Oil Characterization, Amino Acid and Vitamin A and C Composition of *Cucurbita Maxima* Seed obtained from Sakpe, Niger State, Nigeria.

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ABSTRACT

Oil characterization, amino acid and vitamin A and C composition of Cucurbita maxima seeds was carried out using standard analytical methods. The amino acid profile was determined using Techno sequential multi sample amino acid analyser and except phenylalanine which was most abundant in the sample had the highest contents of all the amino acids analysed. The fatty acid profile was carried out using GC/MS and the results revealed that 9, 12-Octadecadienoic acid was the most abundant fatty acid in the oil. Also the physicochemical composition reveals that the sample was rich in saponification value (243.70±0.02), iodine value (105.77±0.20), free fatty acid content (5.85±0.02) and low peroxide value (2.43±0.15) as well as acid value (11.70±0.05). Thus, C. maxima seed can be use for both plant and animal food.

INTRODUCTION

Cucurbita maxima is known by various names; such as pumpkin or winter squash in English, *kabewa* in Hausa, *ebeshe* in Nupe, *Ogbokolo, Okoro, Anya* in Igbo and and *Elegede, Isi*, /*si* in Yoruba. The name pumpkin was derived from the Greek word pepon meaning "large melon". Later the Americans changed it to the word "pumpkin". The plant bears a fruit having a thick orange or yellow shell containing about 90% water. Some of the fruits are dark-green, pale-green, orange, yellow, white and grey[1]. The fruit of *Cucurbita maxima* weighs between 4 to 34 kg borne on the stems which are rigid, spiky, angular and generally soft. It is a monoecious plant having both male and female flowers on the same plant. The seeds are characteristically flat, asymmetrically oval and light green in colour[1].

This work is aimed to evaluate the physicochemical, amino and fatty acids profile and as well as vitamin A and C.

MATERIALS AND METHODS

Sample Collection and Pre-treatment

Fresh matured pumpkin fruits were collected from different farms in Sakpe village Edati Local Government Area of Niger state. The samples were carefully washed with water. The sample seeds was prepared, washed and dried in the laboratory. The dried seeds were shelled

manually to remove the seed kernel. The dried sample was made into powder with pestle and mortar and stored in air tight container separately prior the analysis.

Physicochemical properties

Physicochemical parameters were determined using the standard method of Official Analytical Chemists[2].

Fatty acid

The fatty acid analysis was carried out at the NARICT research laboratories, Zaria, Kaduna State, Nigeria. The extracted fat was hydrolyzed and the fatty acids converted to their fatty acid methyl derivatives. The constituent fatty acids and their concentrations were determined using GC/MS.

Amino acid

3.0 g of ground sample was extracted with petroleum ether (40 –60°C) using soxhlet extractor for six hours[3]. 30 mg of the defatted samples was weighed into a glass ampoule and 7.0 cm^3 of 6.0 mol/dm^3 hydrochloric acid was added. Oxygen was expelled by passing nitrogen into the ampoule (to avoid possible oxidation of some amino acids during hydrolysis). The ampoule was sealed with Bunsen flame and put in an oven preset at 105°C for 22 h, after which it was allowed to cool, broken at the tip and the content filtered. The filtrate was evaporated to dryness at 40°C under vacuum in a rotary evaporator. The residue was dissolved with 5.0 ml of acetate buffer (pH 2.0), stored in plastic bottle and kept in deep freezer for 24 h. Five to ten microlitres of the hydrolysate was loaded on the Technicon Sequential Multi-Sample (TSM) amino acid analyzer (DNA 0209) made by Technicon (Ireland) Ltd. This was dispensed into the cartridge of the analyzer and the analysis lasted for 76 min[4].

Vitamin A and C

The standard of analytical methods of Vitamin A and C determination was used as described by Onwuka[5].

