



Mineral Contents of (*Allium cepa*) Red and White Onions Grown around Gashu'a Fadama Area

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Abstract

*Onion bulbs (*Allium cepa*) have found wide applications either fresh or powdery dry in virtually all meals in this part of Nigeria. Others reported significant findings on its medicinal values. This work aims at estimating the concentrations of mineral nutrients present in onion bulbs. Standard procedures were used for the analysis. Mineral elements were determined using flame photometer and atomic absorption spectrophotometers. Mineral nutrients assessed includes: Calcium, Iron, Magnesium, Phosphorus and others. The study revealed the following nutrients: $Zn < P < Fe < Na < Ca < Mg < K$ in an increasing order of presence. Comparison of cultivars indicates red onion bulb is superior in **K, Fe, Mg, Zn and P** contents while white onion bulb has higher contents of **Na and Ca**. The ash and moisture contents are in the range of 0.825 ± 0.06 -- $1.06 \pm 0.02\%$, and 82.11 ± 0.16 -- $83.10 \pm 0.40\%$ for red and white onion bulbs respectively. Concentrations of calcium in onion bulbs are higher than phosphorus. *Allium cepa* species with a **Ca/P** ratio > 10.01 is a good source of calcium and phosphorus. Mineral profile of onion bulbs obtained is a good data on *Allium cepa* species. The result suggests that, Onion bulbs of both cultivars are rich in minerals that are essential for healthy growth.*

Keywords: *Allium cepa*; onion bulb; mineral content; calcium/phosphorus ratio; cultivar.

1.0 INTRODUCTION

Vegetables are edible parts of plant that are consumed wholly or in parts, raw or cooked as part of main dish or salad. These include fruit, seed, root, leaf, flower, bark, stem, bulb or tuber. Vegetables can serve as a source of minerals, vitamins and carbohydrates depending on the type consumed (Uzo, 1989). *Allium cepa* commonly known as onions have been cultivated since ancient Egyptian times as vegetable due to its characteristic flavor and widespread use as a flavouring agent in food and for the treatment of diseases as reported elsewhere (Olujobi, 2015). *Allium cepa* belongs to the Genus *Allium* and

family of Liliaceae. Onions have found wide application when fresh or dried. It is used as a flavor additive in a wide variety of food formulations such as soups, salad dressings, sauces, comminuted meats, and pickle relishes (Kumar *et al.*, 2006). Onion has been used by various cultural groups for the treatment of bacterial, fungal as well as viral infections with numerous investigations suggesting sulphur compounds as responsible for the antimicrobial activity. Other compounds that could contribute to the activity include some phenolic compounds, proteins and saponins. Combination of essential oils of onion and garlic were used to substitute

synthetic preservatives in food safety to control mycotoxin production and fungal contamination. Onion was reported to have promoting influence on the bio-accessibility of iron and zinc from food grains (Gautam *et al.*, 2010).

Onions are reported to have antioxidant abilities which could arrest free radicals that cause gastric ulcer. There are considerable differences between different varieties in potential antioxidant content. They are reported to have antihypertensive and anticonvulsant property (Michael and Smith, 2005). Most onions contain vitamin C, vitamin B₆, folic acid and numerous other nutrients in small quantities, but are low in fats and sodium and can contribute their flavor to savory dishes without raising caloric content. Considerable differences were observed between different varieties in potential antioxidant content. Sometimes people experience allergic reactions after coming into contact with onions, and the aftermath of that include itching of the skin, blurred vision, rhino conjunctivitis, sweating, as well as bronchial asthma as reported elsewhere (Edet *et al.*, 2015). However, the allergic reaction might not be experienced by these people due to the consumption of onions possibly because of denaturing the proteins involved during the cooking process (Arochena *et al.*, 2012). Onions could be deadly when consumed by animals like monkeys, dogs, cats etc. This happened due to the presence of toxic compounds of sulfoxides in raw and cooked onions which many animals could not

digest. Therefore, sick pets that are sometimes fed with tinned baby foods should be carefully examined to avoid anything that contains onions (Kovic-Tanackov *et al.*, 2012).

Minerals or chemical elements which are inorganic elements that are essential to nutrition or dietary requirements, are usually needed in small amounts from less than 1 to 2500mg/day; depending on the nutrient concerned. The dietary balance requires chemical elements that could support the biochemical reactions of metabolism with the desired elemental components. Proper intake amounts of certain chemical elements have been reported to be required to maintain optimal health. Some of the mineral elements of much biological significance among others are: Fe, Na, K, Ca, Mg, and P (Fasuyi, 2006 and Edet *et al.*, 2015). *Allium cepa* (Red/White onion) bulb or leaf is eaten raw or cooked as part of daily meal. It's known to serve as seasoning agent or odour remover in fried/cooked meals (meat or fish in particular). On the other hand, onion leaf is often cooked and served with other leafy vegetables (Roselle/Alaiyafo) as soup. Though as essential and commonly significant as onion might be in this part of Nigeria; little is known about the nutritional value and mineral content evaluation. Whether as soup, sauce or edible vegetable; onion requires complete nutritional analysis for data generation. This study intends to determine the mineral profile of two *Allium cepa* cultivars (red/white onion bulbs) grown in Gashu'a Fadama farms.

