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 8 (1): 32-34, 2009
ISSN 1680-5194

Nutritional and Antinutritional Components of *Pennisetum purpureum* (Schumach)

C.C. Okaraonye and J.C. Ikewuchi
Department of Biochemistry, Faculty of Science, University of Port Harcourt,
P.M.B. 5323, Port Harcourt, Nigeria

Abstract: The matrices of young shoots of *Pennisetum purpureum* (Schumach) were subjected to proximate and phytochemical analyses. The proximate profile included moisture (89.00%), total ash (2.00% WW and 18.18% DW), crude protein (2.97% WW and 27.00% DW), crude fat (1.63% WW and 14.82% DW), total carbohydrate (3.40% WW and 30.91% DW) and total metabolizable energy value (34.48 kcal 100 g^{-1} WW and 313.45 kcal 100 g^{-1} DW). The phytochemical screening revealed the presence of alkaloids, cyanogenic glycosides, flavonoids, oxalates, phytates, saponins and tannins. The anti-nutrients composition included tannins (28.640%), cyanogenic glycosides (2.830%), oxalates (0.159%), phytates (0.006%) and saponins (0.850%). This result suggests relative safety for consumption and the possibility of improving the nutritional quality of *Pennisetum purpureum* through dehydration.

Key words: *Pennisetum purpureum*, proximate composition, anti-nutrients and phytochemical screening

Introduction

Pennisetum purpureum (Schumach), commonly known as elephant grass or Napier grass belongs to the Poaceae (alt. Gramineae) family. It is called achara by the Ibo speaking people of South Eastern Nigeria. It is generally used as animal food, an ornamental and for erosion control (USDA, 2008). The dried matured shoots are used for making fences in Northern Nigeria. The matrixes of the matured shoots are used for preparing the special soup called 'ofe achara" by the Ngwa and Umuahia people of Abia State, in South Eastern Nigeria. The present study is designed to assess the nutritional quality and safety of the *Pennisetum purpureum* meal.

Materials and Methods

Samples of fresh young shoots of *Pennisetum purpureum* were purchased from retailers in Mile 3 market in Port Harcourt, Rivers State, Nigeria. The collected samples were identified at the University of Port Harcourt Herbarium, Port Harcourt, Nigeria. After ridding them of dirt, their outer, hard and fibrous portion were removed and discarded, while the inner fresh, tender and edible portion was retained. These were divided into two portions; the first portion was used immediately for proximate analysis while, the other portion was oven-dried, to a constant weight and ground into powders, which was then packed into dark polythene bags and stored in a desiccator for subsequent uses in the phytocmemical analysis.

Proximate analysis of the samples for moisture, crude protein, fat, ash, fiber and total carbohydrate contents of the samples were carried out in triplicates according to standard methods (AOAC, 1990). The energy value was calculated using the factors 4, 9 and 4 for protein, fat and carbohydrate, respectively (Chaney, 2006). The phytochemical screening of the sample was carried out as described by Sofowora (1980) and Harbone (1973). The sample was screened for alkaloids, cyanogenic glycosides, flavonoids, oxalates, phytates, saponins and tannins. Quantitative determination of oxalates, phytates, tannins, saponins and cyanogenic glycosides were carried out in triplicates, using the method of AOAC (1990).

Results and Discussion

The proximate composition of *Pennisetum purpureum* is given in Table 1. Our result show that *Pennisetum purpureum* has high moisture content (89.00%). The moisture content of any food is an index of its water activity (Frazier and Westoff, 1978) and is used as a measure of stability and the susceptibility to microbial contamination (Scott, 1980). This implies that *Pennisetum purpureum* may have a short shelf-life due to its high moisture content. This high moisture content also implies that dehydration would increase the relative concentrations of the other food nutrients and improve the shelf-life/preservation of the *Pennisetum purpureum* meal. The protein content of *Pennisetum purpureum* shown in Table 1 is higher than those reported for *Nypa fruiticans* fruits and seeds (Osabor *et al*., 2008), *Boerhavia diffusa* and *Commelina nudiflora* (Ujowundu *et al*., 2008), *Trichosanthes anguina* (Ojiako and Igwe, 2008) and compares with that of *Parkia biglobosa* (Esenwah and Ikenebomeh, 2008) and those of most conventional protein sources (Pyke, 1979). The relative proportion of protein can even be increased further by dehydrating the *Pennisetum purpureum*. Thus when dehydrated, *Pennisetum*

