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Nutritional Composition of the Seeds of Wild Melon (*Citrullus ecirrhosus*)

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Abstract: The proximate, minerals and amino acids contents of wild melon (*Citrullus ecirrhosus*) seeds were determined. The results for proximate analysis (% DW) showed a composition of 3.73±0.25 moisture, 2.12±0.08 ash 26.36±0.10 crude protein, 50.67±0.76 crude lipid, 2.17±0.29 crude fibre, 18.69±0.82 available carbohydrate and energy value of 601.7±8.75 kcal/ 100 g. The seeds amino acids profile revealed that for adults but leucine, lysine and threonine are below the requirement value for children. The overall result implies that seed of the wild melon possessed the potential to be used as a source of nutrition.

Key words: Proximate, minerals, amino acids *Citrullus ecirrhosus*, wild plants

INTRODUCTION

Food is no doubt the most basic necessity for one to effectively function in his own ecosystem. It is a substance that often composed of carbohydrates, lipids, proteins, vitamins and water which are eaten or drunk by animals or humans for nutrition (Adeyeye, 2002; Aguilera and Stanley, 1999). The constituent in food contains important chemical substances known as nutrients. These are ingested, digested, absorbed and circulated in the blood streams to feed the cells which constitute the body building blocks and consequently, the increase in body resistance to diseases and faster recovery of illnesses is witnessed (Worthington-Roberts, 2008).

Most of the food consume by humans are sourced from plants and animals, the former has been grouped into; leafy vegetables, seeds, tubers and fruits (Oyiza, 2005). There are over 30,000 known edible plants, from which only 300 were domesticated accounting for more than 95% of the required human plant food (Tabuti *et al*., 2004). This is not surprising because the utilization of plant as part of the human diet can be traced back to the emergence of the first man on earth; Adam and Eve and forbidden fruits or apple (Abulude *et al*., 2007). The part of the plant responsible for bearing of seeds is known as fruit and is considered a healthy food supplement because it composed of an appreciable amount water, carbohydrate, proteins, lipids, vitamins and minerals; Ca, Mg, K, Zn and Fe (Wenkam, 1990; Umar, 2010). However, despite the nutritional benefits ascribed to different parts of the plant, anti nutritional factors which blocked the bioavailability of some mineral elements and change the nutritional status of the food are also present (Ewaida, 1993; Lo-Voi *et al*., 1995).

Meanwhile, the realization of the significance of plants in furnishing the basic nutrients necessary for healthy growth of an individual has prompted the world researchers into the investigation of the nutritional status of various plants with the aim of introducing more plant food required to control the alarming food shortage in the human nutrition (Umaru *et al*., 2007; Bello *et al*., 2008; Hassan *et al*., 2008; Rathore, 2009).

The plant under investigation grows in the wild and has not been fully utilized as source of food. Therefore, the purpose of this study was to identify the proximate, minerals and amino acids content of the seeds of *Citrullus ecirrhosus*.

MATERIALS AND METHODS

Sampling and sample treatment: Fresh and matured fruits of wild melon were randomly selected from the farmlands at Usmanu Danfodiyo University Sokoto main campus. The fruits were mixed together from which matured and healthy was picked. These were then transported to the Laboratory in polythene bag. The fruits were identified at the Herbarium unit of Biological Sciences Department, Usmanu Danfodiyo University Sokoto as *Citrullus ecirrhosis*. The fruits were cut open, sun-dried, crushed and seeds removed. Representative sample was obtained using alternate shovelling method (Alan, 1996). The sampled was decorticated by hand, wrapped in aluminium foil and keep refrigerated at a temperature of 2-4°C, to avoid deterioration (Chinyere *et al*., 2009).

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Proximate analysis: The standard methods of the Association of Analytical Chemist (AOAC, 1990) were used for the determination of ash, moisture, crude protein, crude lipid and crude fibre contents. Available carbohydrate was calculated by the difference and the sample energy value (in kcal/100 g) was estimated by multiplying the percentages of crude protein, crude lipid and available carbohydrate by the factors 4, 9 and 4, respectively (Hassan *et al*., 2008).

