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Abstract

The determination of some essential metals such as sodium, potassium, calcium, manganese, zinc and copper content of banana (*Musa sapientum),* guava (*Psidium guajava*), mango (*Mangifera indica)* and water melon (*Cucumis melon*) edible fruits as obtained from some towns in Nigeria and Niger Republic has been carried out. The analyses for sodium and potassium contents were done using the flame emission method while atomic absorption spectrophotometric method was used in the analysis of the remaining metals. The results showed that guava and banana contain the highest levels of sodium, potassium and calcium while mango had the least amount of these metals. It was also observed that guava contain the highest amount of zinc, and thus provides highest nutritional value in comparison with the other fruits. The levels of manganese and copper were found to be low when compared to the other metals while there are observable differences in the average metal levels in the watermelon sourced from Niger Republic and those from Hadejia, Nigeria.

Keywords: Essential metals, Nigeria, Niger Republic, Nutritional value

Introduction

Fruits have been used worldwide for decades as herbal medicines with therapeutic and nutritional values. Studies (Block et al., 1992; Hoe and Siong, 1999) have shown that consumption of adequate quantity of fruits may have disease preventive properties. Fruits consumption has also been reported to be beneficial to health as this contribute to the prevention of degenerative processes, particularly lowering the incidence and mortality rate of cancer and cardio and cerebral vascular diseases (Rapidsararda et al., 1999). Furthermore, fruits, either fresh or processed, form an important part of the daily diets, and the demand for varieties of fruits has continued to increase in all affluent societies of the world (Anon, 2001). Advances in fruits processing technology, transportation, storage and distribution have made it possible for consumers to enjoy these products all year round and at different locations. Most of the fruits grown in the tropics are under utilized as a result of some economic, climate and biological factors (Annual index of fruits, 2006). To meet the changing demands of the consumers, processors are also using more fruits as value added ingredients as fruit concentrates, pulps, candies etc. in their formulations. Fruits are usually considered as healthy food supplements since they contain high levels of water, carbohydrates, proteins, fiber, vitamins A, B1, B2, C, D and E and minerals such as Ca, Mg, K, Zn and Fe (Wenkam, 1990; Okwu and Emenike, 2006).

In addition to ascorbates, vitamin E and carotenes most of the other phytochemicals present in fruits act as antioxidants that reduce

the oxidative damage caused to lipids, proteins, nucleic acid and other cellular target organs by reactive oxygen species in the body. (Blumberg and Cappelland, 2002).

The idea of well-balanced diet changed in recent years as more vegetable and fruit are advised to be consumed (Ames and Gold, 1996; Dazzano, 2002; Gilman, 1995). Food sources rich in calcium (Ca), magnesium (Mg) and potassium (K) are of special interest in the world as most of these nutrient requirement can be met by increasing the consumption of fruits about 5-13 servings per day (Gilman, 1995).

Less than 1% of total body calcium is needed to support vascular contraction and vasodilatation muscle function and hormonal secretion (Nevo, 1996). Inadequate intake of dietary calcium from food and supplements produce no obvious symptoms in the short term but if left untreated the deficiency can lead to death (Dawson- Hughes et al., 2009). Calcium has been associated with prevention of osteoporosis and has protective effects in colon cancer (Block, 1992). Potassium is a very important mineral for the proper function of all cells, tissues and organ in the human body and it is an electrolyte in the body along with sodium, chloride, calcium and magnesium (Charney, 2002). Zinc has been shown to be efficacious in the treatment of (childhood) malnutrition, peptic ulcer, leg ulcers, infertility, Wilson's disease, herpes and taste or smell disorder (Al-Maroof, 2006; Gilman 1995; Gibson, 1994).

This study is aimed at assessing the levels of sodium, potassium, calcium, zinc, manganese and copper in banana, guava, mango and water melon which are commonly eating fruits in Nigeria and Niger Republic. The study is expected to provide a guide to the consumers on the benefits of eating some fruits over others based on the body's nutritional requirements.

Materials and Methods

Sample collection

The fruits were purchased in triplicates twice in the year 2011 from various localities in Nigeria and Niger Republic. The fruits include bananas (from Bendel and Ikare in Nigeria, mango (from Zuba and Gboko in Nigeria, guava (from Katsina and Jos in Nigeria and watermelon (from Hadejia-Nigeria and Niger Republic).

