PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 5 (2): 166-168, 2006
ISSN 1680-5194

Nutritive and Anti-Nutritive Evaluation of Sweet Potatoes (*Ipomoea batatas*) Leaves

B.S. Antia[1], E.J. Akpan[2], P.A. Okon[1] and I.U. Umoren[1]
[1]Department of Chemistry, Faculty of Science, University of Uyo, Uyo, Nigeria
[2]Department of Biochemistry, Faculty of Basic Medical Sciences, University of Uyo, Uyo, Nigeria

Abstract: Levels of some nutrients and antinutrients of sweet potatoes (*Ipomoea batatas*), leaves were determined using standard analytical methods. Crude protein, crude fat, crude fibre, ash, carbohydrate, moisture contents and calorific values were 24.85%, 4.90%, 7.20%, 11.10%, 51.95%, 82.21% and 351.30 kcal respectively. The vitamin composition was found to be at the levels of 0.672 mg/100g for vitamin A and 15.20 mg/100g for vitamin C. The elemental analysis of the leaves in mg/100g Dry matter (DM) indicated that the leaves contained appreciable levels of zinc (0.08), potassium (4.05), sodium (4.23), manganese (4.64), calcium (28.44), magnesium (340.00) and iron (16.00). The antinutrient composition for phytic acid, cyanide, tannins and total oxalate were 1.44 ± 0.01, 30.24 ± 0.02, 0.21 ± 0.02 and 308.00 ± 1.04 mg/100g respectively. These results reveal that the leaves contain an appreciable amount of nutrients, vitamins and mineral elements and low levels of toxicants and should be included in diets to supplement our daily allowance needed by the body.

Key words: Sweet potatoes, human diet, vitamins, minerals

Introduction

Vegetables serve as an indispensable constituent of the human diet supplying the body with minerals, vitamins and certain hormone precursors, in addition to protein and energy (Oyenuga and Fetuga, 1975). However, there are some used and inexpensive leafy vegetables whose nutritive and antinutritive potentials are yet to be adequately studied and utilized. Among these leafy vegetables are the leaves of sweet potatoes. Sweet potato (*Ipomoea batatas*) is a herbaceous creeping plant with smooth, lightly moderate green leaves sometimes with a considerable amount of purple pigmentation especially along its veins (Longe, 1986). Its starchy tuberous root is the major economic part of the crop.

Occasionally, the leaves are used as vegetable in yam and cocoyam porridges is some parts of Nigeria particularly among the Efik-Ibibio people of South-Eastern Nigeria (Eka and Edijala, 1972). Besides being used for human consumption, the leaves serve as fodder and browse for cattle, sheep, goats, pigs and other domestic animals. According to Oyenuga (1968), the young leaves of sweet potatoes serves as a good vegetable source for man. Its wide use as vegetable is however hampered by the fact that it is considered a poor man's vegetable, coupled with the fact that it had always been used traditionally as feeds for domestic animals.

Much attention in most literatures have only been paid to the tubers and not the leaves. Since there is very little or no information on the true chemical composition of *Ipomoea batatas* leaves, the processing of the leaves for nutritional or therapeutic purposes may be misleading. This work is therefore aimed at finding out the nutrient and antinutrient compositions of sweet potato leaves in a bid to determining its suitability as an edible vegetable or otherwise.

Materials and Methods

Analytical procedure: The leaves of *Ipomoea batatas* were collected from Uyo, Akwa Ibom State, Nigeria and was identified by a taxonomist, Dr. (Mrs.) Bassey of the Botany Department, University of Uyo, Nigeria. The leaves were destalked, washed and ovendried at 60°C for 24 hours. After drying, the leaves were ground into a fine powder using a mortar and pestle, and then sieved and stored in a well labelled air-tight container for analysis.

The proximate analysis for the various constituents was carried out based on the recommendation of the Association of Official Analytical Chemist (A. O. A. C., 1975).

Moisture content determination involved washing a known weight of sample with clean and distilled water and drying to a constant weight at 60°C in an oven (Gallen Kamp hot box).

Determination of ash involved incineration in a muffle furnace (Gallenkamp hot box) at 550°C for 24 hours. Crude fat determination involved using exhaustive soxhlet extraction of a known weight of sample with petroleum ether (b.pt 40-60°C) and methanol mixed properly in the ratio 1:1. Crude fibre was obtained from the loss in weight on ignition of dried residue remaining after digestion of fat-free samples with 1.25% each of

Table 1: Result of the proximate analysis of sweet potatoes leaves*

Parameters	% Dry matter
Moisture Content	82.21±0.06
Ash Content	11.10±0.02
Crude fat	4.90±0.02
Crude protein	24.85±0.04
Crude fibre	7.20±0.01
Carbohydrate	51.95±0.05
Caloric value (kcal)	351.30±1.25

*Mean ± S. D of three determinations.

