academicJournals

Vol. 9(13), pp. 456-459, 8 April, 2015
DOI: 10.5897/AJPP2015.4300
Article Number: B23556752701
ISSN 1996-0816

http://www.academicjournals.org/AJPP

African Journal of Pharmacy and Pharmacology

Full Length Research Paper

Anti-nutrients composition and mineral analysis of *allium cepa* (onion) bulbs

Asanga Edet[1]*, Olorunfemi Eseyin[2] and Ekanem Aniebiet[3]

[1]Department of Biochemistry, College of Medical Sciences, University of Calabar, Cross River State, Nigeria.
[2]Department of Pharmaceutical and Medicinal Chemistry, University of Uyo, Akwa Ibom State, Nigeria.
[3]Federal School of Medical Laboratory Science, Jos, Plateau State, Nigeria.

Received 24 February, 2015; Accepted 25 March, 2015

Allium cepa **(onion) bulbs are used as spice in the preparation of virtually all meals in Nigeria, and some researchers had reported its medicinal values. This study was designed to estimate the anti-nutrients and mineral composition of this spice. Standard procedures were used for the analysis of antinutrients. Estimation of the various minerals was done using flame photometer and atomic absorption spectrophotometers. The result showed presence of cyanogenic glycosides, total oxalate, soluble oxalate, phytate and tannin and it was found that, all were in low concentration (8.64+0.05, 70.40+0.01, 44.00±0.02, 34.20±0.01 and 51.32±0.03 mg/100 g, respectively) showcasing the safety in consumption of this spice. Mineral analysis of the spice showed presence of Ca^{2+} > Mg^{2+} > Mn^{2+} > K^{+} > P^{-} > Na^{+} > Fe^{2+} in this decreasing order. The determination of Ca^{2+}/P^{-} and Na^{+}/K^{+} indices provided evidence that onion bulb is a good source of ingredients for bone, teeth and muscle growth. It can also serve as a good source of diet for hypertensive patients respectively.**

Key words: *Allium cepa,* anti-nutrients, minerals.

INTRODUCTION

Allium cepa commonly known as onions belongs to the family of Liliaceae. It is a plant found mainly in the temperate region. Its other names are Ayim (Ibibio), Ayo (Igbo), Alubusa (Yoruba), Albasa (Hausa). Michael and Smith (2005), reported the antioxidant abilities of onions in arresting free radicals which cause gastric ulceration. Also, Pamplona and George (1999) reported that onions have hypoglycemic, antihypertensive and anticonvulsant property. Most onions contain vitamin C, vitamin B_6, folic acid and numerous other nutrients in small amounts. They are low in fats and in sodium, and with an energy value of 166 kJ (40 kcal) per 100 g (3.5 oz) serving, they can contribute their flavor to savoury dishes without raising caloric content appreciably (Williamson et al., 1997). Onions contain chemical compounds such as phenolics and flavonoids that basic research shows to have potential anti-inflammatory, anti-cholesterol, anticancer and antioxidant properties (Michael and Smith, 2005). These include quercetin and its glycosides quercetin 3,4'-diglucoside and quercetin-4'-glucoside. There are considerable differences between different varieties in potential antioxidant content. Shallots have the highest level, six times the amount found in Vidalia onions, the variety with the smallest amount (Yang et al., 2004). Some people suffer from allergic reactions after handling onions, and other symptoms can include contact

*Corresponding author. E-mail: edyasangae1@yahoo.com

dermatitis, intense itching, rhino conjunctivitis, blurred vision, bronchial asthma, sweating and anaphylaxis (Arochena et al., 2012). There may be no allergic reaction in these individuals to the consumption of onions, perhaps because of the denaturing of the proteins involved during the cooking process (Arochena et al., 2012).

