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PRELIMINARY NUTRITIONAL EVALUATION OF CASHEW NUTS FROM DIFFERENT LOCATIONS IN NIGERIA

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ABSTRACT
Cashew nut samples from three geographical locations of Nigeria viz: Anambra state, Oyo state and Kogi state were obtained and analysis were carried out on the nuts and oil. The proximate composition of the cashew nuts was determined. The extracted oil was analyzed for both physical (colour, specific gravity and refractive index) and chemical (saponification value, iodine value, peroxide value and free fatty acid value) properties. The vitamin content of the samples was also determined. The protein content ranged from 23.42% – 26.39%, the moisture content ranged from 5.66% - 6.17%, ash content ranged from 3.03% - 3.18% and the crude fibre content ranged from 5.60% - 6.12%. The fat content of the cashew nut from Oyo state was the highest (42.03%) followed by the cashew nut from Kogi state (40.72%) while the cashew nut from Anambra state had the least value (40.15%). The refractive index ranged from 1.452 – 1.463nD 20ºC and specific gravity ranged from 0.848 – 0.860g/cm^3. The oil from the three samples had a light yellow colour. The saponification value ranged from 233.19 – 237.00mgKOH/g oil; iodine value 83.65 – 86.93mgKI/100g oil; peroxide value 19.75 – 20.34meqO_2/Kg oil and free fatty acid 0.05046 – 0.05601%. The mineral content of the samples correlated with the values from literature. Statistical analysis was carried out using the Analysis of Variance (ANOVA) at 95% confidence limit and Duncan test. There was significant difference between the Vitamin A and B12 content, Sodium, Potassium, Magnesium, Phosphorus, moisture, fat, fibre, ash, carbohydrate and free fatty acid content of the samples while there was no significant difference in the Vitamin B12 and B6, Iron, Zinc, Iodine value and Saponification value of the samples. The cashew nuts from the different locations demonstrated high potential as industrial materials.

KEYWORDS: Cashew nuts, Mineral profile, Saponification value, Iodine value, Peroxide value, Free Fatty acid

INTRODUCTION

The cashew is a tree in the family Anacardiaceae. The tree is small and evergreen, growing to 10 – 12m tall, with a short often irregularly shaped trunk. The fruit of the cashew tree is an accessory fruit (sometimes called a pseudocarp or false fruit). What appears to be the fruit is an oval or pear – shaped structure that develops from the pedicel and receptacle of the cashew flower (Varghese and Pundir, 1964). It was introduced to Nigeria by the Portuguese during the 15th and 16th centuries. Since then, it has flourished in a whole state (Crystal 1991, Olunloyo 1996, Ohler, 1979). The kernel of the cashew nut contains approximately 5% moisture content, 20% protein, 45% fat, 26% carbohydrate, 1.5% ash and 2.5% mineral matters such as sodium, potassium, magnesium, calcium, iron etc (Falade, 1972).

Cashew tree is grown in India, Tanzania, Kenya, Malaysia, Senegal, Malawi, Nigeria and other countries (Brucker, 1989). In Nigeria, cashew tree is an economic crop and it has long been grown in small plantations in Anambra, Imo, Kogi, Oyo, Edo, Lagos state and to a lesser extent in Ogun, Osun, Delta, Ondo, Niger and other states (Akinwale, 1996).

The true fruit of the cashew tree is a kidney or boxing glove shaped drupe that grows at the end of the cashew apple. The drupe develops first on the tree and then the pedicel expands into cashew apple. Within the true fruit is a single seed, the cashew nut. Although a nut in the culinary sense, in the botanical sense, the nut of the cashew is a seed. The seed is surrounded by a double shell containing an allergenic phenolic resin, anacardic

acid, a potent skin irritant chemically related to the more well known allergenic oil urushiol which is a toxin found in the related poison ivy. Properly roasting cashew nuts destroys the toxin. Some people are allergic to cashew nuts, but cashews are a less frequent allegen than nuts or peanuts (Rosen and Fordice, 1994).