Table 2: Antinutrient Composition of *Ipomoea batatas* leaves

Antinutrients	Composition (mg/100g)
Cyanide	30.24±0.02
Tannins	0.21±0.02
Total oxalate	308.00±1.04
Phytic acid	1.44±0.01

*Mean±S. D of triplicate determinations.

Table 3: Elemental and Vitamin Compositions of *Ipomoea batatas* leaves

Mineral Elements	Composition (mg/100g)
Calcium	28.44±0.03
Magnesium	340.00±0.17
Iron	16.00±0.04
Zinc	0.08±0.00
Potassium	4.50±0.01
Manganese	4.64±0.10
Phosphorus	37.28±0.15
Copper	0.00±0.00
Sodium	4.23±0.02
Vit A ± S. D of triplicate	0.67±0.01
Vit C	15.20±0.02

*Mean±S.D of triplicate determinations

sulphuric acid and sodium hydroxide solutions under specified condition.

$$\% \text{ Fibre} = \frac{\text{loss of weight on ignition}}{\text{weight of sample used}} \times 100$$

Determination of crude protein was done using the microkjeldahl nitrogen method which involve the digestion of a given weight of the sample with concentrated H_2SO_4 and a catalyst to convert any organic nitrogen to ammonium sulphate in solution, followed by the decomposition of ammonium sulphate with NaOH. The ammonia liberated was distilled into 5% boric acid. The nitrogen from ammonia was deduced from titration of the trapped ammonia with O.O5N HCl using methylene red and methylene blue (double indicator solution) indicators. The value of nitrogen obtained was multiplied by 6.25 to give the % crude protein.

The carbohydrate content was determined by subtracting the total crude protein, crude fibre, ash and lipid from the total dry matter. The caloric value estimation was done by summing the multiplied values for crude protein, fat or lipid and carbohydrate (excluding crude fibre) by their respective AT WATER factors (4,9,4). Vit A and C were determined by the methods of AOAC (1984).

Mineral element composition was determined using the AAS after acid digestion of the samples (A.O.A.C, 1984). Hydrogen cyanide was determined by alkaline titration method (A.O.A.C, 1984), total oxalate was by the permanganate titration method of Dye (1956) and Tannins were estimated by the alkaline method of titration (A. O. A. C, 1984).

Results and Discussion

The results of Proximate composition of sweet potato (*Ipomoea batatas*) leaves is represented in Table 1.

The values for ash content, crude fat, crude protein, crude fibre, carbohydrate and moisture content were 11.10, 4.90, 28.85, 7.20 and 51.95% dry matter respectively. The caloric value was 351.30 Kcal.

The ash content of the leaf was lower than that of some leafy vegetables commonly consumed in Nigeria such as *Talinum triangulare* (20.05%). It is however higher than some other vegetables such as *Occimum graticimum* (8.00) and *Hibiscus esculentus* (8.00) (Akindahunsi and Salawu, 2005). The high ash content is a reflection of the mineral contents preserved in the food materials. The result therefore suggests a high deposit of mineral elements in the leaves.

The crude fat (4.90%) is moderate when compared to those of *Talinum triangulare* (5.90%), *Baseila alba* (8.71), *Amaranthus hybridus* (4.80%), *Calchorus africanum* (4.20%) (Ifon and Basir, 1979; Akindahunsi and Salawu, 2005). Comparing it with the values obtained from other leaves shows that *Ipomoea batatas* leaves contain low fat contents. Dietary fats function in the increase of palatability of food by absorbing and retaining flavours. A diet providing 1-2% of its caloric of energy as fat is said to be sufficient to human beings as excess fat consumption is implicated in certain cardiovascular disorders such as atherosclerosis, cancer and aging .

Ipomoea batatas, leaves contain crude protein quite high when compared to *Heinsia crinita* (14.7%), *Amaranthus caudatus* (20.59) (Etuk *et al.*, 1998, Akindahunsi and Salawu, 2005). Compares favourably with cassava leaves (*Manihot utilisima*), 24.88% and other leaves but quite low when compared to *Piper guineeses* and *Talinum triangulare* with values of 29.78, and 31.00% respectively (Akindahunsi and Salawu, 2005). The presence of tannins is however known to inhibit the bioavailability of protein and minerals (Davidson *et al.*, 1975).

