PROXIMATE COMPOSITION AND BASIC PHYTOCHEMICAL ASSESSMENT OF TWO COMMON VARIETIES OF *Terminalia catappa* (INDIAN ALMOND).

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ABSTRACT

Terminalia catappa is a common tree found in Ghana but it is much underutilized. The objective was therefore set to investigate the medicinal and nutritive potential of two common varieties of the plant; the red and yellow varieties. The proximate composition of the nut and pulp of the two varieties were determined using certified methods of the Association of Official Analytical Chemists. Phytochemical screening was also determined using standard screening methods. The red nut had a moisture content of 31.05%; crude fat, 36.9%; protein, 22.19%; ash, 2.76%; carbohydrate, 5.24% and crude fibre, 1.86%. The pulp contained up to 81.96% moisture; 0.04% crude fat; 1.07% protein; 1.47% ash; 14.05% carbohydrates and 1.41% crude fibre. The moisture content constituted 32.06% of the nut of the yellow variety, crude fat was 35.69%; protein, 23.05%; ash, 2.68%; carbohydrate, 4.92% and crude fibre, 1.6%. The pulp of the yellow variety had the proximate composition as: moisture, 84.37%; crude fat, 0.05%; crude protein, 1.54%; ash, 1.62%; carbohydrate, 11.03%; crude fibre, 1.39%. The pulps of both varieties were found to contain saponins, general glycosides, flavonoids, alkaloids, anthraquinones and anthraquinone glycosides. The nut of the yellow variety had terpenoids and steroids present in it while the nut of the red variety had alkaloids present. Statistical analyses carried out showed that there were no significant differences ($p \leq 0.05$) between the two varieties based on their proximate composition.

INTRODUCTION

Terminalia catappa is among the most common trees found in Ghana. It grows in the wild but is sometimes cultivated for ornamental purposes. It is found in almost all the regions of the country as it thrives well in the tropics, hence its name Tropical almond. It has a single stem which grows to a height of about 10 m and then branches horizontally with leaves at the end of the branches that form a rosette (Arbounier, 2002; Thomson and Evans, 2006). The leaves change colour from green to red, yellow or gold and copper brown during the dry season and then are shed. *T. catappa* Linn. belongs to the family Combretaceae (Combretum family) and is locally called 'Abrofo nkate" (Whiteman's peanut).

Studies on the plant have shown that it could serve a lot of useful purposes. Extracts of the flesh of the fruit have been found to be a good acid-base indicator (Untwal and Kondawar, 2006). The fruit is said to contain agents for

chemo-prevention of cancer because it contains antioxidant phytochemicals that can break up the chromosomes of insects that feed on it (Hayward, 1990). The aqueous extract of *T. catappa* L. exhibits superoxide radical scavenging activity preventing lipid peroxidation (Lin *et al.*, 1999). It has also been found to possess anti-HIV reverse transcriptase (Tan *et al.*, 1999), hepatoprotective, anti-inflammatory, aphrodisiac anti-diabetic (Nagappa *et al.*, 2003).

Proximate analysis done by Agatemor and Mark (2006) on the sun-dried kernel showed the potential of the nut to serve as dietary supplement. However, studies on the extracts of defatted *Terminalia catappa* seed meal on the performance and carcass of rats led to the deduction that the defatted seed meal of *T. catappa* could cause depression in growth rate and enlargement of rat tissues (Nasir and Oyelola, 2004). They attributed their observation to the presence of anti-nutrients such as phytate, oxalate and tannin which are present in high amounts in the seed. The anti-nutritional nature of a fruit is likely to be due to the presence of phytochemicals.

In Ghana, the flesh and kernel of the fruits is eaten raw. The kernel is also sun dried or roasted. The leaves, roots and bark are however used for treating diseases such as anaemia, hypertension, malaria, fever and asthma.

The main objective of this project was to compare the results of proximate and phytochemical analyses on the nut and pulp of two common varieties (red and yellow) of *T. catappa.*

MATERIALS AND METHODS

Source and preparation of materials

The fruits of the *T. catappa* were collected from KNUST Maintenance Area, Kumasi. The tests were carried out at the Biochemistry Laboratory at KNUST. After collection of fresh samples, the pulp (mesocarp and endocarp) was separated from the kernel of the fruit manually. The nuts were cracked open manually to obtain the kernels and grounded into fine particles (particle size not determined). The moisture contents were determined and the rest of the tests were carried out using the oven-dried samples. The determinations were done in triplicates. The percentages were then converted to their wet basis to estimate the percentage of carbohydrate (100%).