2.0 MATERIALS AND METHODS

2.1 The Study Area

Gashu'a Fadama land is located along river Yobe in Yobe state. Fadama are low laying lands subject to seasonal floods or water logging along banks of streams or depressions. Fadama irrigation farming is practiced in the area of study. Gashu'a town is located between Latitude 12.5° and 13.0° North of the Equator and Longitude 12.3° and 13.1° East of the Greenwich meridian, at altitude 299m above Sea level. The annual rainfall ranges between 500—1000mm between the months of June to October with eight (8) months of dry season. The hottest period in the area is early March to late June with temperature range of 38—40°C.

2.2 Sample Collection and Treatment

The onion bulbs used for the study were harvested fresh (collected directly) from the farmers at the

farm sites of the Fadama farms along river Yobe at Gashu'a. 50 grams of fresh red and white onion bulb samples were collected with no regard to size or shape, placed in prewashed, dried and labeled polythene bags immediately after collection and transported to the laboratory for subsequent analysis. They were cleaned with distilled water to remove sand particles and other foreign material then subjected to air-drying at ambient temperature for 6 hours. The samples obtained after drying were separated into two portions. One portion was sliced into many replicates using a sharp stainless steel knife. This was dried in an oven in the laboratory at 50°C for 8 hours. The dried slices were grounded using an electric blender. The powdered samples of each onion bulb (red/white) was sieved through a mesh of 100mm and stored in an air tight covered plastic containers as stock

sample then kept in a refrigerator until used for analyses. The other portion i.e. fresh onion bulbs were used for the determination of moisture contents, while ash content and elemental analysis (mineral profile) were carried out on the dry-milled samples.

2.3 Determination of Mineral Elements

Wet digestion of samples was carried out in a fume chamber to avoid the dangerous acid fumes evolved. Acid digestion of each grounded onion bulb sample (2.0g) was done using solution of Nitric acid and Perchloric acid (50/50) mixture in a digestion block at 180°C. Heating was continued as the liquid dried off, additional nitric/perchloric solution mixture was added till the content was heated to dryness. This was repeated until the reddish brown fumes were no longer observed and the solution was clear, and then heated to dryness. The ash obtained was dissolved in 1ml conc. HCl and 5ml of Nitric acid, mixed and kept in a plastic bottle for analysis. The samples ash solutions were analyzed for mineral elements using Atomic

Absorption Spectrophotometer (AAS Model 210VGP), whereas potassium and sodium contents were determined by flame photometry and phosphorus was determined by the ammonium molybdo-vanadate method (AOAC,1995). Concentration of each element in the samples solutions was determined by reference to a calibration curve.

2.4 Other Properties

Ash and Moisture contents were analyzed according to the procedures reported by AOAC (2000). Moisture was determined by taking 2.0g of each fresh onion bulb sample in duplicate and weighed, and then samples were dried to a constant weight (at least 8 h) at 105°C in an air-oven method in carefully labeled moisture dishes using the method reported by (Oils & Fats, 2012). Ash content of each onion bulb sample was determined by incinerating 2.0g sample in a porcelain dish in a muffle furnace (6000P.C./1200/E/R. Pyrometer) at 600°C for 6 h, until the charred sample turned to white color.

3.0 RESULTS AND DISCUSSION

Table 1 depicts the mineral profile of *Allium cepa* species (red/white). The two cultivars are outstanding sources of potassium, magnesium and calcium and good sources of sodium, iron and phosphorus. The least amongst the elements analyzed in this study was zinc. The amounts of the mineral elements ranged between 932.24—1072.5, 610.9—810.1, 423.5—475.5, 168.1--268.3,79.8--108.5,46.9--92.15 and 28.3--36.6 mg/kg, respectively. Generally, red onion bulb contained higher concentrations of potassium, iron,

magnesium, phosphorus and zinc, while white onion bulb has higher values of sodium and calcium minerals (Table 1). Minerals are very important in human diets. Calcium and potassium are reported as responsible for the repair of worn out cells, building of strong bones, muscles and teeth as well as red blood cells and for body mechanisms (WHO, 1996). Potassium is reported to be good for pregnant women especially at the time of delivery.

Table 1: Mineral contents of *Allium cepa* species (mg/kg).

