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Chemical Composition and Nutritive Significance of *Luffa aegyptica* and *Castenea* sp. Seeds

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Abstract: The seeds of *Luffa aegyptica* (Sponge gourd) and *Castenea* sp. (Chestnut) were analyzed for their proximate composition, nutritive elements and some of the physicochemical properties of the extracted oil, using standard methods. Results show that *L. aegyptica* and *Castenea* sp. have moisture contents of 6.47±0.18 and 7.56±0.49%, respectively. Other proximate composition of *L. aegyptica* and *Castenea* sp. are crude protein 33.55±1.01 and 10.84±1.60; fiber 6.47±0.54 and 13.18±1.58; fat 22.17±0.28 and 48.37±0.86; carbohydrate 29.51±1.83 and 16.90±1.53; ash 1.84±0.20 and 3.17±0.66; nitrogen free extract 23.04±0.90 and 3.72±0.50, respectively. Defatting the seeds increased the protein content of the samples to 54.49±0.08 and 35.04±0.09, respectively. The mineral contents (g/100 g) of *L. aegyptica* and *Castenea* sp., respectively are calcium (14.29 and 14.47), zinc 2.34 and 1.41), magnesium (21.40 and 21.51) and phosphorus (0.42 and 0.38). The antinutritional factors of *L. aegyptica* and *Castenea* sp. gave tannin 4.26, 6.51% and phytic acid 15.21, 36.86, respectively. The invert sugars, respectively are 13.77±0.18 and 22.12±2.49 mg/100 g. The physicochemical properties of the extracted oils of *L. aegyptica* and *Castenea* sp., respectively showed saponification value of 108.23±0.00 and 89.93±6.7; iodine value 102.67±0.03; acid value 68.71±1.55 and 34.79±0.57. These results indicate potential good and industrial use of these seed flour and their oils.

Key words: Chestnuts, sponge gourd, *Luffa* sp., *Castenea* sp., chemical composition

INTRODUCTION

Luffa sp. belongs to the family of Cucurbitaceae. The family is mainly tropical and subtropical consisting of climbing and scrambling herbs with either simple or branched tendrils. The leaves are oval, simple, deeply five to seven lobed- dentate, dark green and frequently hairy. *Luffa aegyptica* grows well in a well-drained soil that is rich in organic waste. The fruits are smooth and cylindrical shaped with white flesh. The length of the fruit is one to two feet. The young fruit is used as a cooked vegetable although some gardeners grow smooth *Luffa* for the fibrous interior only. The mature fruits are the source of the spongy reticulated material known as the domestic loofah. These loofahs are used for sponges and filters and for stuffing pillows, saddles and slippers. They can also be used for insulation and are attractive sources for packing materials because of their biodegradability. There is an increasing interest in domestic production (Berrie *et al*., 1987; Dupriez and Leener, 1989; Davis, 1991; Tropilab Inc, 2007) since the United States is the major market and imports millions of loofahs from Asia each year. The fibre of Brazilian sponge-gourds (*Luffa cylindrical*) was chemically characterized in order to improve the fibre properties so as to enhance its large scale commercial utilization (Tanobe *et al*., 2005).

Castenea belongs to a beech family Fagaceae. It is widely distributed throughout the northern temperate zone. It is grown for its edible nut. Chestnut species have been used as a source of tannin

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(McGraw-Hill, 1997). *Castenea* sp. is not wide-spread in Nigeria due to its exotic nature. However, where it is present, yield is satisfactory. Fruits form about 4% of the world's food supply. Botanically, fruits are seed-containing organs formed from the ripened ovary of a flower. Dry fruits include cereal grains, nuts and legume pods (Kilgour, 1986). Nuts have high energy content due to high concentration of protein and liquid. They are good sources of vitamins B_1 and B_2 and folic acid. The iron and calcium contents are generally high, together with the phytic acid content, which may reduce the availability of these minerals (Kilgour, 1986). *Castenea* sp. contains 0.4% nitrogen, 2.7% oil and 7.0% invert sugar (Pearson, 1976). The objective of this study is to determine the proximate composition and some nutritive value of *L. aegyptica* and *Castenea* sp.

MATERIALS AND METHODS

Material and Their Preparation

Luffa aegyptica seeds were collected in Omuo-oke, Ekiti State while *Castenea* sp. was collected in Akure, Ondo State, both in Nigeria. The dry samples were dehulled manually and grounded into powdered form. The powdered samples were kept in an air-tight container and stored in a refrigerator prior to the analysis.