Mineral analysis: Minerals were extracted from the sample by the acid digestion method described by Umar (2010). Ca, Mg, Zn, Fe, Cu and Mn were analyzed using atomic absorption spectrometer (210/211 VGP, USA). Phosphorus content was determined using phospho-vanadomolybdate colorimetric method described by Schroeder *et al*. (1990), with spectrophotometer (LF 2400, Germany), while K and Na were analysed with flame photometer (PF7, Jenway, UK). All the determinations were carried out in triplicate and reported as mean mineral content (mg/100 g).

Amino acids: The analysis of the amino composition in the seed oil was conducted according to the method of Schroeder *et al*. (1990) and Gaitonde (1967) and was determined using Amino Acid Analyser Beckman Gold 320 at the University of Ibadan.

Statistical analysis: The data obtained was subjected to statistical analysis using statistical package (R version 2.13.1) to determine the mean±standard deviation of triplicate values.

RESULTS AND DISCUSSION

The result of proximate composition of *C. ecirrhosus* seeds was shown in Table 1. The moisture content of *C. ecirrhosus* seed (3.73±0.25%) is similar to 3.8±0.2% reported by Maina and Aliyu (2009), for Guna seed. Low moisture content implied low water activities which ensure greater stability of solid constituents of the seed (Maina and Aliyu, 2009). It also indicates that the seeds are less prone to microbial attack in the course of storage (Hassan *et al*., 2006).

The seeds of *C. ecirrhosus* have 2.12±0.08% DW ash which is similar to 2.18% for Guna seed (Maina and Aliyu, 2009) and low compared to *Ceiba pentandtra* seed (5.0%) (Hassan *et al*., 2006). The ash content of a seed may partially be a function of the soil composition on which the plants grow (Maina and Aliyu, 2009).

Table 1: Proximate content of *C. ecirrhosus* seed (%DW)

Parameter	Composition (%)
Moisture (ww)	3.73±0.25
Ash content	2.12±0.08
Crude protein	26.36±0.10
Crude lipid	50.67±0.76
Crude fibre	2.17±0.29
Available carbohydrate	18.69±0.82
Energy value (kcal/100 g)	601.7±8.75

The data are mean±standard deviation of triplicate determination expressed in dry weight basis

The oil yield of *C. ecirrhosus* for the decorticated seeds was 50.67±0.76%, which was comparable to Guna seeds (62%) reported by Maina and Aliyu (2009). The high oil content in *C. ecirrhosus* seeds justify that the plant could be cultivated in commercial quantity for its oil.

The protein content of the *C. ecirrhosus* seeds (26.36±0.10%) is comparable to silk cotton seed (29.53±0.35) (Hassan *et al*., 2006) and Guna seed (27.20%) (Maina and Aliyu, 2009). The value obtained implied that *C. ecirrhosus* seed could be used as protein supplements.

The crude fibre content of *C. ecirrhosus* seeds (2.17±0.29%) was comparable to 2.4% reported for water melon (Badifu and Ogunsua, 1991) and was lower than the values obtained from silk cotton seed (15.00±2.05%) (Hassan *et al*., 2006). Adequate intake of crude fibre might have a helpful physiological role such as low incidence of colon cancer (Sanchez-Castillo *et al*., 2000). High fibre content in the diet was reported to reduce minerals, proteins as well as carbohydrate bioavailability by hindering their hydrolytic break down (Plessi *et al*., 1999; Vadivel and Janardhanan, 2000).