Table 1: Proximate composition of *Pennisetum purpureum*

Parameter	Wet weight	Dry weight
Moisture (%)	89.00	-
Total ash (%)	2.00	18.18
Crude protein (%)	2.97	27.00
Crude lipid (%)	1.63	14.82
Total carbohydrate (%)	3.40	30.91
Crude fiber (%)	1.00	9.09
Total metabolizable energy (kcal 100 g^{-1})	34.48	313.45

Values are means of triplicate determinations

Table 2: Phytochemical profile of *Pennisetum purpureum*

Phytochemical	Result
Alkaloids	++
Cyanogenic glycosides	++
Flavonoids	++
Oxalates	++
Phytates	+
Saponins	++
Tannins	+++

Key: + = slightly present; ++ = moderately present; +++ = highly present

purpureum can be regarded as a good source of protein. This high protein content is suggestive of it being used in combating protein deficiency. This implies that a 100g dry sample of *Pennisetum purpureum* will meet the daily protein requirement of 23-56 g (NRC, 1974; Chaney, 2006). The ash value observed for *Pennisetum purpureum* is relatively high compared with reported values for meat, egg and comparable with that of wheat flour (Singh, 2004). The relative values of the crude fiber, total carbohydrate and crude fat content of *Pennisetum purpureum* can all be improved by dehydration.

The phytochemical screening revealed that *Pennisetum purpureum* is rich in tannins, alkaloids, flavonoids, saponins, cyanogenic glycosides and oxalates, but with very little phytate (Table 2). Alkaloids, flavonoids, saponins and tannins are known to have antimicrobial activity, as well as other physiological activities (Sofowora, 1980; Evans, 2005). In fact, flavonoids have a wide range of biochemical and pharmacological activities in mammalian and other biological systems. They possess anti-inflammatory, antioxidant, anti-allergic, hepatoprotective, anti-thrombic, antiviral and anti-carcinogenic activities (Middleton *et al.*, 2000). The concentration of some of the anti-nutrients is given in Table 3. The level of oxalates observed here is less than that reported for *Trichosanthes anguina* (Ojiako and Igwe, 2008) and is unlikely to pose toxicity problems to man since it is below the toxic levels of 2-5 g (Oke, 1966; Munro and Bassir, 1969). The phytate level observed is less than that reported for seeds of *Nypa fruiticans* (Osabor *et al.*, 2008), *Trichosanthes anguina* (Ojiako and Igwe, 2008) but higher than that for *Chrysophyllum albidum* (Edem *et al.*, 1984). The knowledge of the phytate level in foods is necessary because high concentration can cause adverse effects on the digestibility (Nwokolo and Bragg, 1977). Phytate forms stable complexes with Cu^{2+}, Zn^{2+}, Co^{2+}, Mn^{2+}, Fe^{2+} and Ca^{2+}. Saponins reduce 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 they may aid in lessening the metabolic burden that would have been placed on the liver. Very high tannin content was recorded in this study. This high tannin content can probably be lowered by processing methods such as soaking, boiling and fermentation (Mbajunwa, 1995; Igboeli *et al.*, 1997; El-Adawy, 2002; Esenwah and Ikenebomeh, 2008).

Table 3: Some anti-nutritional contents of *Pennisetum purpureum*

Anti-nutrient	Composition (%)
Cyanogenic glycosides	2.830±0.040
Oxalates	0.159±0.010
Phytates	0.006±0.000
Saponins	0.850±0.030
Tannins	28.640±0.000

Values are Means ± SD of triplicate determinations

References

AOAC, 1990. Official Methods of Analysis. 15th Edn. Association of Analytical Chemists. Washington D.C., USA.

Chaney, S.G., 2006. Principles of Nutrition I: Macronutrients. In: Devlin, T.M. (Ed.). Textbook of Biochemistry, with Clinical Correlation. 6th Edn. John Wiley and sons, New York, pp: 1071-1090.

