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COMPARATIVE STUDY ON THE PROXIMATE CONTENT OF THE FLESH OF RED AND YELLOW FRUITS OF *TERMINALIA CATAPPA L.*

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ABSTRACT

The flesh of two fruits were analysed and compared for their proximate compositions on dry weight basis, the red fruits have the following proximate composition: ash content (7.83±0.76%): crude protein (3.92±0.08%): crude fibre (8.67±0.29%): crude lipid (1.33±0.29%): and available carbohydrate (78.31± 1.14%) with high energy value (1447.19 KJ per 100g). The moisture content (71.33±6.90) was high. while for the yellow sample are: ash content (8.33 ±0.76%): crude protein (10.01±0.43%): crude fibre (15.83±0.29%): crude lipid (0.67±0.29%): and available carbohydrate (64.90± 0.69%) with high energy value (1295.13 KJ per 100g). The moisture content (84.00± 2.00%): the result showed moisture, crude protein and crude fibre are significantly (p<0.05) higher in yellow compared to red variety. On the other hand crude lipid, available carbohydrate and calorific value were significantly (p<0.05) higher in the red variety. Ash content however, showed no significant (p>0.05) variation between the two varieties.

Key words: *proximate composition, crude lipid, available carbohydrate, crude protein.*

INTRODUCTION

Terminalia catappa is a tropical tree belonging to *Combretaceae* family, its origin is controversial, and could have been India, Malay Peninsula, or New Guinea (Almond, 2008). 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. T. catappa* is a medium sized tree whose branches form layers of canopy and its large leaves (15-25cm long and 10-14cm broad) are reported to have medicinal values (Lin *et al.*, 1999; Chen *et al.*, 2000). The large (2-3 inches) fruits is edible, fleshy, green (unripe) and yellow or red (when ripe) with thin exocarp and hard endocarp which when cracked an edible kernel is obtained. The kernel is reported to have aphrodisiac activity that may be useful in the treatment of certain form of sexual inadequacies such as premature ejaculation (Ratnasooriya and Dharmasiri, 2000).

T. catappa leaves is claimed to have therapeutic effects for liver related diseases (Tin and Kan, 1990). Traditionally, only fallen leaves of *T. catappa* are used and brewed in water as a drink for the treatment of liver diseases while young leaves are used for colic (Manjunat, 1979; Kirtikar and Basu, 1991; Corner, 1997). The leaves of *T. catappa* contain many hydrolysable tannins these include; punicalagin, punicalin, terflavins A and B, tergallagin, tercatain, chebulagic acid, geraniin, granatin B, corilagin, but no caffeine (Tanaka *et al.*, 1986). Some of these tannins were found to have pharmacological effects in vitro, i.e punicalin and punicalagin were shown to have inhibitory effects on purified HIV reverse transcriptase and on HIV replication in infected H9 lymphocytes with little cytotoxicity. Chen *et al.* (2000) reported that the leaf water extract and punicalagin were effective against bleomycin-induced genotoxicity in Chinese hamster ovary cells and also concluded that the effectiveness of the extract and punicalgin against bleomycin-induced genotoxicity could be at least in part, due to their antioxidant potentials. Wang *et al.* (2000) also reported the presence of antioxidant activity in the essential oil of *T. catappa* in red fallen leaves. Gao *et al.* (2004) reported that the chloroform fraction of the ethanol extract of the leaves has the strongest anti-inflammatory activity among all fractions from ethanol extract. Osagie and Eka, (1998) have shown that the seed is rich in protein (19 – 22%) and oil (50 – 52 %) while amino acid and mineral profiles have been documented (Oloyede and Muhammad, 2001).

In a recent study Christian and Ukhun (2006) analyzed the nut of *T. catappa* for its nutritional composition. The result showed the presence of significant amount of phosphorus (2200 µg/g dry weight), carbohydrates (78.14% dry weight) and crude fat (16.36% dry weight) while magnesium, calcium, iron, zinc, sodium, manganese, vitamin A and C were also detected at significant levels.