While onions and other members of the genus *Allium* are commonly consumed by humans, they can be deadly for dogs, cats, guinea pigs, monkeys and other animals. The toxicity is caused by the sulfoxides present in raw and cooked onions which many animals are unable to digest (Wissman, 1994). Ingestion results in anaemia are caused by the distortion and rupture of red blood cells. Sick pets are sometimes fed with tinned baby foods and any that contain onion should be avoided (Wissman, 1994). Previous studies on onions purchased from a market in Port-Harcourt, Nigeria showed that the following phytochemicals are present tannin, saponin, oxalate and cyanogenic glycosides (Nwinuka et al**.,** 2005)**.**

Antinutrients are chemicals which have been evolved by plants for their own defense, among other biological functions and reduce the maximum utilization of nutrients especially proteins, vitamins, and minerals, thus preventing optimal exploitation of the nutrients present in a food and decreasing the nutritive value. Some of these plant chemicals have been shown to be deleterious to health or evidently advantageous to human and animal health if consumed at appropriate amounts (Ugwu and Oranye, 2006). Antinutrients in plant foods are responsible for deleterious effects related to the absorption of nutrients and micronutrients. However, some antinutrients may exert beneficial health effects at low concentrations. For example, phytic acid, tannins, saponins, and protease inhibitors have been shown to reduce the availability of nutrients and cause growth inhibition.

However, when used at low levels, phytate, tannins, and saponins have also been shown to reduce the blood glucose and insulin responses to starchy foods and/or the plasma cholesterol and triglycerides. In addition, phytates, tannins, saponins, protease inhibitors, and oxalates have been related to reduce cancer risks. This implies that anti-nutrients might not always be harmful. Despite the result of this, the balance between beneficial and hazardous effects of plant bioactives and anti-nutrients rely on their concentration, chemical structure, time of exposure and interaction with other dietary components. Due to this, they can be considered as anti-nutritional factors with negative effects or non-nutritive compounds with positive effects on health (Habtamu and Negussie, 2014).

Minerals or chemical elements which are inorganic nutrients, are usually required in small amounts from less than 1 to 2500 mg/ day depending on the mineral. The dietary focus on chemical elements derives from an interest in supporting the biochemical reactions of metabolism with the required elemental components (Lippard and Jeremy, 1994). Appropriate intake levels of certain chemical elements have been demonstrated to be required to maintain optimal health. Some of the minerals of much biological importance are Ca^{2+}, Mg^{2+}, Mn^{2+}, K^{+}, P^{-}, Na^{+}, Fe^{2+}. Arising from the use of onions in almost all meals in a typical Nigerian family, the safety, nutritional and anti-nutritional composition of this plant which may be responsible for its reported medicinal abilities must be investigated to unravel new information, authenticate earlier claims or counter same; hence, this study was designed to determine quantitatively the anti-nutrients and mineral composition of onion bulbs.

MATERIALS AND METHODS

Collection and treatment of samples for analysis

100 fresh onion bulbs (15 to 98 g) were bought from Akpan Andem main market, Uyo, Akwa Ibom State, Nigeria from different sellers with no regards to shape. They were identified in the department of Botany and Ecological study, University of Uyo, Nigeria. The fresh onion bulbs were peeled carefully, washed and sliced into many replicates using a sharp knife. It was dried in oven at 30°C in the laboratory. The dried samples were ground using electric blender, the powder of each sample was sieved through mesh 300 µm, and stored in an air – tight cellophane bag as stock sample in a refrigerator until required for analyses (Nwinuka et al., 2005)**.**

Anti-nutrients determination

Standard procedures according to Association of Official Analytical Chemist (1990) were used for the estimation of cyanogenic glycosides, oxalate, tannins and phytic acid.

Mineral analysis

Test for the presence of minerals was carried after acid digestion, the supernatant was decanted and the liquid was analyzed for the levels of Ca^{2+}, K^{+}, Mg^{2+}, Mn^{2+}, Na^{+}, Fe^{2+}, and P^{-} using standard procedures. Na^{+} and K^{+} were determined using flame photometer, P^{-} level using vanadate/molybdate yellow colour method by Allen and Deitz (1953) whereas Ca^{2+}, Mg^{2+} and Fe^{2+}, were analyzed using Atomic Absorption Spectrophotometer. The concentration of each element in the sample solution was determined by reference to a calibration curve. The results were statistically analyzed and presented as mean $\pm$ SEM at 95 % confidence level.

