJ (1999). Food Plants in Borno State Nigeria, University Press, Maiduguri, Nigeria, pp. 20-43.

Cocks LV, Pede C (1996). Laboratory Handbook for Oil and Fat Analysis", London, New York, U.S.A., Academic Press, pp. 30-130.

FAO (1993). Amino Acid content of Foods and Biological Data on Proteins, Food and Agricultural Organization of the United Nations, Rome, Italy, p. 285.

Fafunso M, Bassir O (1977). Variations in the Loss of Vitamins in Leafy vegetables with various methods of food preparation, Food Chem, 21: 51-55.

Ifon ET, Bassir O (1979). The Nutritive value of some Nigeria green vegetables Part 1; Vitamin and Mineral Content. Food Chem, 5: 253-267.

Marshal VI, Buck WB, Bell GI (1967). Pig weed (*Amaranthus reproflexus*) an Oxalate containing Plant, Am. J. Vet. Res. 28: 888-889.

Nielson SS (1994). Introduction to the Chemical Analysis of Foods, Jones and Bartletes publishers, London, pp. 93-201.

Okaka JC, Akobundu ENT, Okaka NC (2000): Human Nutrition an Integrated Approach, 2nd Edition, O. C. JANCO Academic Publishers, Enugu, Nigeria, pp. 1-66.

Osagie AU, Offiong YE (1998). "Nutritional Quality of Plant Foods", Ambik Press, Benin City, Edo State, Nigeria, pp. 131-221.

Oke OC (1969). Composition of some Nigerian Leafy vegetables. J. Am. Diet Assoc. 53(2): 130-132.

Price MC, butler LC (1977). Anti-nutritional Content of some Forage Crops, J. Agric Food Chem. 25(6): 1268-1273.

Reddy MB, Love M (1999). The Impact of Food Processing on the Nutritional Quality of Vitamins and Minerals. Adv. Exp. Biol. 15: 459-1006.

Rubahaiyo EB (1994). The contribution of indigenous vegetables to household food security. Afr. Crop Sci. J. 3: 1337-1340.

Sparkman DH, Stein EH, Moore S (1958). Automatic recording apparatus for use in Chromatography of amino acids, Anal. Chem. 30: 119.

Ukpabi AT, Ejidon OA (1999). Experimental Procedures for Food and Water Analysis, Computer Edge Publishers Calabar, Nigeria, pp. 84-88.