Chemical Composition

Standard procedure was used in the chemical analyses to determine the proximate composition of the sample. The moisture content, total ash and crude fibre were determined as described by AOAC (1990). Crude fat was extracted by the Soxhlet method with petroleum ether (60-80^{o}C) for 16 hours. The total nitrogen was analyzed using the Kjedahl method and converted to crude protein by multiplying by 6.25 while the carbohydrate was determined by the difference (Pearson, 1976).

Phytochemical Screening

Qualitative determination of some phytochemicals was done on both the fleshy pulp and the nuts of the two varieties of *T. catappa* using standard procedures as described by Harborne (1973), Trease and Evans (1989), and Sofowora (1993). The various phytochemicals determined included saponins, flavonoids, steroids and terpenoids, general glycosides, carotenoids, alkaloids, anthraquinones and anthraquinone glycosides.

Statistical analysis

The data was expressed as mean ± SEM and were analyzed using one way Student t-test and values for $p \leq 0.05$ were considered to be statistically significant.

RESULTS AND DISCUSSION

The results of proximate nutritional composition of the pulp and nut of the two varieties of *T. catappa* are as presented in Table 1. There were no significant differences between the two varieties for most of the parameters studied with the exception of moisture ($p<0.05$)

The presence of phytochemicals (secondary metabolites) in a plant material is a good indication of the medicinal value of the plant. *T.*

Table 1: Proximate Composition of *Terminalia catappa*

Parameter	Percentage(mean for kernel)		P-value	Percentage(mean for pulp)		P-value
	Yellow variety	Red variety		Yellow variety	Red variety	
Moisture	32.06±0.44	31.05±0.04	0.0249*	84.37±0.02	81.96±0.22	0.0591
Ash	2.68±0.02	2.76±0.11	0.5997	1.62±0.00 [a]	1.47±0.07	0.2780
Crude fat	35.69±0.15	36.90±0.36	0.1841	0.05±0.00[a]	0.04±0.00[a]	0.3743
Crude fibre	1.60±0.01	1.86±0.55	0.1112	1.39±0.03	1.41±0.00 [a]	0.5092
Protein	23.05±0.00 [a]	22.19±0.00 [a]	0.4763	1.54±0.00 [a]	1.07±0.00 [a]	0.3114
Carbohydrate	4.92±0.63	5.24±0.04	0.6627	11.03±0.05	14.05±0.29	0.0619

** Statistically different (p<0.05), [a] Replicates were the same*

Table 2: Phytochemical constituents of *Terminalia catappa*

Phytochemical	Yellow kernel	Red kernel	Yellow pulp	Red pulp
Saponins	-	-	+	+
General glycosides	-	-	+	+
Flavonoids	-	-	+	+
Terpenoids and steroids	+	-	-	-
Carotenoids	-	-	-	-
Alkaloids	-	+	+	+
Anthraquinones	-	-	+	+
Anthraquinone glycosides	-	-	+	+

(+) present, (-) absent

catappa was screened for the presence of saponins, general glycosides, flavonoids, terpenoids, steroids, carotenoids, alkaloids, anthraquinones and anthraquinone glycosides and the results are presented in Table 2.

Nuts of both varieties were found to contain relatively higher percentages of moisture of 32.06% for the yellow variety and 31.05 for the red variety (Table 1) of statistically significant differences (p=0.0249). Since general availability of water encourages the growth of microorganisms and hence microbial spoilage of food, it is not advisable to store these nuts in their fresh state. The moisture content must be reduced by drying to increase the storage time. This observation is however not as a result of varietal difference since the overall data analysis does not show such trends in the other determinations.

The percentages of crude fat were high in both varieties with the red variety having a slightly higher percentage but not statistically significant (Table 1). Since the proportion of crude fat is high, the nut can serve as a good source of oil.

The crude fibre content determined was almost of the same percentage for both varieties with the red variety having a slightly higher percentage of 1.86 as compared to the yellow variety (1.60%). The nut of the yellow variety had a higher percentage of protein relative to that of the red variety (23.05% for yellow, 22.19% for red).

