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COMPARATIVE STUDY ON THE MINERALS COMPOSITION OF THE FLESH OF RED AND YELLOW FRUITS OF *TERMINALIA CATAPPA L.*

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ABSTRACT

The analyses of mineral composition of red and yellow fruits varieties of Terminalia catappa using standard analytical apparatus, reagents and procedures gave the following results on dry weight basis: K (1980.20mg and 1809mg), Na (17.82mg and 17.33mg), Ca (143.47mg and 143.30mg), Mg (40.39mg and 48.50mg), P (13.20mg and 13.20mg), Fe (5.50mg and 3.98mg), Cu (0.25mg and 0.43mg), Mn (3.09mg and 1.02mg), S (70.50mg and 50.47mg) and Zn (1.28mg and 1.42mg) for red and yellow fruits respectively. On the other hand Cd, Cr, Co and Pb were not detected on both fruits which indicate that both fruits are safer for human consumption. Therefore, from these results it can be recommended that red and yellow fruits of T.catappa l. are good sources of K, Mg Mn, Na, Ca, Cu, Fe and S but poor sources of P and Zn.
Key words: composition, fruits, minerals, Terminal catappa.

INTRODUCTION

Food is any substance, usually composed of carbohydrates, fats, proteins and water, that can be eaten or drunk for nutrition (Aguilera and David, 1999).

Human beings require food to grow, reproduce and maintain good health. Without food, our bodies could not stay warm, build or repair tissues or maintain a heartbeat. Eating the right foods can help us avoid certain diseases or recover faster when illness occurs. These and other important functions are fueled by chemical substances in our food called nutrients (Worthington-Roberts, 2008).

The relevance of fruits and the need to introduce more plant food in order to bridge the gap of alarming food shortage in human nutrition have aroused attention of various researchers throughout the world especially Nigeria into evaluation of nutritional analysis of various plants and fruits (Al-Shahib and Marshall, 2003; Anhwange *et al*., 2004; Hassan *et al*., 2004; Amarteifio and Mosase, 2006; Nkafamiya *et al*., 2006; Dahiru *et al*., 2006; Umaru *et al*., 2007; Bello *et al*., 2008; Hassan *et al*., 2008; Rathore, 2009).

Despite the fact that fruits are widely consumed with no cultural inhibition and tend to be nutritious, there is lack of sufficient information on their nutritional status; thus became imperative to analyse the minerals content of these noble fruits and compare it with available literature results.

Terminalia catappa (Fig: 1) *is* a large tropical tree belonging to *Combretaceae* family. The tree's origin is controversial, and could have been India, Malay Peninsula, or New Guinea. Common names include Indian almond, Bengal almond, Singapore almond, Malabar almond, Tropical almond, Sea almond, and Umbrella tree (Almond, 2008). The Hausas call it l*ema*.

MATERIALS AND METHODS

Sampling and Sample Preparation

Freshly matured fruits were plucked from Guiwa low-cost and Rinjin Sambo in Sokoto metropolis. The fruits were transported to the laboratory in a poly ethene bag. Prior to analysis the flesh of the fruits were removed using sharp laboratory Stainless steel knife, sun dried, milled into fine powder using pestle and mortar, sieve through 20-mesh and stored in airtight poly ethene bag.

Procedure for Analysis

The mineral elements were analysed using Walinga *et al*., (1989). The mineral elements in the samples were brought into solution by wet digestion techniques. One gram of the dried sample was put into Kjeldahl digestion flasks to which 24cm^3 of a mixture of concentrated; HNO_3, H_2SO_4 and 60% $HClO_4$ (9:2:1 v/v) was added.

The mixture was then allowed to stand overnight to prevent excessive foaming. The flask was put on a heating block and digested to clear solution cooled and the content filtered into 50cm^3 volumetric flasks through No1 Whatman filter paper. 5cm^3 of lanthanum chloride heptahydrate ($LaCl_3.7H_2O$) was then added as releasing agent to overcome phosphate interference. The flask was then made-up to the volume with distilled water. Blank was prepared in similar manner without samples being added. Furthermore AAS and AES were used for the quantification of elements present through standard analytical procedures.