RESULTS AND DISCUSSION

The cyanogenic glycosides content in *A. cepa* was noted to be about 8.64 mg/100 g, this value was quite low when compared with the toxic level of cyanogenic glycoside level (50 to 200 mg) (NRC, 2001). Implying that the quantity consumed was not harmful to the body. The value was quite small when compared to 30.05 mg/ 100 g earlier reported by Nwinuka et al. (2005) on similar studies. Oxalate present in foods occurs as both soluble

Table 1. Anti-nutrient composition of *A. cepa*.

Antinutrients	Composition
Hydocyanic acid	8.64±0.05
Total oxalate	70.40±0.01
Soluble oxalate	44.00±0.02
Phytic acid	34.20±0.01
Cyanogenic glycoside	51.32±0.03

Values presented in mg/100 g.

Table 2. Mineral analysis of *A. cepa*.

Minerals	Composition
Sodium	16.15±0.05
Potassium	185.05±0.05
Phosphorus	19.24±0.07
Calcium	375.15±0.12
Iron	2.60±0.01
Magnesium	232.05±0.06
Manganese	213.65±0.07

values presented in mg/100 g.

and insoluble components. The soluble component is toxic to the body with a lethal dose of 200 to 500 mg/100 g (Eka, 1997). Values obtained from Table 1 (70.40 mg/ 100 g) showed that onions oxalate level is not toxic to the body because the toxic level (2 to 5 g) is reported by Nwinuka et al. (2005). Therefore, even though oxalates is capable of chelating with bivalent metal ions like Mn^{2+}, Ca^{2+} Mg^{2+} and Fe^{2+} and that some may even precipitates in kidney tubules resulting in oxaluria (Eka, 1997), the level in onions showed it won't cause such effects. The value when compared with that obtained by Nwinuka et al. (2005) as 0.03 g/ 100 g proved to be a good source of adjunct food due to its low level of oxalate.

A. cepa had a lower phytic acid content, therefore, its role in hindering absorption and utilization of certain mineral elements in human and animal bodies (Eka, 1997) will be minimal when consuming a diet rich in onions. The anti-nutrient, tannin is noted for its role in inhibiting the activity of some enzymes such as trypsin, chymotrypsin and amylase by forming complexes with the protein (Eka, 1997). According to Table 2, tannin content in onions was low; hence, the tendency of inhibiting these digestive enzymes will be low on consumption of diets garnished with onions. Moreover, the value was even lower when compared to 0.01 g/ 100 g (Nwinuka et al., 2005). The inorganic mineral analysis of *A. cepa* bulb showed that, it contained minerals in the following order: Calcium > Magnesium > Manganese > Potassium> Phosphorus > Soidum> Iron.

Ca^{2+} is needed for growth and maintenance of bones, teeth and muscles. The Ca^{2+} content of onion bulb (Table 2) was high when compared with the Ca^{2+} content of 3.05 mg/100 g of *Diospyros mesipiliformis* (Hassan et al., 2004) and 313.30 mg/100 g in *Mucuna flagellipes* (Ihedioha and Okoye, 2011). It implies that onion can contribute a meaningful amount to dietary Ca^{2+} to enhance structural function, energy provision, osmotic regulation and, catalytic functions (Hanounes, 2001; Hermanson et al., 2002). Onion bulb provided higher Mg^{2+} level (Table 2) when compared with 2.56 mg/100 g in *D. mespiliformis* (Hassan et al., 2004), 112.73 mg/100 g in *M. flagellipes* (Ihedioha and Okoye, 2011). Magnesium is noted for its roles in chlorophyll formation, germination, amino acid and carbohydrate synthesis in plants as well as forming part of soft tissues, bones and essential components of many enzymes involved in energy transfer in animals. Hence, onion is a good dietary source of Mg^{2+}. Mn^{2+} is a cofactor of enzyme systems involved in energy transfer such as co-enzyme A. It is important for normal functioning of the nervous system, and also plays a part in bone formation (Mc Donald et al., 1995). Table 2 shows that manganese content in onions bulb is higher than 5.82 mg/100 g in *Launeaea taraxacifolia* leaves (Adinortey et al., 2012), 0.3 mg/100 g in lettuce and 0.2 mg/100 g in cabbage (Turan et al., 2003).

