Original article

Proximate and Mineral Analysis of Selected *Cucurbita* Species in Nigeria

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ABSTRACT

The chemical compositions of *Curcubita maxima, Curcubita moschata* and *Cucurbita pepo* were examined. The proximate compositions were determined by soxhlet extraction, official method of Association of Analytical Chemist, Kjeldhal and other standard procedure, the Mineral contents were determined using Atomic Emission Spectrometry, Atomic Absorption Spectrophotometry and Vanado-molybdate method. The results from the proximate analyses of the seeds revealed that there were significant ($p<0.05$) differences among the samples in all the parameters (moisture content, crude fibre, ash, protein, carbohydrate and fat) considered. *Cucurbita pepo* recorded the highest values in terms of crude protein, fat and fibre (31.54 %, 43.04% and 4.18 % respectively) while *Curcubita moschata* had the least protein 23.53% and *Curcubita maxima* had the least fat and fibre (28.31% and 3.08% respectively). Percentage carbohydrate content and moisture was highest in *Curcubita maxima* (30.30% and 7.20% respectively). *Curcubita moschata* had the least percentage moisture (5.16%) and *Cucurbita pepo* least carbohydrate (11.20%). The mineral analysis revealed that potassium have the highest value (7.40mg/100g) and was obtained in *Curcubita moschata* followed by phosphorus (5.34mg/100g) in *Curcubita maxima*. In terms of Magnesium and calcium *Curcubita pepo* has the highest with (2.10mg/100g) and (2.10mg/100g) respectively. In terms of Na and Cu, *curcubita moschata* has the highest (0.62 and 0.02mg/100g) while *Curcubita maxima* has the highest in terms of Zn (0.04 mg/100g).The results of the study revealed that *Curcubita maxima, Curcubita moschata* and *Cucurbita pepo* seed flour are a good source of important nutrients such as fat, protein, fibre and minerals. The high contents of protein and fat make these seeds valuable dietary supplements especially for the less privileged people that cannot afford meat and dairy products.

Keywords: Proximate, mineral, *Curcubita maxima, Curcubita pepo, Curcubita moschata.*

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INTRODUCTION

Cucurbits (Cucurbitaceae) are among the most important plant families supplying humans with edible products and useful fibers (Bisognin, 2002). The main diversity center of cucurbits was traditionally believed to be in Africa, however recent molecular systematic studies, suggested that they may be primarily originated from central and Southeast Asia, West Africa, Madagascar and Mexico (Schaefer and Renner, 2011; Raghami *et al.*, 2014). Cucurbitaceae is an important family comprising one of the most genetically diverse groups of food plants. There are nearly 100 genera and more than 750 species in the family. They are annual or perennial vines that either trail along the ground or climb upwards using tendrils. The different species of Cucurbitaceae have served humans for over 10,000 years as important foods and as many useful products (Ajuru and Okoli, 2013). In Nigeria, they are used for different purposes in different parts of the country.

Several species of Cucurbitaceae are economically more important than others including: melon (*Cucumis melo* L.); cucumber (*Cucumis sativus* L.); watermelon (*Citrullus lana tus*); summer squash (*Cucurbita pepo*); winter squash (*Cucurbita maschata*); pumpkin (*Cucurbita maxima*); Bottlegourd (*Lagenaria siceraria*) and Loofah (*Luffa acutangula*) (Bisognin 2002). Although inter-specific hybridization of them have been employed in breeding programs more than in any other family, there is still a high potential for increasing its application for germplasm and cultivar development (Bisognin 2002). The genus Cucurbita are flowering plants that occur in the tropical and sub-tropical vegetation, primarily in rainforest, vine thickets and sparsely vegetated rocky outcrops (Yamaguchi, 1983).

Curcubit seed products have good quantities of Sulphur, Calcium, Potassium, Iron, Magnesium, Phosphorus and Manganese. The mineral contents play important roles in improved human nutrition. The moisture content of a seed is the most important parameter, which affects the seed's quality and storage life. Fat is very important it provides the body with energy. Copper helps the body to use iron and sugar properly. It is also necessary for bone growth and nerve function. Deficiency of copper may result to anaemia.

Nwofia, *et al.* (2012) reported that the Curcubita seeds are richly endowed in macro elements (magnesium, phosphorus and calcium) and moderate amounts of micro elements (calcium, manganese, copper and zinc) and thus the seed could be used as a valuable food supplement. Stevenson *et al.* (2007) reported that the four fatty acids present in significant quantities in the Curcubita seed oil from different origins and varieties are palmitic, stearic, oleic, and linoleic acids. Younis *et al.* (2000) reported that the seed of *Cucurbita pepo* are rich sources of unsaturated oil, energy and vitamin E, while the dominant fatty acids present in the oil were oleic 29% and linoleic 47%.

Several plants exist with very high nutritive values that are yet to be exploited for human and animal benefits (Oladele and Oshodi, 2007).