Statistical analysis
All analyses were carried out in triplicate and result expressed as mean $\pm$ standard deviation, paired t-test was used for mean separation at $p< 0.05$ confidence.

RESULTS AND DISCUSSION
Results of the various analyses were as presented in Table 1, from which the following observations were drawn:

The calcium concentrations are 143.47 and 143.30mg/100g of red and yellow fruits respectively. The values are lower compared to the values reported by Nwosu *et al*., (2008) using similar fruits. The values are also low compared to grape fruit pulp (722mg/100g), grape fruit peel(1165mg/100g), guava(1456mg/100g) and pawpaw (2964mg/100g) while lower calcium level of 16mg/100g, 88mg/100g, 93mg/100g of banana, apple and sweet orange (Olaofe and Akogun 1990; Onibun *et al*., 2007). Calcium help in regulation of nerve impulses transmittance, muscle contractions and help in bone formation (Bello *et al*., 2008). In comparison with recommended dietary allowance (RDA) for adult (NRC, 1989), l00g each of red and yellow fruits could provide the daily body calcium requirement of 11.96 and 11.94% respectively. This shows that these fruit parts could be a better supplement than other calcium sources even better compared to some conventional fruits.

The phosphorus concentration for both fruits is 13.2mg/100g; which is lower when compared with other values reported by Amarteifio and Mosase (2006) for banana (40mg/100g), sweet orange (23mg/100g) and ripe pawpaw (74mg/100g). This is an indication that; the fruits are not good sources of phosphorus particularly when compared to its RDA value (800mg/day).

Magnesium content of red and yellow *T. catappa L.* is 40.39 and 48.50mg/100g respectively. Comparatively, the values obtained are much lower than those reported by Nwosu *et al*. (2008) using similar fruit, also other fruits reported lower values of 2.56mg/100g, 400mg/100g, 7mg/100g and 10mg/100g for monkey guava, sugar apple, grape and orange respectively (Hassan *et al*., 2004; Amarteifio and Mosase, 2006; Hassan *et al*., 2008). Since the magnesium RDA is 350mg (NRC, 1989) so l00g of red and yellow fruits could provide the daily body magnesium requirement of 11.54 and 13.86% respectively.

The sodium content of red and yellow fruits is 17.82 and 17.33mg/100g respectively. The results compare favourably to other conventional fruits; like 13mg/100g and 21.7mg/100g for marula and monkey orange respectively while lower values of 1mg/100g, 3mg/100g and 2.08mg/100g for banana, orange and monkey guava respectively (Kirk and Sawyer, 1991; Hassan *et al*., 2004). The result shows that *T. catappa* fruits have low sodium content which is a characteristic of food of vegetable origin that earns the sample a good food for hypertensive patients (Umar, 2005).

Potassium was the most abundant mineral in all the samples (1980.20mg/100g for red and 1806.93mg/100g for yellow fruits). High values could be due to high uptake of Potassium by the plant from the soil, whose parent materials are believed to contain more Ca and K (Yusuf and Yusuf, 2008). These values are higher compared with other results on conventional fruits for orange (152mg/100g), pineapple pulp (213mg/100g), banana (39.86mg/100g), apple (11.44mg/100g) and guava (0.09mg/100g) (Olaofe and Akogun 1990; Onibun *et al*., 2007) while in comparison with recommended dietary allowance (RDA) for adult (NRC, 1989), l00g each of red and yellow fruits could provide the daily body potassium requirement of 99 and 90.34% respectively. This shows that these fruit parts could be a better source of potassium than some conventional fruits.

Zinc content of red and yellow fruits is 1.28 and 1.42mg/100g respectively. Comparatively Nwosu *et al*. (2008) reported lower value of 0.62mg/100g and 0.45mg/100g of *T. catappa* and *H. thebaica* respectively. The NRC (1989) set the recommended dietary allowance of zinc for adults to be 12-15mg, thus, the mean contribution to the dietary allowance from red and yellow are 8.53-10.67 and 9.47-11.83% respectively.