K^+ is the principal cation in the intracellular fluid; it functions by influencing acid-base balance, osmotic pressure including water retention, contraction of smooth, skeletal and cardiac muscles (Greeves and Holmes, 1999). The potassium content in this study (Table 2) was found to be higher than 6.42 mg/100 g found in *D. Mespiliformis* and 42.74 mg/100 g in *M. flagellipes* (Ihedioha and Okoye, 2011). Nevertheless, the value was lower when compared with 300 to 600 mg/100 g as the daily requirement of potassium by a healthy adult. Hence, onion bulb has low content of potassium ions. P^- is noted for playing structural roles in building up bones and teeth (Lehninger, 1987). The recommended daily allowance for phosphorus is in the range of 400 to1200 mg/100 g which is very high (NRC, 2001) in comparison to the phosphorus content (Table 2) of the present study. It showed that onion bulb is not rich in phosphorus content. More over, the value in this study was seen to be higher when compared to 1.0 mg/100 g in *D.s mespiliformis* and 5.72 mg/100 g in *M. flagellipes* (Ihedioha and Okoye, 2011). Also, Nieman et al. (1992) considered a food as good source if the Ca/P ratio is above 1 and poor if the ratio is less than 0.5. Onion bulb which had a Ca/P ratio as 19.50 is therefore a good source of Ca and P needed in maintenance of bones, teeth and muscles (Turan et al., 2003).

The Na^+ content of onion bulbs (Table 2) was high when compared to 5.00 mg/100 g in *Tribus terrestris* leaves (Hassan et al., 2005) and 3.29 mg/100 g in *M. flagellipes* (Ihedioha and Okoye, 2011). The recommended dietary allowance (RDA) for Na^+ is 500 mg which means that onion bulb can provide 3.23% of RDA of an adult. Na^+ and K^+ are important in our diets due to

their role in blood pressure regulation (Yoshimura et al., 1991). Na^+/K^+ ratio of less than one in our diet is recommended, hence, onion bulb with Na^+/K^+ ratio as 0.09 is good, and therefore, adequate use of the spice in the diets of hypertensive patients could help in blood pressure control.

The RDA value for Fe^{2+} is 10 to 15 mg (Nieman et al., 1992). From Table 2, Fe^{2+} content of onions bulb was seen to be lower when compared with the RDA value. More over, the value was higher when compared with 1.6 mg/100 mg in spinach, 0.7 mg/100 g in lettuce and 0.3 mg/100 g in cabbage (NRC, 2001). Therefore, onion bulb can provide about 17.3 to 26.0 % of Iron to the RDA thereby helping in boosting the blood level especially in anemic conditions.

Conclusion

The results of this study have revealed that *A. cepa* bulb contain some anti-nutrients which do not pose any toxicity on consumption because of their low concentrations. It also showed the rich mineral composition of this spice which can be recommended for patients in diseased conditions like ricket, osteomalacia and hypertension.

Conflicts of interest

The authors declare that they have no conflicts of interest.

REFERENCES

Adinortey MB, Sarfo JK, Quayson ET, Weremfo A, Adinortey CA, Ekloh W, Ocran J (2012). Phytochemical screening, proximate and mineral composition of *Launaea taraxacifolia* leaves. Res. J. Med. Plant 6(2):171-179.

Allen G, Deitz VR (1953). Determination of phosphate by differential spectrophotometer. Analytical Chem. 25:1320-1324.

AOAC (1990). Official methods of analysisl, 15th edition. Association of official analytical chemist, Washington D.C. U.S.A. Pp. 359 - 362.