The crude fibre content of 7.20% is high when compared to *Talinum triangulare* (6.20%), *Piper guineeses*

(6.40%), *Corchorus olitorius* (7.0%), bitter leaves (*Vernonia amygdalina),* 6.5% (Akindahunsi and Salawu, 2005), Non-starchy vegetables are the richest sources of dietary fibre (Agostoni *et al*., 1995) and are employed in the treatment of diseases such as obesity, diabetes, cancer and gastrointestinal disorders (Saldanha, 1995). The caloric value obtained is in lieu with that of *Colocasia esculenta* (355.19kcal) and *Xanthosoma sagittifolium* (340.99kcals) (Davidson *et al*., 1975).

The results for antinutrient composition (Table 2) revealed low values of cyanide (30.24mg/100g), phytic acid (1.44mg/100g) and tannins (0.21mg/100g) but exceptionally high value of oxalate (308mg/100g) when compared to 95.50mg/100g for *Vernonia amygdalina* (bitter leaf) and 59.80mg/100g for *Telferia occidentalis* (fluted pumpkin) (McGraw Hill, 1987). This may constitute potent human poisons. But interestingly, cooking properly before consumption significantly reduces the total oxalate content of leaves or vegetables (Akwaowo *et al*., 2000).

The mineral composition of the leaves (Table 3), revealed high concentrations of magnesium (340mg/100g) and phosphorus (37.28mg/100g). Levels for calcium, Iron, sodium, potassium and manganese were 28.44, 16.00, 4.23, 4.05 and 4.65mg/100g respectively. The leaves however, contain very little of Zinc (0 .08mg/100g) while copper is completely absent (0.00mg/100g). Vitamin A and C contents of the leaf (Table 3) are low compared to the daily requirements for adult male and female (National Research Council, 1974). And to be able to meet the daily requirements, it should be taken in large quantities.

However, though low in content it is still significance since the complete absence of Vit A and C in the leaf could be injurious to health.

Conclusion: The leaves of *Ipomoea batatas* from the data, reveals that it contains an appreciable amount of proteins, minerals, fat, fibre, carbohydrate, caloric values (energy) and low levels of toxicants except for oxalate whose value can be reduced by cooking. Since it contains substantial amount of nutrients, it can therefore be concluded that *Ipomoea batatas* leaves can contribute significantly to the nutrient requirements of man and should be recommended.

Acknowledgments

The authors are grateful to Peace Adindu, Mary Tetteh and Samuel Hanson for their contributions.

References

Agostoni, C., R. Riva and M. Giovannini, 1995. Dietary Fiber in Waning Foods of Young Children. Pediat., 96: 1000-1005.

Akindahunsi, A.A. and S.O. Salawu, 2005. Phytochemical Screening and nutrient-antinutrient composition of selected tropical green leafy vegetables. Afr. J. Biotech., 4: 497-501.

Akwaowo, E.U., B.A. Ndon and E.U. Etuk, 2000. Minerals and antinutrients in fluted pumpkin (*Telfairia occidentalis Hook. F.*). J. Food Chem., 70: 235-240.

A.O.A.C. (Association of official Analytical Chemists), 1975. Official Methods of Analysis, 14th edn. (Ed. S. Williams) Washington D.C, 152-164.

Davidson, S.P., J.F. Brock and A.S. Truswell, 1975. Human Nutrition and Dietetics. 6th ed. Churchill Livingstone / Longman Group Ltd. 107-119, 221-224.

Dye, W.B., 1956. Studies on Halogeton glomerulus, Weeds 4: 55-59.

Eka, O.U. and J.K. Edijala, 1972. Chemical Composition of some Traditionally prepared Nigerian Food. J. Biol. Appl. Chem., 6: 177.

Etuk, E.U., M.N. Bassey, U.O. Umoh and E.G. Inyang, 1998. Comparative nutritional studies on three Local varieties of Heinsia crinita, Plant Varieties and Seeds. 11: 151-158.

Ifon, E.T. and O. Bassir, 1979. The nutritive value of some Nigerian leafy green vegetables part 2. Distribution of protein, carbohydrate, Fat. J. Food Chem., 5: 231-235.

Longe, O.G., 1986. Energy Content of some tropical starch crop in Nigeria. J. Agri., 21: 134-136.

Mc-Graw Hill, 1987. Encyclopedia of food Agricultural Nutrition, 5th edn. Mc-Graw Hill Book Company, New York, Vol. 4: 117-120.

National Research Council, 1974. Recommended Dietary allowance. USA Nutr. Rev., 395: 374-395.

Oyenuga, V.A. and B.L. Fetuga, 1975. First National Seminar on Fruits and Vegetables. In: proc. And Recom. & papers by NIHORT, Ibadan.

Oyenuga, V.A., 1968. Nigerian Food and Feeding stuffs, their chemistry and Nutritive value; 3rd ed. University Press Ibadan, Nigeria

Saldanha, L.G., 1995. Fibre in the diet of U. S. Children: results of national surveys. Pediat., 96: 994-996.