As the global consumption of conventional feed resources such as cotton seed, rape seed, soybean and sunflower seed are on the increase, it is necessary to urgently search for alternative/additional feed ingredients (USDA, 2011). This study explores the nutritional potential of the seeds of three selected *Cucurbita* species: *Curcubita maxima, Curcubita moschata* and *Cucurbita pepo.*

MATERIALS AND METHODS

Collection of melon seeds

The samples were collected from farmer's field in Nkanu and Emene in Enugu and Rano in Kano states in September 2015. Ripe fruits were cut and the seeds separated. Seeds were cleaned using filter paper to remove the pulp and air-dried at room temperature. The dried seeds were ground to flour using a grinder, the flour was then packed in a clean dry plastic containers, sealed and stored at 10°C until the time for analysis.

Mineral analysis

Determination of mineral elements was done according to the method of AOAC (1990). 2.0g of the sample was ashed in a furnace at 550^{0}C for 18hrs and the ash dissolved in 10ml of 0.1M HCl, filtered into a 100ml volumetric flask and made up to mark with distilled H20. This was used to determine the mineral content by the use of Atomic Absorption Spectrophotometer (AAS) using prepared standards of the different mineral elements to be analyzed.

Proximate Analysis

The moisture content and the fat content were determined according to the procedures described by AOAC (2000) while the ash content, crude fibre and crude protein were estimated using procedures described by Pearson,(1979). The nitrogen was estimated based on the Kjeldhal procedure and the percentage nitrogen was converted to crude protein by multiplying by a factor of 6.25 while carbohydrate was determined by simple difference as follows: Carbohydrate = 100 - (%Ash + %Crude protein + %Crude fat + %Crude fibre). Energy value was obtained by the summation after multiplying percentage carbohydrate, protein and fat by factors of 4, 4 and 9 respectively and expressed in Kcal/100g. All analyses were carried out in triplicates. All the proximate values were reported in percentage %.

RESULTS AND DISCUSSION

Proximate composition

The proximate composition of three *Curcubita* seed flour is shown in Table 1. Moisture content was highest in *C. maxima* (7.20%) and least in *C. moschata* (5.16%). This implies that *C. maxima* seeds may have the lowest storability potential while *C. moschata* seeds will be easier preserved. The moisture content recorded for all the species are lower than those reported for mango seeds (12.50 %) (Etong *et al.*, 2013) and *Gardenia aqualla* seeds (49%) (Dagogo *et al.*, 2011). *Curcubita moschata* has the highest mean in terms of Ash with (3.36) while *curcubita pepo* has the least with (2.14) these values were significantly different at $p<0.05$ level of significance. The high ash content in the sample

indicates the percentage of inorganic mineral elements present in melon seeds. The values are within the range obtained for cotton seed (4%) sesame (3.8%) and the seeds and kernels of some Cucurbitaceae species (Achu *et al.*, (2005). The ash content of all the seeds is lower than 5.00% reported for *Terminalia catappa* (Akpabio, 2012). Crude fat was highest in *C. pepo* (43.04%) and lowest in *C. maxima* (28.31%) where it was the main component. These values were lower than those reported for *Citrullus vulgaris* 55.00% and *Citrullus lanatus* seeds from Southern Nigeria, 57.26% (Edidiong and Eduok, 2013) and *Colocynthis citrullus* seeds, 53.85% (Bankole *et al.*, 2005). The high value of fat in the melon seeds is the reason for it being referred to as the oil seed. The seeds had fibre contents ranging from 3.08% to 4.18% which is higher than those reported for four varieties of melon seeds, 1.66-2.16% (Abiodun and Adeleke, 2010) and *Mangifera indica* kernels, 2.22-3.95% cultivars grown in Western parts of Nigeria (Kayode *et al.*, 2011), but a little lower than those of ripe and unripe *Carica papaya* seeds, 7.85% and 7.40%; ripe and unripe *Citrus sinensis* seeds, 8.05% and 7.40% respectively (Abulude, 2000). The high fibre content of the three curcubita seed will help in flushing carcinogens out of the body. It is believed that fibre reduces the level of cholesterol in human blood and decreases the likelihood of different cancers. *Curcubita pepo* has the highest mean (31.54) in term of protein while the least was recorded in *Curcubita moschata* with (23.53) these values were significantly different among all the 3 species at $p<0.05$. The crude protein content is comparable to those reported for *Colocynthis citrullus* seeds 28.63% (Bankole *et al.*, 2005) and *Cucurbita pepo* L seeds, 27.48% (Elinge *et al.*2012), thus *curcubita* seeds could provide the necessary protein requirement for the rural populace. *C. maxima* and *C. moschata* had significantly higher carbohydrate content (30.34% and 27.36% respectively) while *C. pepo* had the lowest (11.20%). Carbohydrate values of the samples were found to be very low. From this result, melon seeds cannot be considered a good source of carbohydrate compared with other sources such as cereals, which contain average of 65-75% carbohydrate.