Iron contents in red and yellow fruits are 5.50 and 3.98mg/100g respectively. This shows that; red fruits contain the highest amount of iron than yellow samples. In comparison with other research; lower amount of iron are reported for 0.08mg/100g, 0.52mg/100g, 13.04mg/100g, 0.28mg/100g, and 2.40mg/100g monkey guava, banana, apple, guava and sweet orange respectively (Hassan *et al*., 2004; Onibun *et al*., 2007).The mean contributions of these samples to dietary allowance of iron for adult men when compared to 10-15mg range of NRC (1989) is 36.67-55.00% and 26.53-39.80% for red and yellow fruits respectively.

The concentration of manganese in red and yellow fruits was 3.09mg/100g and 1.02mg/100g respectively which are higher compared with 0.01mg/100g, 0.35mg/100g and 0.21mg/100g *Diospyros mesliformis*, *Cassipourea congoenis* and *Nuclea latifolia* respectively (Hassan *et al*., 2004; Onibun *et al*., 2007). When compared with 2-5mg set as recommended dietary allowance, NRC (1989), the contribution made by these samples are within the range of 61.80-154.50% and 20.40-51.00% for red and yellow fruits respectively.

Manganese supports the immune system, regulates blood sugar levels, works with vitamin K to support blood clotting and is involved in the production of energy and cell reproduction (Bello *et al*., 2008). Moreover, manganese also works with the B-complex vitamins, helps to control the effects of stress and possibly result in birth defects by pregnant women due to shortage of manganese (Anhwange *et al*., 2004).

Copper concentration of the red and yellow *T.catappa* fruits had 0.25 and 0.43mg/100g respectively. These values are comparable with 0.01mg/100g, 0.25mg/100g and 0.15mg/100g *Diospyros mesliformis*, *Cassipourea congoenis* and *Nuclea latifolia* respectively (Hassan *et al*., 2004; Onibun *et al*., 2007). These values indicate that; the sample posses 8.33-16.67 and 28.67-14.33% of the recommended dietary allowance of 1.5-3mg (NRC, 1989), respectively. Deficiencies of copper have been reported to cause cardiovascular disorders as well as anaemia and disorders of the bone and nervous systems (Mielcarz *et al.*, 1997).
The sulphur content of red and yellow fruits is 70.50 and 50.47mg/100g respectively.

In all the samples, cadmium, chromium, cobalt and lead are not detected in both samples by AAS. This is in agreement with some Nigerian fruits reported by Bello *et al*. (2008). Non detection of this element particularly Cd, Pb and Cr make the fruits safer as these metals have detrimental effects to the body when ingested.

Table 1: Mineral composition of *T.catappa* fruits (mg/100g dry weight)

Element	Red Fruits	Yellow Fruits
Ca	143.47±6.08	143.30±6.63
P	13.20±0.03	13.20±0.06
Mg	40.39±5.19	48.50±.88
Na	17.82±0.25	17.33±0.50
K	1980.20±49.50	1806.93±24.75
Cu	0.25±0.02	0.43±0.10
Fe	5.50±0.78	3.98±0.50
Zn	1.28±0.13	1.42±0.12
Mn	3.09±4.06	1.02±0.98
S	70.50±0.20^{a}	50.47±0.32^{b}
Cd	ND	ND
Cr	ND	ND
Co	ND	ND
Pb	ND	ND

ND = Not Detected
*The data are mean value ± standard deviation of triplicates result.
** Values within the same row with different superscript a,b are significantly different ($p<0.05$).

CONCLUSION

In Nigeria, wild fruits are consumed by both rural and urban dwellers especially during dry season when most cultivated fruits are scarce. Among these fruits are the red and yellow varieties of *Terminalia catappa* whose minerals compositions were investigated and revealed that, both fruits have similar content of mineral elements except for Potassium and Sulphur which are both higher in red compared with its yellow counterpart. Conclusively, these fruits are good sources of K, Mg, Mn, Na, Ca, Cu, Fe and S but poor sources of P and Zn. So based on these findings, it is necessary for this work to recommend continues use of the fruits from all ages so as to meet up the body nutrient demand. Though minerals analysis alone should not be the sole criteria for judging the nutritional importance of a plant parts; thus, it becomes necessary to consider other aspects such as presence of antinutritional and toxicological factors and biological evaluation of nutrients content. Study on antinutritional factors and bioavailability of this fruit is on progress.

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