Arochena L, Gámez C, del Pozo V, Fernández-Nieto M (2012). Cutaneous allergy at the supermarket. J. Investigational Allergol. Clin. Immunol. 22(6):441–442.

Eka OU (1997). Studies on the levels of oxalic acid, phytic acid in traditional foods of Northern Nigeria. W.A.J. Biol. Chem. 20:24-30.

Greeves MA, Holmes KC (1999). Structural mechanism of muscle contraction. Ann. Rev. Biochem. 68:728.

Habtamu FG, Negussie R (2014). Antinutritional factors in plant foods: potential health benefits and adverse effects. Int. J. Nutr. Food Sci. 3(4):284-289.

Hassan LG, Umar KJ, Usman A (2005). Nutrient content of the leaves of *Tribulus terrestri* (Tsida). J. Trop. Biosci. 5:77-82.

Hassan LG, Abdulrahaman D, Zuru AA (2004). Nutritional and phytochemical investigation of *Diospyros mespiliformis* (L). Nig. J. Basic Appl. Sci. 13:1-8.

Hanounes DN (2001). Regulation and role of adenylcyclase isoforms. Ann. Rev. Pharmacol. Toxicol. 145:45-60.

Hermanson O, Glass CK, Rosenfield MG (2002). Nuclear receptor co-regulation: multiple modes of receptor modification. Trend Endocrinol. Metabol. 13:55-56.

Ihedioha JN, Okoye COB (2011). Nutritional evaluation of *Mucuna flagellipes* leaves: An underutilized legume in Eastern Nigeria. Am. J. Plant Nutr. Fertil. Technol. 1:55-63.

Lehninger A (1987). Principles of Biochemistry. Worth publisher, New York Inc., Pp. 753-759.

Lippard SJ, Jeremy MB (1994). Principles of Bioinorganic Chemistry. Mill Valley, CA: University Science Books. P. 411.

Mc Donald P, Edwards RA, Greenhalgh JFD, Morgan CA (1995). Animal nutrition, 5th edition. Longman Singapore publishers (PVT) limited, Singapore. P. 129-135.

Michael AJ, Smith BA (2005). Antioxidant activities of onions. J. Agric. Food Chem. 21:345-360.

Natural Research Council (NRC) (2001). Recommended daily dietary allowance, U.S.A. Nutritional Rev. 3:374-395.

Nieman DC, Butterworth DE, Nieman CN (1992). Nutrition. WMC Brown publisher, Dubugue. P. 50.

Nwinuka NM, Ibeh GO, Ekeke GI (2005). Proximate composition and levels of some toxicants in four commonly consumed spices. J. Appl. Sci. Environ. Manage. 9(1):150-155.

Pamplona R, George D (1999). Encyclopedia of medicinal plant. Education and Health Library Publishers 1:151-153.

Turan MS, kordali H, zengin A, Dursun A, Sezen Y (2003). Macro and micro mineral content of some wild edible leaves consumed in Eastern Anatolia. Acta Agric. Scand. 53:129-137.

Ugwu FM, Oranye NA (2006). Effects of some processing methods on the toxic components of African breadfruit (Treculia qfricana). Afr. J. Biotechnol. 5:2329-2333.

Williamson G, Plumb GW, Uda Y, Price KR, Rhodes MJ (1997). Dietary quercetin glycosides: antioxidant activity and induction of the anticarcinogenic phase II marker enzyme quinone reductase in Hepalclc7 cells. Carcinogenesis 17(11):2385–2387

Wissman MA (1994). Anemia caused by onions. Anemia in primates. Retrieved 2013-04-01.

Yang J, Meyers KJ, VanDer HJ, Liu RH (2004). Varietal Differences in phenolic content and antioxidant and antiproliferative activities of onions. J. Agric. Food Chem. 52(22):6787-6793.

Yoshimura M, Takahashi H, Nakanishi T (1991). Role of sodium, potassium, calcium, magnesium on blood pressure regulation: an antihypertensive dietary therapy. Japan J. Nutr. 49:53-62.