The available carbohydrate content of *C. ecirrhosus* seeds was computed to be 18.69±0.82 and was almost similar to African bean seed (19.20%) (Osagie *et al*., 1986), African Walnut (17.8%) (Ogunsua and Adebona, 1983). The value was also higher than that of melon seed (7.3%) (Achinewu, 1983), Pumpkin (7.6%) (Farinu, 1986) and silk cotton seed (6.27%) (Hassan *et al*., 2006). Carbohydrate is the chief source of energy, it was reported that a gram of carbohydrate furnishes 16.73 kJ of energy (Helen and Bagby, 1989). In this direction, the value of the carbohydrate obtain from the seed can supply to the body with 298.97-326.40 kJ of energy. Therefore, the seed could supplement the energy requirements for some of our daily activities.

The calorific value of *C. ecirrhosus* seeds (601.7±8.75 kcal/100 g) was within the range (84-2500 kJ/100 g) reported for plant foods (Saka and Msonthi, 1994). However, the value was low compared to the energy requirement of 3000 kcal day^{-1} for male adult (Cole, 1980).

The minerals content of *C. ecirrhosus* seeds was shown in Table 2. Potassium level in the seeds

Table 2: Mineral content of the *C. ecirrhosus* seed (mg/100 g DW)

Element	Concentration
K	2962.00±2.83
Na	23.15±0.21
Ca	38.45±0.35
Mg	1315.50±4.95
Zn	22.05±0.04
Fe	49.40±0.14
Cu	5.10±0.01
Mn	6.05±0.07
P	0.27±0.07

All values are mean±standard deviation of triplicate determinations expressed in dry weight basis

(2962.0±2.83 g/100 g) was higher than 28.0 mg/100 g for silk cotton (Hassan *et al*., 2006), *Ceasalpina plucherima* (11.6 mg/100g) (Johnston *et al*., 1992). Moreover, the value is also above the recommended daily allowance (2000 mg/100 g DW) (RDA, 1989). The high level of potassium could be attributed to its abundance in Nigerian soil (Oshodi *et al*., 1999).

Sodium level in the seeds of *C. ecirrhosus* (23.15±0.21 mg/100 g) was higher than 17.0 mg/100 g for silk cotton seed (Hassan *et al*., 2006) and 3.80 mg/100 g for African locust bean (Hassan and Umar, 2004). The daily dietary allowance for sodium is 200-500 mg (RDA, 1989). This indicates that the seed of *C. ecirrhosus* have low sodium content.

The concentration of calcium in *C. ecirrhosus* seed (38.35±0.35 mg/100 g) is lower than 66.25 mg for silk cotton seed (Hassan *et al*., 2006) and 35.5 mg *Caesalpina plucherima* seed (Omole, 2003). The recommended daily allowance (RDA, 1989) for calcium was given as 1000 mg for adult (men). Hence the seed could contribute about 4% of the dietary requirement.

Magnesium content of *C. ecirrhosus* seeds (1315.50±4.95 mg/100 g) was higher than the value obtained from Gurum seed (700 mg/100 g) (Ziyada and EL-Hussien, 2008), *C. pentandra* seed (Hassan *et al*., 2006) and *Hasta lapasta* seed (210.36 mg/100 g Dw) (Hassan *et al*., 2009). Magnesium activates many enzymatic systems responsible for calcium metabolism in bones and in the nerves electrical potential (Ishida *et al*., 2000). The recommended dietary allowance of magnesium for adult was 350 (RDA, 1989). Thus, 100 g of *C. ecirrhosus* seed could supply the body with 37% of the body daily magnesium requirement.

