EFFECTS OF PROCESSING METHODS ON THE PROXIMATE AND PHYSICOCHEMICAL PROPERTIES OF FLOUR AND OIL OF CASHEW NUT

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ABSTRACT
Background: Cashew nut is an underutilized crop, majorly used as a snack, while its other potentials are unexploited. It is nutritious and its oils could serve as alternative source for edible oils.
Objective: The study investigated the effect of roasting, sun and oven-drying on the proximate and physicochemical properties of cashew nut flour and oil.
Methods: Cashew nuts were bought from Sayedero market, Ilaro, extraneous objects and bad ones were removed, the nuts cut into halves, dried using sun, oven-drying and roasting (95ºC for 16hr) and milled into flours. Oil was extracted from the flour using standard laboratory methods. The proximate properties of the flour and the physicochemical properties of the oil were investigated; data obtained was analyzed using SPSS version 23.0
Results: The moisture, ash, fibre, protein, fat and carbohydrates contents of the flours ranged from 5.73 to 5.83%, 3.12 to 3.49%, 2.01 to 2.30%, 22.05 to23.97%, 40.16 to 42.13% and 22.39 to 26.72%, respectively. The physicochemical properties of the oil from the three samples showed no significant difference in the specific gravity (1.02), refractive index (1.02). Significant differences existed in the saponification (139.50 to 141.33mgKoH/g), peroxide (20.63 to 22.35Meg/kg), acid (12.39 to 12.60mgKOH/g) and iodine (42.52 to 43.79 g/100g) values of the sample.
Conclusion: The cashew nut seed flour was found to be a good source of protein, the oils exhibit good physicochemical properties. . Oven dried samples had the best values in terms of proximate and physicochemical properties.

Keywords: Cashew nut flour, oil, proximate, physicochemical properties

Introduction

Cashew (*Anacardium occidentale Linn.*) belonging to family *Anacardiaceae* is an extremely hardy tree that grows on poor soil under various climatic conditions. Cashew nut is composed of an outer shell, film and the nut itself. The nut is the most important product (1). It is a native to Brazil and extensively grown in India, East Africa and Vietnam. These countries including Nigeria are the main producers of cashew (3). Cashew is one of the most important plantation crops earning huge amount of foreign exchange through its kernel and Cashew Nut Shell Liquid (CNSL). Africa gains little from the production as most of the nuts produced are exported to the United States of America (USA), Netherlands and other European countries unprocessed (5). Cashew nut is good source of unsaturated fatty acids, including monounsaturated and polyunsaturated fatty acids (2). Nuts, in general, are healthy foods, and their consumption is associated with a reduced risk of cardiovascular disease and diabetes (6). These benefits are related to the nutritional composition of nuts, they are rich in unsaturated fatty acids, fiber, minerals, and proteins (7).

Food materials are usually processed in order to improve palatability and reduce toxicity and for preservation (8). Processing methods such as thermal processing, refrigeration, freezing, and fermentation have been applied to various food materials to achieve these purposes. Thermal or heat processing is one of the most important methods developed by man to processing reduce or eliminate anti-nutritional components (5). However, heat processing also has a detrimental effect on the nutritional and functional properties of food. It is therefore important to establish scientific evidence that shows the effect of different food processing methods on the nutritional and other useful properties of the food.

El Gharras (9) reported that the health effects of polyphenols vis-à-vis antioxidant property depend on their respective intakes and their bioavailability which can vary greatly. Oils and proteins derived from plant seed sources remain important for their nutritional, industrial and pharmaceutical applications (10). Therefore, the objective of this research work was to evaluate the effect of processing methods on the proximate and physicochemical properties of cashew nut seed flour and oil.