Elemental composition/Other parameters	Red onion	White onion
Ash content (%)	1.06±0.02	0.825±0.06
Moisture content (%)	82.11±0.16	83.10±0.40
Potassium (K)	1072.5±1.25	932.24±1.60
Iron (Fe)	108.5±1.80	79.82±0.77
Sodium (Na)	168.1±2.20	268.28±2.10
Magnesium (Mg)	810.12±4.20	610.95±1.15
Zinc (Zn)	36.55±0.01	28.30±0.18
Calcium (Ca)	423.52±2.10	475.53±3.24
Phosphorus (P)	92.15±4.65	46.95±0.99

Values are mean ±SD triplicate analysis of sample.

Potassium is the major cation in intracellular fluid which functions by regulating the acid-base balance, osmotic pressure and contraction of smooth skeletal and cardiac muscles (Edet *et al.*, 2015). Calcium and potassium concentrations in *Allium cepa* species observed in this study are higher than those reported by Hassan *et al.*, (2004) for *Diospyros mespiliformis* (3.05mg/100g) and for *Allium cepa* 375.15, 185.05mg/100g for Ca and K respectively as reported elsewhere (Cota *et al.*, 2013).

Sodium is an essential element necessary for humans to maintain the balance of physical fluids system. White onion bulb has higher value of sodium (268.28±2.10mg/kg) compared to 168.1±2.2mg/kg in red onion bulb. The values obtained in this study are higher when compared 16.15mg/g reported elsewhere (Edet *et al.*, 2015). However, the recommended dietary intake/allowance (RDA) for Na is 500mg/day. This suggests that onion bulb can only provide about one-half of RDA for an adult. Sodium and potassium are vital in daily diets due to their role in blood pressure regulation (Musah *et al.*, 2014).

Andreini *et al.*, (2008) reported that, some trace metals including iron, magnesium, manganese and zinc are essential elements for life through their function as both structural and catalytic cofactors for proteins. Zinc supplements for children within the age bracket of three months to five years reduce both the frequency and severity of diarrhea and respiratory illness (Akinwande & Olatunde,

2015). The result showed very low concentration values for zinc and iron. This suggests that, *Allium cepa* would not be a good source of the two. The bioavailability of these minerals i.e. iron and zinc in *Allium cepa* may be low due to high concentration of dietary inhibitors such as fiber and tannins (UNICEF, 1998). Iron on the other hand is a constituent of many proteins in the body. It plays a vital role in numerous metabolic processes where it reacts with haemoglobin to form oxyhaemoglobin that is required for red blood cells formation (Musah *et al.*, 2014). Magnesium plays important role in chlorophyll formation and carbohydrate synthesis in plants as well as being part of soft tissues and essential components of some enzymes involved in energy mobilization in animals. Both red and white onions used for this study are excellent dietary source of magnesium (Edet *et al.*, 2015). Values obtained for iron and magnesium in *Allium cepa* species in this study (Table 1) are higher than values reported by Edet *et al.*, (2015).

Phosphorus content is higher in red onion bulb (92.15±4.65mg/kg) when compared to that in white onion bulb (46.95±0.99mg/kg). The main function of phosphorus in human body is in the formation of bones and teeth. It is also needed in the body for the utilization of carbohydrates and fats and in the synthesis of protein for growth, maintenance and repair of cells and tissues (Shuaib *et al.*, 2015). The daily recommended amount for phosphorus ranged between 400 to 1200mg/100g as reported by Edet

et al., (2015), which turned out to be very high when compared to phosphorus content obtained for the present research. The values recorded in this study might be very low compared to RDA for phosphorus, yet they are higher compared to values reported for *Allium cepa*, 19.24 ± 0.07 (Edet *et al.*, 2015). This showed that onion bulbs could supplement phosphorus need to about 23.04% of the daily recommended amount. The concentrations of calcium in *Allium cepa* species are higher than that of phosphorus. This observation favors higher calcium to phosphorus ratio which is an important factor to consider in the absorption of these two minerals especially in view of their interaction through competitive absorption. *Allium cepa* with a Ca/P ratio of more than 10.01 is

4.0 CONCLUSION

The results of this study indicate that *Allium cepa* species (red/white onion bulbs) contained appreciable amount of mineral elements (calcium, potassium, magnesium and iron) analyzed. Frequent intake of the species could contribute substantial amounts of these minerals to the dietary needs of human body.

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an excellent source of calcium and phosphorus required for the maintenance of bones, teeth and muscles (Turan *et al.*, 2003).

Allium cepa species are high moisture foods with the moisture contents ranging from 82.11 to 83.10 per cent from red to white onion bulbs respectively as depicted in Table 1. These values are less than 87.33% reported elsewhere (Akinwande & Olatunde, 2015).

The ash contents of red onion bulb ($1.06 \pm 0.02\%$) are higher compared to white onion bulb ($0.825 \pm 0.06\%$) and both are relatively low. This indicates that, total mineral contents are high in the red than the white specie; since ash content of a plant material is an index of total mineral content (Musa and Itodo, 2010).

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