The amount of zinc in *C. ecirrhosus* seeds (22.05 mg/100 g) was higher than 15 mg recommended as dietary allowance for adult (RDA, 1989). Iron content of *C. ecirrhosus* (49.40 mg/100 g) was lower than 75 mg/100g for melon seed (Badifu and Ogunsua, 1991) and 482.7 mg/100 g cocoa bean seed (Offem, 1990). The amount of copper in the seed was found to be 5.10±0.01 mg/100 g, higher than 0.01 mg/100 g reported for *Diasporas misliformis*, 0.25 mg/100 g for *Cassipourea congoenis* and 0.25 mg/100 g for *Nuclea latifolia* (Hassan and Umar, 2004; Abulude *et al*., 2007). The recommended dietary allowance for copper was 2 mg (RDA, 1989). Manganese concentration in *C. ecirrhosis* seeds (6.05 mg/100 g) was comparable to 5.44 mg/100 g obtained in *C. Pentandra* seed (Hassan *et al*., 2006). The recommended dietary allowance of manganese was 5 mg (RDA, 1989). Thus, the seed could contribute 121% to the dietary allowance of the mineral. Manganese helps in supporting the immune system, regulating the sugar level in the blood, enhance blood cloating and also contribute in the energy production during cell division. Moreover, deficiency in manganese could result to birth defects in pregnant women (Anhwange *et al*., 2004; Bello *et al*., 2008).

Table 3: Amino acid content of *C. ecirrhosus* seeds

Amino acid (Abbreviation)	Composition (g/100 g)	FAO/WHO/UNU (g/100g protein)	Chemical score (%)
Valine (Val)*	3.53	3.5	101
Leucine (Leu)*	5.27	6.6	80
Isoleucine(ile)*	3.46	2.8	124
Threonine (thr)*	2.61	3.4	77
Cysteine (Cys)*	1.25		
Methionine (met)*	2.74	2.8[a]	143[a]
Lysine (Lys)*	2.80	5.8	48
Phenylalanine (Phe)*	3.15		
Tyrosine (Tyr)*	3.27	6.3[b]	102[b]
Glycine (Gly)**	5.14		
Alanine (Ala)**	3.13		
Serine (Ser)**	3.98		
Aspartic acid (Asp)**	5.13		
Glutamic acid (Glu)**	14.83		
Proline(Pro)**	3.33		
Arginine(Arg)***	10.65		
Histidine (His)***	2.71		

*Essnetial amino acid, **Non-essential amino acid, ***Essential amino acid to children, [a]Met+Cys, [b]Phe+Tyr

C. ecirrhosus seed contain low level of phosphorus (0.27±0.07 mg/100 g) below the range (12.2-79.9 mg/100 g) reported for some conventional seeds and nuts (Almustafa *et al*., 1995).

The amino acid composition of the *Citrullus ecirrhosus* seed was shown in Table 3 and interestingly the amino acids content of this seed can be compared with the results obtained from other seeds. The glutamic acid (14.83 g/100 g) and arginine (10.65 g/100 g) have the highest proportion compared to the other amino acids in the sample. Similar trend was observed for melon seeds (De Melo *et al*., 2000) and African locust beans (Hassan and Umar, 2004). Also, the results for glycine (5.15 g/100 g) aspartic acid (5.13 g/100 g) and cystine (1.25 g/100 g) are similar to that African locust beans (Hassan and Umar, 2004).

Moreover, the values for isoleucine (3.46 g/100 g) and tyrosine (3.27 g/100 g) are comparable to the results obtained from silk cotton seed (Hassan *et al*., 2006). The seed of the *C. ecirrhosus* was blessed with those acids essentially for children (FAO/WHO/UNU, 1985), namely; histidine (2.71 g/100 g) and arginine (10.65 g/100 g).

The result of the comparison of the essential amino acids content of the *C. ecirrohosus* seeds with the reference standard (FAO/WHO, 1991) indicated that the seeds have sufficient amount of isoleucine, methionine+tyrosine, phenyl alanine and valine with moderate amount of isoleucine, methionine+cystine. However, lysine is the most limiting amino acid.

CONCLUSION

The results of this research have indicated that seeds of *Citrullus ecirrhosus* are potentially a good source of oil and calorific value with appreciable amount of mineral elements of nutritional benefit. The seed also contain appreciable amount of protein with amino acids that meet the standard of the FAO/WHO/UNO. Therefore, the seeds possessed the potentials to be as source of protein. The results also agrees with those on similar seeds, hence can serve as a source of literature in the of study nutrition related to seeds.

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