Sample preparation

Fresh fruits were washed with water and then rinsed with deionised water. The edible portions of the individual fruits were separated, dried and oven dried at 105^0C overnight. The dried samples were allowed to cool to room temperature, powdered using mortar and pestle, placed in polythene bags and labeled.

Sample digestion/analysis

One gram (1.0g) of each of the powdered fruit sample was weighed in a crucible and placed in a furnace at 500^0C for 4 hours to enable complete ashing. The ash was allowed to cool to room temperature and dissolved in 5ml, 2M HCl and the solution was filtered into a 50ml volumetric flask using a whatman number 42 filter paper. The filtering unit was further rinsed with 10ml of deionised water and added to the original filtrate. The resulting solution was then made to the 100 ml mark with deionised water. The standard solutions were analyzed for the metals using AAS model 167N Whatman Buck scientific 2004.

Statistical Analyses

Results obtained were expressed as mean± SD (standard deviation) and statistically analyzed for significance in variations between sampling locations. The variations between sampling locations were analyzed by analysis of variance (ANOVA) using Microsoft Excel+Analyse-it v. 2.10 (Analyse-it®, 2007). Variations were considered significant at $p<0.05$.

Results and Discussion

Plots of the metal contents in the fruits from the various locations are as shown in Fig 1. From the results expressed in mg/100g, it was observed that potassium ranged from 98.55±0.78 – 186.29±0.20 and is the most abundant metal in the entire fruits sampled, though the levels are lower than literature

values for potassium in fruits which ranged from 158 to 396 (Cunningham et al. 2001; Nevo 1996). While copper was present in trace amounts. This is in contrast with the levels of sodium (22.62±0.75 – 39.29±0.98), calcium (3.67±0.06 – 41.32±0.74), zinc (5.45±0.12 – 11.59±0.02), manganese (0.41±0.02 – 1.29±0.05) and copper (0.05±0.01 – 0.34±0.06) which were averagely much higher than literature values (Cunningham et al., 2001; Nevo, 1996).

There are significant differences ($p<0.05$) in the concentrations of the metals level in each fruit as obtained from different localities for example; the concentration of potassium in banana (Ikare) was 148.87±0.01 while that of banana (Bendel) was 176.62±0.65. The observed differences in these concentrations are a good indication of environmental effects. Also, comparing the result obtained for watermelon from Niger Republic and those from Hadejia- Nigeria, it was observed that the levels of potassium, calcium, manganese, zinc and copper were higher in those from Niger Republic. The sodium levels in the watermelon from Hadejia Nigeria were higher than those from Niger republic. This might be due to the soils of the Hadejia area which contain more available sodium salts for plants. A complete graduation of the fruits based on the metal content show that;

Na- Guava > Mango > watermelon > banana**,**
K- Guava > Banana > watermelon > mango,
Ca- Banana > Guava > watermelon > Mango,
Mn- Banana > Guava > watermelon > mango,
Zn- Guava > Watermelon > Banana > Mango and
Cu- mango > Banana > Guava > watermelon.

From the result of these analyses, guava has the overall superiority because it has high nutritional value from the stand point of macro element such as sodium, potassium and calcium and micro element such as zinc.

Conclusion

Generally, there is no correlation between the sampling areas of the fruit and metal levels. These results though indicate superiority in the consumption of guava for improved nutritional health of individuals but when unavailable banana would serve as a good alternative.

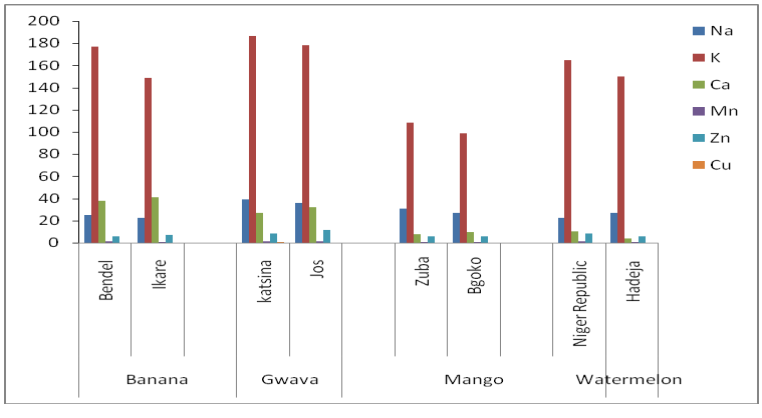

Figure-1 Metal Contents (mg/100g) in the fruits in relation to the locations of collection

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