RESULTS AND DISCUSSION

Table 1. presents the physicochemical properties of oil extracted from *Cucurbita maxima* seeds. The iodine value of *Cucurbita maxima* seed was 105.77±0.20 $gI_2/100g$ of the oil. This value was similar to the 115.00mg/100g, 105.38±3.02, 100.62±16.92 and110.61±23.28 for *Cucurbita mixta, C. mannii, C. maxima and L. siceraria* reported by Achu *et al*[6] , but higher than the 18.66±0.02$gI_2/100g$ for *Cucurbita maxima* reported by Amoo *et al*[7]. The low iodine values of the oils indicated that they have low contents of unsaturated fatty acids. This shows that this oil will not be more susceptible to oxidation deterioration thus they will be easily stored for a long time without spoilage[8]. Saponification value is used in checking adulteration. The high saponification value of the sample (243.70±0.02) mgKOH/g of oil) suggested that the oils could be quite suitable for cosmetic production[9]. This value was higher than the 185.20±5.84mgKOH/g of oil reported for *Cucurbita maxima* by Mohammed[10] and similar to 228.27±37.30, 204.89±27.10, 213.47±31.78 and 231.26±41.38 for *C.*

manni, *C maxima*, *C. moschota* and *C. sativus* reported by Fokou *et al*[9]. The acid value of 11.70±0.05mgKOH/g of oil was recorded for *Cucurbita maxima* seed which was high compared to the 2.04mgKOH/g of oil reported for *Cucurbita maxita* by Shobha[11]. The codex Alimentarius commission[12] stipulated permitted maximum acid values of 19mgKOH/g oil for virgin palm oil and 4mgKOH/g oil for coconut oil. The free fatty acid of *Cucurbita maxima* seed oil obtained in this work was 5.85±0.02% oleic acid. This value is higher than the 1.02mgKOH/g of oil for *Cucurbita mixta* by Shobha[10]. Free fatty acids are more susceptible to lipid oxidation, leading to rancidity and production of off-odour compared to intact fatty acids in the FAO/WHO[12]. The peroxide value of *Cucurbita maxima* was 2.43±0.15 meq peroxide/kg oil. This value was high compared to the 0.85±0.46meq peroxide/kg oil *Cucurbita maxima* reported by Mohammed[9], and lower than 7.39±2.05meq peroxide/kg and 20.47±11.83meq peroxide/kg for *C. maxima* and *C. moschota* as reported by Fokou *et al*[10].

Table 1. Physicochemical properties of oil extracted from C. maxima seeds.

Parameter	Value
Iodine value (g I_2/100g oil)	105.77±0.20
Saponification value(mg KOH/g oil)	243.70±0.02
Acid value (mg KOH/g oil)	11.70±0.05
Free fatty acid (%oleic acid)	5.85±0.02
Peroxide value (meq peroxide/Kg oil)	2.43±0.15
Specific gravity	0.9299±0.00
Refractive index	1.4680±0.01

Values are means ±SD of three determinations

The peroxide value of oil is a sign of its rancidity, thus a high peroxide value of oil indicates a poor resistance of the oil to peroxidation during storage Fokou *et al*[10].

The refractive index of *Cucurbita maxima* seed oil was 1.4680±0.01 which was similar to the 1.4081 for *Cucurbita mixta* reported by Shobha[11]. The refractive index of oil indicates the level of optical clarity of the oil, sample relative to water. The specific gravity of the sample (0.9299±0.00) suggests that the oil obtained from this sample was more unsaturated and it might be more fluidic at room temperature and less viscous at low temperature.

Table 2 shows the fatty acid composition of the lipid of the *Cucrubita maxima* seed. The major saturated fatty acids were undecane and E,E,Z-1,3,12-nonadecatriene-5,14-diol with 7 and 15% respectively, while the major unsaturated fatty acids were n-hexadecanoic acid, 9,12-octadecadienoic acid, octadecanoic acid and hexadecanoic acid accounting for 21, 29, 17 and 11% respectively. The unsaturated and saturated fatty acids were 79 and 21% respectively. Similar result was obtained of the 73.03±0.78 and 27.73±1.80% (total saturated and unsaturated fatty acids) for pumpkin seed kernels reported by Mohammed[10]. The ratio of total unsaturated fatty acid to saturated fatty acids (TUFA/TSFA) is 3.70; this was high compared to the 2.90 reported for pumpkin seed kernels by Mohammed[10]. Also, this result indicates that the fatty acid composition obtained in this work is quite close to that of melon seed oil as reported by de Mello *et al.*[11]. The ratio of TUFA/TSFA recorded in this work is associated with desirable level of cholesterol and reduced coronary heart problems[14].