Method

Proximate analysis of the sample was done in triplicates. The crude fat and moisture content were determined using AOAC (1984) method. The crude fat was estimated by exhaustive extraction with petroleum ether (bp 40-60°C) using a soxhlet apparatus. The moisture content was determined by drying the sample to a constant weight in a Gallenkamp oven at 105°C. The protein content, crude fibre, ash content and carbohydrate were determined using the methods described by Pearson (1976). The micro-Kjeldahl method was used for the determination of protein (N×6.25). The crude fibre was determined by defatting the samples repeatedly by boiling the sample with dilute tetraoxosulphate (vi) acid and dilute sodium hydroxide. The total carbohydrate was obtained by difference. The protein concentration was obtained by estimating the protein content when the sample was totally defatted (AOAC, 1984). The nitrogen free extract was determined as: % total carbohydrate -% crude fibre, (Al-Jassir *et al.*, 1995). The food energy was calculated by multiplying the value of crude protein, carbohydrate and fat by factors 4, 4 and 9, respectively; finding the sum of their product and expressing the result in Kilocalories (EEC, 1990).

Determination of the mineral composition was done using the method described by Joslyn (1970). The sample were ashed in a muffle furnace. The ash samples were taken up in 1 mL concentrated trioxonitrate(v) acid and then filtered into 50 mL flask. The filtrate was made up to the mark with de-ionized water. The metals in the solution were determined using Atomic Absorption Spectrophotometer (Joslyn, 1970). Phosphorus content was determined using vanado-molybdate method (AOAC, 1984).

The physico-chemical properties of the extracted oils which include specific gravity, refractive index, acid value, iodine value, peroxide value, saponification value and unsaponifiable matter were determined using methods described by Pearson (1976). Quantitative determination of sugars was carried out using Lane and Eynon's method (Pearson, 1976). The phytic acid and tannin contents were determined using the methods described by Makkar (1996).

RESULTS AND DISCUSSION

The proximate composition of *L. aegyptica* and *Castenea* sp. are shown in Table 1. The moisture contents of *L. aegyptica* and *Castenea* sp. which are 6.47 and 7.56%, respectively are less

Table 1: Proximate composition of *Luffa aegpytica* and *Castenea* sp. seeds flour

Composition of seeds flour	*Luffa aegyptica*	*Castenea* sp.
Moisture (%)	6.47±0.18	7.57±0.49
Crude fibre (%)	6.47±0.54	13.18±1.58
Crude fat (%)	22.17±0.28	48.37±0.86
Ash (%)	1.84±0.20	3.17±0.66
Crude protein (%)	33.55±1.83	10.84±1.60
Carbohydrate (%)	29.51±1.83	16.90±1.53
Food energy (kcal)	451.97±1.60	542.29±1.55
Dry matter (%)	93.53±0.10	92.44±0.51
Protein concentration (%)	54.49±0.08	35.04±0.09
Nitrogen free extract (%)	23.04±0.90	3.72±1.50

Table 2: Mineral composition (g/100 g) of *Luffa aegyptica* and *Castenea* sp. seeds

Mineral composition	*Luffa aegyptica*	*Castenea* sp.
Calcium	14.29	14.47
Sodium	18.08	22.71
Potassium	25.05	24.87
Phosphorus	0.42	0.38
Zinc	2.34	1.41
Magnesium	21.40	21.51
Lead	ND	ND

ND = Not Detected

than 10% reported for general composition of dry nuts and seeds (Kilgour, 1986), but are greater than 5.6% reported for *Haematostaphis barter* fruit by Amoo and Lajide (1999). The crude proteins of *L. aegyptica* and *Castenea* sp. are 33.55 and 10.84%, respectively while defatting the sample to obtain the protein concentration, significantly increased the protein contents of the sample to 54.49 and 35.04%, respectively. This agrees with previous works of Akubor and Chukwu (1999) and Oshodi (1992). Their high protein concentrate value makes them a good protein supplement especially in animal feeds. These values are, however, lower than the protein values observed for beach pea protein isolates (Chavan *et al*., 2001). The carbohydrate contents of *L. aegyptica* and *Castenea* sp. are 29.51 and 16.90%, respectively. These values are less than 36.12% reported for *Bauhinia racemosa* seed flour by Amoo and Moza (1999). The fat contents of *L. aegyptica* and *Castenea* sp. are 22.17 and 48.37%, respectively. These values place the seeds as oil seeds (Kilgour, 1986). The ash content of Castenea sp. is 3.17%, this falls in the range of values reported for some domestic chestnut by Ertürk *et al*. (2006). Table 2 shows the mineral composition in g/100 g of the analyzed samples. The calcium contents of *L. aegyptica* and *Castenea* sp. are 14.29 and 14.47, respectively. The samples show close composition of calcium and are higher than 90.50 mg/100 g and 129.00 mg/100 g for whole seed flour and dehulled full fat seed of *Adenopus breviflorus* benth reported by Oshodi (1992). The result shows that the seeds may be good sources of calcium. The amount of sodium contained in the samples are 18.08 and 22.71 for *L. aegyptica* and *Castenea* sp., respectively. Their potassium content, respectively are 25.04 and 24.08, while their phosphorus, zinc and magnesium contents, respectively are 0.42 and 0.38, 2.34 and 1.41, 21.40 and 21.50. The two samples show good comparison in their mineral composition and are good sources of minerals. The results of physicochemical properties of the extracted oils of the samples are presented in Table 3. From the results *L. aegyptica* and *Castenea* sp. oils have specific gravities of 0.812 and 0.890, respectively. Their refractive indices are 1.468 and 1.465, respectively. High acid values of 68.71 and 34.79 were obtained, respectively for *L. aegyptica* and *Castenea* sp., compared to low acid values of some seed oils (Amoo and Moza, 1999; Esuoso and Odetokun, 1995). The high acid values of the two samples render them inedible. The iodine values of *L. aegyptica* and *Castenea* sp. are 102.67 and 34.32, respectively. This result shows that the oil of *L. aegyptica* is highly unsaturated. The values are greater than 13.52 for *Bauhinia racemosa* (Amoo and Moza, 1999). The peroxide values are 21.66 and 28.28 for *L. aegyptica* and *Castenea* sp., respectively but higher than the range (2.70-7.40) reported for