Mustapha (2000) analyzed the bark, leaves, fruits and woods of *T.catappa* for tannins and reported the presence of tannins in high quantity.

Ekop and Eddy (2005) compared the toxicity of *T. catappa* (*Indian Almond*) seeds and African walnut fruits and found that tannin, oxalate and hydrogen cyanide concentrations are not alarming when compared with their respective concentrations in some fruits that can be eaten raw while the concentration of phytic was higher. Apart from medicinal, nutritional and antinutritional importance of *T. catappa*, Untwal and Kondawar, (2006) reported that the fruits extract are beneficial for weak acid and weak base titration while traditionally the fruit is useful in bronchitis, nausea, headache and bowels (Manjunath, 1976; Corner, 1997).

Terminalia catappa fruit is an important fruit consumed in their raw form by children and few adult in Sokoto, Nigeria and through out the world. Although a lot of literature has been published on the *Terminalia catappa* nuts, leaves but few literature exist on the nutritional value of its fruits as no such result were published from this region considering the fact that; environmental condition, soil texture, fertilizer application and genetic variation exert a significant influence on the variation of chemical constituents of the tree (Hassan and Umar, 2004). It is important to determine the chemical composition of this plant within each local environment. Hence, this study was aimed to investigate and compare the proximate composition of the flesh of yellow and red fruits *T.catappa*.

MATERIALS AND METHODS

Collection and preparation of plant material

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 ethane bag. Prior to analysis the flesh of the fruits were removed using sharp laboratory knife, sun dried, milled into fine powder, sieved through 20-mesh and stored in airtight poly ethene bag.

Proximate analysis

The analysis of crude lipid, crude fibre, crude protein, moisture content and ash content were determined in triplicate using AOAC (1990). Carbohydrate content was calculated by difference while energy was estimated by multiplying % CHO, %CP, %CL by 17, 17 and 37 respectively. The nitrogen content was estimated using micro Kjeldahl method and multiplied by 6.25 to estimate the crude protein content (James, 1995). All reagent and apparatus were of analytical grade.

Statistical analysis

All analysis was 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

The results of various analyses carried out in this work are shown in Tables 1 – 3.

Table 1: weight analysis of yellow and red *T.catappa* fruit.

Sample	Whole Fruits (g)	Flesh (g)	Shell + Seed (g)
Yellow	27.93 ± 2.71^b	13.47 ± 0.87^b	14.45 ± 2.10^a
Red	32.40 ± 2.33^a	18.74 ± 1.69^a	13.66 ± 0.72^b

Values are mean value$\pm$standard deviation of triplicates result and expressed at ($p<0.05$)

Table 2: Comparative proximate composition of *T.catappa* fruits (%)

Component Analyze (WM $ DM)	Red Fruits Sample	Yellow Fruits Sample
Moisture (% WM)	71.33 ± 6.90^b	84.00 ± 2.00^a
Ash content (%)	7.83 ± 0.76	8.33 ± 0.76
Crude lipid (%)	1.33 ± 0.29^a	0.67 ± 0.29^b
Crude fibre (%)	8.67 ± 0.29^b	15.83 ± 0.29^a
Crude protein(%)	3.92 ± 0.08^b	10.01 ± 0.43^a
Available carbohydrate (%)	78.31 ± 1.14^a	64.90 ± 0.69^b
Energy value (in Kj per 100g)	1447.19^a	1295.13^b

*The data are mean value $\pm$ standard deviation of triplicates result.
** Values within the same row with different superscript are significantly different ($p<0.05$).
*** DM = Dry matter and WM = Wet weight.

From Table 1, it was shown that yellow variety is significantly ($p<0.05$) smaller compared to red variety. The weight of *T.catappa* fruits reported in this work was similar to those reported by Agunbiade and Olanlokun, (2006).

For proximate composition (Table 2) moisture, crude protein and crude fibre are significantly ($p<0.05$) higher in yellow compared to red variety. On the other hand crude lipid, available carbohydrate and calorific value were significantly ($p<0.05$) higher in red variety. The ash content showed no significant ($p>0.05$) difference in the two varieties.