Materials and methods

Sample collection and preparation of cashew nut flour

Cashew nut seeds were obtained from a local market in Ilaro, Ogun state, Nigeria. The nuts were thoroughly screened to remove the bad ones, stones and other extraneous matters. The outer shells of the nuts were cut into halves using a locally fabricated manual cashew nut cutter., the nuts were removed and divided into three parts; one part was roasted in hot sand at 120ºC for 30min, the second part was sundried for 5 days and the third part was oven-dried (Carbolite, ELF11/14B, S336RB) England for 16 hours at 95ºC. The testa of the nuts was manually removed with hand, the nuts milled using an attrition mill to a smooth/fine texture of 400µm particle size and put in a dark polyethylene and placed in an air tight container for further analysis.

Extraction of oil

The oil was extracted from the milled cashew nut flour using Soxhlet extractor with N-Hexane, boiling at 60-80ºC for 8 hours (11).

Chemical analyses

The chemical composition of the sample was determined using the method of AOAC (11). Protein content was determined on 0.5g sample by the Kjeldahl method. The percentage nitrogen obtained was used to calculate the crude protein by multiplying with a conversion factor of 6.25. Moisture was determined on 5g sample using the gravimetric method of AOAC (11) at 105°C for 3hours. Ash content of the samples was determined on 5g sample by dilute acid alkaline hydrolysis after incineration in a muffle furnace at 550 °C for 4 hours and cooling. Fat content was determined on 5g sample using the Soxhlet solvent extraction method. The carbohydrate content was calculated by difference.

Physicochemical properties determination of the oils

The acid, peroxide values, saponification number and iodine values were determined using the method described by Idah, Simeon and Mohammed (12). Specific gravity was determined with universal hydrometer and refractive index was determined using Abbe refractometer at 26^{o}C.

Statistical analysis

Data obtained were analyzed using the Statistical Package for the Social Sciences version 23.0. Analysis of variance (ANOVA) was used to determine the differences between the means and the significant differences were accepted at 5% probability level using Duncan's Multiple Range Test.

Results

The proximate composition of the cashew nut flour is presented in Table1. There were significant ($p < 0.05$) differences in the proximate composition except for moisture content of the samples. The oven-dried sample had the lowest moisture (5.73%) while the sun-dried sample had the highest (5.90%). The sun-dried sample had the lowest ash (3.12%), fiber (2.01%) and protein (22.05%) contents while the oven-dried sample had the highest ash (3.49%), fiber (2.30%), protein (23.97%) and fat (42.13) contents. The oven-dried sample had the lowest carbohydrate (22.39%) content while the sun-dried sample had the highest (26.72%).

Table 1: Proximate composition of the cashew nut flour

Sample	Moisture (%)	Ash (%)	Fiber (%)	Protein (%)	Fat (%)	Carbohydrates (%)
Roasted	5.83±0.03^{a}	3.22±0.04^{b}	2.11±0.01^{b}	22.49±0.05^{b}	40.16±0.01^{a}	26.21±0.03^{b}
Sun-Dried	5.90±0.41^{a}	3.12±0.02^{a}	2.01±0.01^{a}	22.05±0.05^{a}	40.20±0.03^{a}	26.72±0.0^{c}
Oven-Dried	5.73±0.10^{a}	3.49±0.03^{c}	2.30±0.06^{c}	23.97±0.01^{c}	42.13±0.03^{b}	22.39±0.11^{a}

Values are Means ± standard deviation of three replicates

Mean values with different superscripts within the same column are significantly different ($p \leq 0.05$) from each other

The physicochemical properties of the extracted oils from roasted, sun and oven-dried cashew nut flours are presented in Table 2. The roasted sample had the highest peroxide value (22.35Meq/kg), saponification (141.33mgKOH/g) and acid value (12.60mgKOH/g) while the sundried sample had the highest iodine value (43.49g/100g). The Oven-dried sample had the lowest acid (12.39mgKOH/g) and iodine (42.52 g/100g) values while the sun-dried sample had the lowest peroxide value (20.63Meq/kg). On the contrary there were no significant ($P \geq 0.05$) differences in the saponification values of sun and oven-dried samples and so were the specific gravity (1.02) and refractive index values (1.46) across the samples.