Table 3: Physicochemical properties of *Luffa aegyptica* and *Castenea* sp. oils

Physicochemical properties	*L. aegyptica*	*Castenea* sp.
Specific gravity at 20°C	0.812	0.890
Refractive index	1.468	1.465
Acid value (mg KOH g^{-1})	68.71±1.55	34.79±0.57
Iodine value	102.67±1.15	34.32±1.54
Saponification value	21.66±0.15	28.28±0.03
(mgKOH g^{-1})	108.23±0.00	89.93±6.71
Unsaponifiable matter (%)	1.80±0.14	1.31±0.01

Table 4: Antinutrient and sugar contents of *L. aegyptica* and *Castenea* sp.

Contents	*L. aegyptica*	*Castenea* sp.
Phytic acid (%)	15.21±0.85	36.86±0.95
Tannin (%)	4.26	6.51
Invert sugar (mg/100 g)	13.77±0.18	22.12±2.49
Fructose (mg/100 g)	16.86±0.30	22.81±2.57
Anhydrous maltose (mg/100 g)	17.12±0.32	27.87±3.13

some locally processed Nigerian palm oils (Aletor *et al*., 1990). The saponification values of *L. aegyptica* and *Castenea* sp. are 108.23 and 89.93, respectively, which are less than 245-265 and 245-255 for coconut oil and palm kernel oil (Pearson, 1976). The oils have low unsaponifiable matter of 1.80 for *L. aegyptica* and 1.31 for *Castenea* sp. These values are less than the values for some oils (Amoo and Moza, 1999). The results of antinutrient composition and sugar contents are shown in Table 4. The phytic acid values of 15.21 and 36.86% were obtained for *L. aegyptica* and *Castenea* sp. Phytates constitute about 1-2% dry weight of many cereals, legumes and oil seeds (Cheryan, 1980). The tannins present in the samples are 4.26% for *L. aegyptica* and 6.51% for *Castenea* sp. These values are lower than 99.2 g kg^{-1} (tannin value) for raw dried breadnut seed flour, but are higher than the tannin values for some processed tropical fruits reported by Fagbemi *et al*. (2005). High tannin diets usually have poor palatability due to its astringent property making it possible to bind with the protein of saliva and mucosal membranes (Mehansho *et al*., 1987). The invert sugar contents of *L. aegyptica* and *Castenea* sp. are 13.77 and 22.12 mg/100 g, respectively. The fructose contents are 16.86 for *L. aegyptica* and 22.81 mg/100 g for *Castenea* sp. These values are less than 76 mg g^{-1} reported for *Haematostaphis barter* fruit (Amoo and Lajide, 1999). The 5-4.4 g kg^{-1} fructose values obtained for some varieties of roasted chestnut (Kunsch *et al*., 2001) is higher than the observed value for *Castenea* sp. in this study. The observed difference could be due to the geographical variation and roasting effect on *Castenea* sp. The maltose contents are 17.12 mg/100 g and 27.87 mg/100 g for *L. aegyptica* and *Castenea* sp., respectively. These results show that *Castenea* sp. is a good source of sugar when compared with *L. aegyptica*.

CONCLUSION

The results obtained from this study showed that *L. aegyptica* and *Castenea* sp. are good sources of protein, fat, carbohydrate, calcium, sodium, phosphorus and sugars. Defatting the samples was seen to improve the protein content. Although *Castenea* sp. is eaten in some parts of the world, *L. aegyptica* has not found its use as a food source. This result could be used to encourage the developing countries like Nigeria to shift from cultural practice of sticking to the known food sources and embrace other food materials with good food values.

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