The cashew nutshell liquid (CNSL), a product of processing cashew is mostly composed of anacardic acids. These acids have been used effectively against tooth abscesses due to their lethality to a wide range of Gram – positive bacteria. Anacardic acid is also used in the chemical industry for the production of cardanol, which is used for resins coatings and frictional materials (Tullo, 2008)

The cashew nut is a popular snack and its rich flavor means that it is often eaten on its own, lightly salted or sugared. Cashew nuts are sold covered in chocolate, but less often than the cheaper peanuts and almonds. The cashew nut can be harvested in its tender form, when the shell has not hardened and is green in colour. The shell is soft at this stage and can be cut into two with a knife (Wikipedia, 2011)

The study is aimed at comparing the nutritional quality of cashew nuts produced from different locations in Nigeria and also comparing the quality attributes of the oil extracted from these nuts.

MATERIALS AND METHODS

Materials

The cashew nuts were obtained from Oba in Anambra state, Ogbomoso in Oyo state and Idah in Kogi state.

METHODS

Removal of Cashew Kernel

The cashew nuts were cleaned by removing the stones, leaves and apple remains. The nuts were dried for three days. The dried cashew nuts were dehulled with the aid of a manual sheller and the kernels were removed with a sharp object (pin) with hands covered with rubber gloves. The kernels were also dried continuously for three days to remove the outer coat. The coatings were removed by winnowing the kernels to obtain a clean cashew kernel.

Analytical Methods

The proximate composition (protein content, crude fibre content, ash content, fat content and carbohydrate content) of the samples were determined using AOAC (1990) methods. The kjedahl method was used to determine the protein content of the samples. The ash content was determined by incinerating 5g of a powdered portion of samples in a muffle furnace at 550ºC and weighing the remains afterwards. The ash was used for the mineral content determination. The vitamins content were analyzed using a combination of acid and enzyme extraction. The refractive index of the oils was determined at 20ºC using sodium light and standard instrument AOAC (1990). The specific gravity of the oils was measured using standard methods. The saponification value, peroxide value, iodine and free fatty acid content of the samples were also determined using the AOAC (1990) methods. The data collected from the studies were subjected to analysis of variance. The means were compared using Duncan's multiple range test

RESULTS AND DISCUSSION

Proximate Composition

Table 1 presents the data obtained from the proximate analysis of cashew nut samples. The protein content of the samples ranged from 23.42% in the sample collected from Oyo state to 26.39% in the sample collected from Anambra state. The ash content was 3.03%, 3.09% and 3.18% for the samples from Anambra state, Oyo state and Kogi state respectively. The carbohydrate content of the sample from Kogi state calculated by difference recorded the highest value (20.21%). The moisture contents recorded were 5.66% (Anambra state sample), 6.17% (Oyo state sample) and 5.71% (Kogi state sample). The Oyo state sample had the highest fat content value of 42.03%. the crude fibre content ranged from 5.60% (Anambra state sample) to 6.12% (Kogi state sample) indicating that if 100g of the sample collected from the Kogi state region was consumed, it would be equivalent to the recommended daily allowance of 15 – 20g of the total fibre. Crude fibre is of great importance in preventing diseases such as heart disease, diabetes, obesity, cancer of the colon etc and the managing of constipation.

There was no significant difference in the protein content of the samples but they varied significantly from the protein content of groundnut measured at 95% confidence limit.. The protein content of the cashew nut from

Anambra state was higher than that of groundnut (23.40%) but less than that of soybean (35.1%) (Norman and Joseph, 1995). Protein in the diet is necessary for normal body growth, water regulation in the body, formation of essential body compounds such as insulin and thyroxine and stimulation of antibodies. The consumption of cashew nut will however help meet these demands. The variation in the protein content of the cashew nuts from the different regions may be attributed to variety in the nitrogen content of the soil in which the cashew was cultivated.

Vitamin Content

Results of the analysis of the vitamin content of the samples as recorded in Table 2 revealed that the vitamin A content of the samples were 0.043mg/100g (Anambra state), 0.039mg/100g (Oyo state) and 0.034mg/100g (Kogi state). The vitamin B_6 content ranged from 0.026mg/100g to 0.034mg/100g while the vitamin B_2 content ranged from 0.023mg/100g to 0.028mg/100g. The samples collected from Oyo state and Kogi state had the same vitamin B_2 content value. The riboflavin content value did not correlate with that stated by Norman and Joseph (1995). Significant difference was recorded in the Vitamin A and B_{12} contents of the samples while there was no significant difference in the Vitamin B_2 and B_6 contents of the samples. The variation may be due to destruction of the riboflavin due to exposure to light. Vitamins play vital roles in carbohydrate metabolism and are essential for growth. Deficiency of these vitamins may lead to itching and vascularization of cornea.