Edem, D.O., O.U. Eka and E.T. Ifon, 1984. Chemical evaluation of the nutritive value of the fruits of African star apple (*Chrysophyllum albidum*). Food Chem., 14: 303-311.

El-Adawy, T.A., 2002. Nutritional composition and anti-nutritional factors of chick peas (*Cicer arietinum* L.) undergoing different cooking methods and germination. Plant Foods Hum. Nutr., 57: 83-97.

Esenwah, C.N. and M.J. Ikenebomeh, 2008. Processing Effects on the Nuttritional and Anti-Nutritional contents of African Locust Bean (*Parkia biglobosa* Benth) Seed. Pak. J. Nutr., 7: 214-217.

Evans, W.S., 2005. Trease and Evans Pharmacognosy. 15th Edn. Elsevier, India.

Frazier, W.S. and D.C. Westoff, 1978. Food Microbiology. 3rd Edn. McGraw Hill, New York.

Harbone, J.B., 1973. Phytochemical Methods, a Guide to Modern Technique of Plant Analysis. 2nd Edn. Chapman and Hall, New York.

Igboeli, L.C., E.O.H. Addy and L.I. Salami, 1997. Effects of some processing techniques on the anti-nutrient content of baobab seeds (*Adansonia digitata*). Biores. Tech., 59: 29-31.

Mbajunwa, O.K., 1995. Effect of processing on some anti-nutritive and yoxic components and on the nutritional composition of African oil bean seed (*Pentaclethra macrophylla* Benth). J. Sci. Food Agric., 68: 153-158.

Middleton, E., C. Kandaswami and T.C. Theoharides, 2000. The Effect of Plant Flavonoids on Mammalian Cells: Implications for Inflammation, Heart Disease and Cancer. Pharmcol. Rev., 52: 678-751.

Munro, A. and D. Bassir, 1969. Oxalates in Nigerian Vegetables. W. African J. Biol. Applied. Chem., 12: 14-18.

NRC (National Research Council), 1974. Recommended Daily Allowances, United State Food and Nutrition Board, National Academy of Science, Washington D.C., USA.

Nwokolo, E.N. and B.B. Bragg, 1977. Influence of phytic acid and crude fiber on the availability of minerals from protein supplements in growing chicks. J. Anim. Sci., 57: 475-477.

Ojiako, O.A. and C.U. Igwe, 2008. The Nutritive, Anti-Nutritive and Hepatotoxic Properties of *Trichosanthes anguina* (Snake Tomato) Fruits from Nigeria. Pak. J. Nutr., 7: 85-89.

Oke, O.L., 1966. Chemical studies on the more commonly used leafy vegetables in Nigeria. J. West Afr. Sci. Assoc., 11: 42-48.

Osabor, V.N., G.E. Egbung and P.C. Okafor, 2008. Chemical Profile of Nypa fruiticans from Cross River Estuary, South Eastern Nigeria. Pak. J. Nutr., 7: 146-150.

Price, K.R., L.I. Johnson and H. Feriwick, 1987. The chemical and biological significance of saponins in foods and feeding stuffs. CRC Critical Revigar in Food Sci. Nutr., 26: 127-135.

Pyke, M., 1979. The science of Nutrition. John Murray Publishers, London.

Scott, W.S., 1980. Water relations of food spoilage microorganisms. Adv. Food Res., 7: 84-127.

Singh, S.P., 2004. Practical Manual of Biochemistry. 5th Edn. CBS Publishers, New Delhi.

Sofowora, A., 1980. Guidelines for research promotion and development in traditional medicine. Nig. J. Pharmacy, 11: 117-118.

Ujowundu, C.O., C.U. Igwe, V.H.A. Enemor, L.A. Nwaogu and O.E. Okafor, 2008. Nutritional and Anti-Nutritive Properties of Boerhavia diffusa and *Commelina nudiflora* Leaves. Pak. J. Nutr., 7: 90-92.

USDA, 2008. Website. USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network-(GRIN) [Online Database] National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?27208.