Table 2 Fatty acids composition *C. maxima* seed oil

S/N	compound name	Mol. Formula	Mol. Wt	%Rel. Abundance
1	Undecane	$C_{11}H_{24}$	156	1.71
2	n-hexadecanoic acid	$C_{16}H_{32}O_2$	256	5.32
3	9,12-octadecadienoic acid	$C_{18}H_{32}O_2$	280	7.52
4	octadecanoic acid	$C_{18}H_{36}O_2$	284	4.42
5	hexadecanoic acid	$C_{19}H_{38}O_4$	330	2.74
6	E,E,Z-1,3,12-nonadecatriene-5,14-diol	$C_{19}H_{34}O_2$	294	3.7
7	TUFA			20
8	TSFA			5.41
9	TUFA/TSFA			3.7

TUFA =total unsaturated fatty acids TSFA = total saturated fatty acids

The presence of both saturated and unsaturated fatty acids in the *C. maxima* seed oils could be an advantage since both may complement the function of one another.

The results of the amino acids profile is shown in Table 3. The results suggests that the seed of *C. maxima* were rich in essential amino acids such as lysine, histidine, threonine, leucine, isoleucine, methionine and phenylalanine while non-essential amino acid were argine, aspartic acid, glutamic acid, valine, cystine, glycine, proline, tyrosine and alanine etc.

Table 3. Amino acid profile of C. maxima seeds (mg/100g)

Amino acids	Contents
Lysine	3.8
Histidine	2.32
Argenine	8
Asphartic acid	10
Thereonine	3.11
Serine	3.59
Glutamic acid	14.3
Proline	3.29
Glycine	3.4
Alanine	3.24
Cystine	1.39
Valine	3.52
Metheonine	1.25
Isoluecine	4.21
Leucine	6.81
Tyrosine	2.42
Phenylalanine	3.97
Total essential amino acids(EAA)	28.99(37.9%)
Non Essential amino acids	49.63(63%)

The contents of non-essential amino acids in these samples were more than that of essential amino acids present. The total non-essential amino acid values was 49.63% g/100g representing 63% for seed while the total essential amino acids contents were 28.99 representing 37% for seed.

This result were compared with those of Jacks[15] who showed that *Cucurbit* seeds are rich in argine, aspartic and glutamic acids; and to those of Ojieh *et al*.[16] who showed that *C. lanatus* has good quantities of argnine, isoleucine, leucine and phenylalanine.

The result of vitamins content was presented in the table 4. The value of vitamin A contents of seed was 0.76±00 mg/100g. This value was within the 0.07 to 8.92 mg/100g of fruit flesh of *Cucurbita maxima Duch* reported by Anna *et al.*[17].

The vitamin C contents of the seed was 0.94±0.01 mg/100g. This value was lower than the 3.91 and 3.78 mg/100g for Ogo-mega and Ugwu-Lng of *Cucurbita spp* reported by Aruah *et al.*[18].

Table 4. the Vitamins contents of seed for C. maxima

	parameters	contents
1	Vitamin A	0.76±0.00
2	Vitamin C	0.94±0.01

values are means ±SD of three determinations

CONCLUSION

This result suggest that the oil obtained from this sample could be exploited in industry especially, like in the production of paints, emulsions, plastics, soap making, drying agents, lubricants and as additives in pharmaceutical as well as drug productions. The higher percentage of non-essential and essential amino acids obtained in this work can complement each other and as a result of that becomes helpful to man and his animals.

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