Table 2: Physicochemical characteristics of the experimental cashew nut flour oil

Samples	Roasted	Sun-dried	Oven-dried
SG	1.02±0.00[a]	1.02±0.00[a]	1.02±0.00[a]
RI	1.46± 0.01[a]	1.46±0.05[a]	1.46 ±0.01[a]
SV (mgKOH/g**)**	141.33±0.11[b]	139.50±0.56[a]	139.50 ±0.56[a]
PV (Meq/Kg)	22.35 ±0.06[b]	20.63±0.90[a]	20.65±0.02[a]
AV (mg KOH/g)	12.60 ±0.04[a]	12.45±0.10[a]	12.39±0.14[a]
IV (g/100 g)	43.47±0.11[b]	43.79±0.18[b]	42.52±0.25[a]

Values are Means ± standard deviation of three replicates

Mean values with different superscripts within the same column are significantly different ($p \leq 0.05$) from each other. SG= Specific gravity, RI=Refractive index, SV= Saponification value, PV=Peroxide value, AV= Acid value, IV=Iodine value.

Discussion

The moisture content obtained in this study showed that the cashew nut flour sample could have a long shelf life since the moisture content was lower than the maximum (12 to 14%) acceptable range for flours (13). The values of the crude fibre were lower than the 4.41% reported by Omosuli et al. (5). A diet low in fibre is undesirable as it could cause constipation and such diets have been associated with diseases of the colon like piles, appendicitis and cancer (14).

The fat content of the flour samples in this study were a higher than that reported in previous studies (12, 15). These differences might be due to varietal difference and the age of maturity in the species of cashew nut used in the study. The fat content of about 40% which was the highest of the constituents of the flour samples showed that cashew nut is an oil seed. Fat values obtained in this study agreed with 42% reported by Aremu et al. (16). The crude fat of the samples (40.16 – 42.13%) are higher than 36.7% reported by Aremu et al. (17) in cashew nut flour. This might be due to differences in the specie of the cashew nut and the environment in which they are grown. Fat promotes the absorption of fat-soluble vitamins hence it is very important in diets. This value of fat is an indication that cashew nut flour is a good oil seed when compared to 23.50% soybean seed oil (18).

The high protein content reported in this work agreed with the finding of Paul and Southgate (19) on cashew nut. The protein content (22.05-23.97%) was a little lower than what was previously reported by Achal (20) The high protein content of the cashew nut as shown in this and previous studies is an indication that cashew nut flour is nutritious (21) and could contribute 23.6g of protein to the daily protein need of an individual. Protein also plays a key role in the organoleptic properties of foods (12).

The iodine value of 123g/100g for *Citrullus colocynthis* as reported by Achal (20) was higher than that observed in this study. Iodine value is an index of rancidity and storability of the oils; it measures the degree of unsaturation in the oils. The high iodine value might make the oil to be suitable for margarine production because hydrogenation might be easy. This could mean that cashew nut flour oil samples were stable and could have long shelf-life. It was observed that the oven-dried sample had the lowest iodine value, which might be due to its limited confinement and availability of oxygen during the drying process.

The low saponification value was an indication that the oil might not be suitable for soap making. Roasted sample had the highest SP value which showed that roasting leads to deterioration of the oils. This could be due to the amount and duration of exposure to heat and temperature of roasting. The RI is the measure of clarity, thickness and viscosity of the oil. The RI and SG showed no significant differences within the samples, and this would affect the rate of flow which might require more pressure to enhance its flowing property. The RI and SG values observed were lower than the values (1.69, 0.94, respectively) reported by Akinhanmi et al. (15) who worked on cashew nut and (1.45 and 0.96, respectively) for cashew kernel oil.

Conclusion

Roasting, sun and oven-drying had significant effects on the proximate composition of the cashew nut flour samples and the physicochemical properties of the cashew nut flour oil samples but no significant effect on the RI and SG of the oil samples while the PV, IV and AV were affected. The oven-dried sample had the lowest rancidity index values, therefore oven-drying method could be recommended for the production of storage stable cashew oil and flour for culinary purposes.

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