Selected Mineral Profile of the Cashew Nut

Table 3 shows the result of the analysis of the mineral content of the samples. The cashew nut from Kogi state had the highest Na, Mg, P and Ca content values of 5096ppm, 3951.56ppm, 426.73ppm and 231.00ppm respectively while the sample collected from Anambra state had the lowest. These minerals are very essential in the human diet. For instance, Calcium and Phosphorus are needed for bone and teeth formation, Calcium is required for clotting of blood and control of fluid movement through the cell membrane, Phosphorus helps control the acid – alkaline state of the blood, Magnesium helps in the metabolism of other minerals while Sodium is necessary for the maintenance of osmotic equilibrium and body fluid volume (Norman and Joseph, 1995). The cashew nut collected from Kogi state recorded the highest Copper content (15ppm), Iron content (165ppm) and Manganese (52.29ppm) while the sample from Anambra state had the lowest values viz 8ppm, 146.00ppm and 53.10ppm respectively. Iron and Copper are components of the blood haemoglobin which carries oxygen and are related to the rate of growth and to blood loss or gain. Manganese is refined in normal bone structure, reproduction and functioning of the central nervous system (Norman 1995). however, the variation in the mineral profile of the cashew nut from the three regions may be due to the mineral content of the soil (soil chemistry) of each area. Since they are readily available in the soil and it in turn has an influence on the growth of the plant and is subsequently transferred to the fruits. There was significant difference in the Sodium, Potassium, Magnesium, and Phosphorus contents of the various samples while the Iron and Zinc contents of all the samples were insignificantly different.

Physical Properties of Cashew Nut Oil (Edible Oil)

The data for the results of the tests of the physical properties of the cashew nut samples from the three regions viz Anambra, Kogi and Oyo are represented in Table 4. The oils from all three regions possess similar colour. However, the colour of groundnut oil was different which could be due to the fact that the cashew nut oil was extracted at a low temperature. The specific gravity (g/cm^3) of the oil extracted from the cashew nut collected from Oyo state had the highest value (0.0860) while the oil from the cashew nut collected from Anambra state had the least (0.0848). The density of oil is temperature dependent and thus decreases with an increase in temperature but increases in value as the carbon chain of the fatty acid increases (Norman, 1995). It is determined to check if the oil is adulterated. The values are lesser than that of groundnut oil but they are acceptable for oil according to SON standard. The refractive index ranged from 1.452 to 1.463nD (20ºC). No significant difference existed amongst the specific gravity values of the samples while there was significant difference between the refractive index values of the samples. The oil sample from Oyo state had the highest value and it was the same as the refractive index of groundnut oil. The refractive index is related to the viscosity of the oil and it is also temperature dependent.

Chemical Properties of Cashew Nut Oil

Table 5 reveals the result of the chemical tests carried out on the cashew nut oil. The saponification value ranged from 233.19 to 237.00mgKOH/g oil in the oil from the samples collected from Oyo state and Anambra state respectively. The iodine value ranged from 83.65 – 86.93KJ/100g oil. The peroxide value ranged from 19.75 – 20.84meqO_2/kg oil while the free fatty acid content ranged from 0.5046 – 0.5601% of oleic acid. The

free fatty acid content determines the extent of rancidity of the oil. The saponification value, iodine value and peroxide value measure the extent of unsaturation of the oil which is an indication of oxidation or rancidity of the oil. The lower the peroxide and iodine values the slimmer the chance of the oil to go rancid while the higher the saponification value, the less liable the oil to rancidity (Food Chain, 2001). All the oils obtained have the tendency of keeping for a long time because of the presence of anti oxidants in the cashew nut.