Table 1: Proximate composition of *Curcubita* Species studied.

Species	Moisture	Ash	Fat	Fibre	Protein	Carbohydrate
Curcubita moschata	5.16 ± 0.09^{a}	3.36 ± 0.12^{c}	37.12 ± 0.06^{b}	3.55 ± 0.28^{b}	23.53 ± 0.24^{a}	27.36 ± 0.31^{b}
Curcubita maxima	7.20 ± 0.13^{b}	2.35 ± 0.11^{b}	28.31 ± 0.22^{a}	3.08 ± 0.04^{a}	25.40 ± 0.30^{b}	30.34 ± 0.29^{c}
Curcubita pepo	7.05 ± 0.45^{b}	2.14 ± 0.09^{a}	43.04 ± 0.03^{c}	4.18 ± 0.15^{c}	31.54 ± 0.29^{c}	11.20 ± 0.15^{a}

Mineral Composition

The mineral composition of three *Curcubita* seed flour is shown in Table 2. *Curcubita pepo* has the highest mean (2.10) in terms of Mg and Ca and the lowest were recorded in *Curcubita maxima* and *Curcubita mochata* (1.70 and 1.27) respectively. Calcium is a

constituent of bones and helps blood to clot and the nerves to convey messages. This value is higher than 0.87mg/100g reported for *Juglans regia* seeds. In terms of potasium *Curcubita moschata* has the highest mean (7.40) and the lowest was recorded in *Curcubita maxima* (6.10) these value were significantly different at $p<0.05$. In terms of Na and Cu, *curcubita moschata* has the highest with the mean of (0.62 and 0.02) respectively and the lowest in *Curcubita maxima* with the mean of (0.32 and 0.01) respectively. Na plays a very importance role in diet as it controls high blood pressure in the body. Studies had showed that lower sodium intake helps to reduce high blood pressure in hypertensive patients. The Na value of 0.30 -0.62 was obtained in this study. The report of this investigation revealed that regular consumption of the *Curcubita* seed flour could help to prevent hypertension and might lower blood pressure in hypertensive patients. This result agrees with the finding of (Aremu *et al.*, 2006), who reported that Nigerian underutilized legumes are good sources of diets for lowering blood pressure. The copper content of 0.01- 0.02mg/100g for curcubits seeds in this study falls below its recommended daily allowance of 1.5-3.0 mg per day for adult male and female. The seeds can therefore not be recommended as good source of copper. *Curcubita maxima* has the highest in terms of Zn and P (0.04 and 5.34) while *Curcubita maxima* and *Curcubita pepo* have the least (0.02) these values were significantly different among the species at $p<0.05$. The recommended daily value for phosphorus is 1000mg. The low value of phosphorus in the sample may be connected to the fact that whole grains and vegetables are usually low in phosphorus. The least in terms of Zn was recorded in *Curcubita pepo* and *Curcubita moschata* (0.03). *Curcubita moschata* has the lowest in terms of Fe (0.01) and *Curcubita pepo* in terms of P (5.13).

Therefore, from the results obtained, curcubit seeds cannot be regarded as a good source of minerals needed for the formation of bones in the body. However, the sample was richer in mineral than those reported for melon varieties (Abiodun and Adeleke, 2010), mango seed, Gmelina fruit (Edidiong and Eduok, 2013) and selected Nigerian oil seeds Onyeike and Achera (2002). The high value of some of the minerals may satisfy the nutritional needs of the consumer, F.A.O. (1968).

Table 2: Mineral composition of *Curcubita* Species studied

Specie	Mg	Ca	Na	K	Zn	Fe	Cu	P
Curcubita moschata	1.90±005^{b}	1.27±0.35^{a}	0.62±0.22^{c}	7.40±0.33^{c}	0.03±0.01^{a}	0.01±0.02^{a}	0.02±0.01^{b}	5.16±0.24^{b}
Curcubita maxima	1.70±0.03^{a}	1.70±0.55^{b}	0.32±0.32^{a}	6.10±0.23^{a}	0.04±0.02^{b}	0.02±0.01^{b}	0.01±0.01^{a}	5.34±0.28^{c}
Curcubita pepo	2.10±0.41^{c}	2.10 ± 0.23^{c}	0.54±0.41^{b}	7.20±0.26^{b}	0.03±0.02^{a}	0.02±0.01^{b}	0.02±0.01^{b}	5.13±0.22^{a}

CONCLUSION

Curcubita maxima, Curcubita moschata and *Cucurbita pepo* seeds are rich in fat, fibre and protein. The results of the study revealed that *Curcubita maxima, Curcubita moschata* and *Cucurbita pepo* seed flour are a good source of important nutrients such as fat, protein and fibre. The high contents of protein and fat make these seeds valuable dietary supplements especially for the less privileged people that cannot afford meat and dairy products.

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