The two varieties (Yellow=71.33% and Red=84%) were high in moisture content indicating that the fruits were harvested fresh. Moisture content of any fruit is a function of its quality as it determines how fresh the fruits were at harvest and for how long they can be stored before analysis (Hassan *et al.*, 2004). The high percentage of moisture content in fruits is responsible for their high susceptibility to microbial attack (Ladan *et al.,* 1997).

The ash content for red and yellow fruits are $7.83 \pm 0.76\%$ and $8.33 \pm 0.76\%$ (dry weight) which is equivalent to 2.24% and 1.33% (Wet weight) respectively. This is an indication that the fruits contained high amount of essential mineral elements. The values obtained are lower compared to 12.65% reported in yellow variety (Nwosu, 2008).

The lipid contents for red and yellow fruits are $1.33 \pm 0.29\%$ and $0.67 \pm 0.29\%$ (dry weight) which is equivalent to 0.38% and 1.11% (Wet weight) respectively. This fruits have low lipid content which justifies the general observation that fruits and vegetables are not good source of fat and oil (Hassan *et al.*, 2004). They are recommended as weight reducing diet, since low fat food reduces the level of cholesterol and obesity (Gordon, *et al.*, 2002). These values are comparable with those reported in some common fruits such as apple 0.4% and guava; 0.4% (wet weight) (Ogbuagu and Enyinna, 2008).

The protein content for red and yellow fruits are 3.92 ± 0.08% and 10.01 ± 0.43% (dry weight) which is equivalent to 1.12% and 1.60% (Wet weight) respectively. Despite the fact that; the protein content for meat and milk is higher than *T. catappa* flesh fruits of less than 2%, these fruits can serve as protein supplement if properly harnessed. The protein content are higher than reported values for pineapple 0.4% and cashew apple; 0.7% (wet weight) (Ogbuagu and Enyinna, 2008).

The fibre content for red and yellow fruits are 8.67 ± 0.29% and 15.83 ± 0.29% (dry weight) which is equivalent to 2.49% and 2.53% (Wet weight) respectively. The values of dietary fibre reported from the samples are above the range of 1.10-1.25% (wet weight) as dietary fibre for fresh fruits of monkey cola varieties (Ossi and Ndukwe, 2008.). Fibres are the indigestible components of plant materials which provide roughages, help to soften stools, lower plasma cholesterol levels, decrease the incidence of colon cancer and lower insulin requirements of diabetics (Ossi and Ndukwe, 2008).

The available carbohydrate content of red and yellow fruits are 78.31 ± 1.14% and 64.90 ± 0.69% (dry weight). This is equivalent to 22.45% and 10.38% (Wet weight) respectively. The values obtained were higher in yellow variety when compared to fruits such as 10% (wet weight) of ripe pawpaw while that of red variety is higher for Guava 13% and ripe pawpaw; 10% (wet weight). Carbohydrate supplies energy to cells such as brain, muscles and blood. They contribute to fat metabolism, spare proteins as an energy sources, act as mild natural laxative for human beings and generally add to bulk of the diet (Gordon, 2000).

The energy values calculated are within the range of 1447.19 KJ per 100g and 1295.13 KJ per 100g which is equivalent to 345.89 K cal per 100g and 309.5 K cal per 100g for the red and yellow fruits respectively. The high energy for red variety could be attributed to its high carbohydrate contents.

CONCLUSION

The results of proximate studies for the two varieties of *Terminalia catappa* fruits revealed that yellow fruits contain significantly ($p<0.05$) high amount of moisture, crude fibre and crude protein compared to red while red fruits have ($p<0.05$) more of available carbohydrate, lipid and energy compared with yellow. The two fruits showed no significant ($p>0.05$) difference in terms of ash content. These results indicat that both varieties have high mineral and carbohydrate content. Additionally the yellow variety have moderate amount of crude protein. In addition to the present research, the next step of the research should be carried out to determine the mineral content and anti-nutritional content of *T. catappa* fruits.

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