Table 1 The Proximate composition of cashew nut compared with that of groundnut

Composition %	Groundnut	Anambra State (Oba)	Oyo State (Ogbomoso)	Kogi State (Idah)
Protein	23.40	26.39 ± 0.02	23.42 ± 0.02	24.04 ± 0.02
Moisture Content	7.30	5.66 ± 0.04	6.17 ± 0.01	5.71 ± 0.02
Fat content	45.30	40.15 ± 0.01	42.03 ± 0.01	40.72 ± 0.02
Crude fibre	2.10	5.60 ± 0.04	5.82 ± 0.11	6.12 ± 0.03
Ash	2.40	3.03 ± 0.03	3.09 ± 0.01	3.18 ± 0.02
Carbohydrate (by difference)	21.60	19.17 ± 0.02	19.47 ± 0.02	20.21 ± 0.01

± standard deviation of three replicates.

Table 2 Vitamin Content of Cashew Nut

Vitamin (mg/100g)	Anambra State	Oyo State	Kogi State
Vitamin A	0.043 ± 0.003	0.039 ± 0.001	0.034 ± 0.003
Vitamin B_2	0.023 ± 0.003	0.028 ± 0.001	0.028 ± 0.000
Vitamin B_{12}	2.06 ± 0.39	2.51 ± 0.61	2.24 ± 0.27
Vitamin B_6	0.026 ± 0.005	0.034 ± 0.002	0.028 ± 0.001

± standard deviation of three replicates.

Table 3 Selected Mineral Profile of Cashew Nut

Minerals (ppm)	Anambra State (Oba)	Oyo State (Ogbomoso)	Kogi State (Idah)
Sodium (Na)	3840.00 ± 18.00	4735.00 ± 15.00	5096.00 ± 98.35
Potassium (K)	2405.00 ± 49.00	3300.00 ± 26.40	3198.26 ± 70.25
Magnesium (Mg)	2010.00 ± 10.00	2215.00 ± 15.60	3951.56 ± 126.20
Iron (Fe)	146.00 ± 1.50	150.00 ± 1.60	165.00 ± 3.00
Zinc (Zn)	42.00 ± 0.00	34.00 ± 0.00	40.00 ± 0.00
Copper (Cu)	8.00 ± 0.00	9.00 ± 0.00	15.00 ± 0.00
Manganese (Mn)	53.10 ± 0.76	42.70 ± 1.20	56.29 ± 2.10
Phosphorus (P)	185.00 ± 1.00	249.60 ± 1.70	426.73 ± 15.28
Calcium (Ca)	102.00 ± 1.50	186.00 ± 7.00	231.00 ± 4.00

± standard deviation of three replicates.

Table 4 Physical Properties of Cashew Nut Oil (Edible Oil)

Location	Parameters		
	Colour	Specific gravity (g/cm^3)	Refractive Index (nD20ºC)
Anambra State (Oba)	Light Yellow	0.848 ± 0.002	1.452 ± 0.002
Oyo State (Ogbomoso)	Light Yellow	0.860 ± 0.001	1.463 ± 0.002
Kogi State (Idah)	Light Yellow	0.853 ± 0.001	1.459 ± 0.001
Groundnut Oil	Light Yellow	0.915 ± 0.003	1.463 ± 0.006

± standard deviation of three replicates.

Table 4 Chemical Properties of Cashew Nut Oil from Different Locations

Parameters	Location		
	Anambra State (Oba)	Oyo State (Ogbomoso)	Kogi State (Idah)
Saponification Value	237.00 ± 0.01	233.19 ± 0.02	236.79 ± 0.05
Iodine Value	83.65 ± 0.04	84.78 ± 0.03	86.93 ± 0.03
Peroxide Value	19.94 ± 0.04	20.84 ± 0.04	19.75 ± 0.05
Free Fatty Acid (FFA) Value (%)	0.5601 ± 0.0002	0.5046 ± 0.0001	0.5601 ± 0.0001

CONCLUSION

The cashew nut samples collected from Anambra, Oyo and Kogi states of Nigeria possess different proximate composition and oil physico – chemical properties. The cashew nuts from Anambra state have high protein content but are low in crude fibre, carbohydrate and moisture contents while the nuts from Kogi state have high crude fibre values. Cashew nuts from Kogi state have the best mineral profile and thus could be used as fortificant in mineral deficient foods. When cashew nuts are to be eaten without further processing, mixing the cashew nuts from Anambra and kogi states will be preferable.

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