The crude protein proportion was the third largest after crude fat and water. As indicated by Agatemor and Mark (2006), many people who live in least developed nations rely almost ex-

clusively on plants as their main source of proteins. This study shows that the nut contains relatively high amounts of protein that can supplement other dietary sources. Therefore the nut can be incorporated into the diets of individuals to increase the protein portion of the diet.

The ash content was also high and its percentage was determined using the amount of ash that was left after ignition. Carbohydrates are easily digested and provide the necessary calories in the diets of most people of the world. Carbohydrates also promotes the utilization of dietary fats and reduces wastage of proteins (Agatemor and Mark, 2006) but the results indicate very low carbohydrate levels in both nut and pulp and this could be due to the high moisture content of the fresh fruits. This implies that the sun-dried nuts are a better alternative to obtain a higher percentage of carbohydrates.

It can also be deduced from Table 1 that the amount of moisture is high in the pulp of the fresh samples of both varieties (84.37% for yellow variety, 81.96% for red variety). This ultimately led to the rest of the components having very small proportions with crude fat having the least percentage of 0.04% and 0.05% for the red and yellow varieties respectively. Except for the percentage moisture, it can be noted that percentage carbohydrate was high (red, 14.05%; yellow, 11.03%) relative to the other determinations.

Comparing the proximate composition of the nut of both varieties to that of Cashew nut (*Anarcadium occidentale*) from the work done by Akinhanmi *et al.,* (2008), it can be noticed that the percentage moisture was low (7.2%). This is because the cashew nuts were dried at 40^{o}C for 5 hours before grinding (Akinhanmi *et al.,* 2008). The nuts contained 49.1% oil, which is a very high percentage. The protein percentage was also high (36.3%) and crude fibre was 3.2%, however a very low carbohydrate percentage (1.4%) was present (Akinhanmi *et al.*, 2008).

Purseglove (1968) found groundnut to have lower moisture content (5.4%) and a higher percentage of carbohydrate (11.7%). The protein and crude fat contents were 30.4% and 47.7% respectively. Crude fibre formed 2.5% and ash or mineral content was 2.3%. This means that even though both groundnut and cashew nut serve as a good source of protein and oil, Indian Almond nut can also be considered as an alternative or complementary source since it is abundant, relatively cheaper and has percentages of protein and oil comparable to groundnut and cashew nut (36.90% for *T. catappa*, 47.7% for groundnut, 49.1% for cashew nut).

From the results of the phytochemical screening, the pulps of both varieties were found to contain saponins as they reacted positively to the froth-forming test. Their presence could have contributed to the bitter taste of the pulp due to its alkali nature. Saponins were however absent in the nuts. General glycosides were present in the pulps of both varieties and are suspected to impart the bitter taste in the unripe and partially ripe fruits of both varieties. They could also account for the sweet taste in very ripe fruits. They were however absent in the nuts of both varieties.

Flavonoids were present in the pulps of both varieties and these may account for the anti-inflammatory (Lin *et al.,* 1999), anticancer and antioxidant (Masuda *et al.*, 1999) and antiviral (Tan *et al*, 1999) effects of the fruit since flavonoids are known to possess such properties. Terpenoids and steroids were absent in the pulps of both varieties and the nut of the red variety. However it was present in the nut of the yellow variety. This means that the nut of the yellow variety might possess antibacterial and antineoplastic properties (*http://en. wikipedia.org/wiki/Terpenoid.html.).*

Any antioxidant property possessed by the fruit could be as a result of the presence of other phytochemicals such as alkaloids. Alkaloids were found to be present in the pulp of both varieties and the nut of the red variety as well. The kind of alkaloid present will determine the

possible effect on the body since they have been reported to have strong physiological effects on the body (www.people.vcu.edu/ ~asneden/alkaloids.htm). The pulps of both varieties were found to contain anthraquinones and their presence could be the likely source of the natural colours of the two different varieties and hence the staining ability of the liquid from the pulp.

CONCLUSION

The nut of both varieties was found to have high amounts of crude fat and protein and can therefore be incorporated into the feed of certain animals. There was however no significant differences between the two varieties based on the proximate composition of the fruits (pulp and nut). The pulp of the fruits of both varieties were found to contain the following phytochemicals; saponins, general glycosides, flavonoids, alkaloids, anthraquinones and anthraquinone glycosides.

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