International Journal of Engineering and Environmental Sciences | ***ISSN 1694-4372***
Published by AIR JOURNALS | *https://airjournal.org/ijees*
16/18 Avenue des Longaniers, Quatre Bornes, Mauritius
airjournals@gmail.com; enquiry@airjournal.org

RESEARCH ARTICLE

Proximate Analysis of Processed Cashew Nut (*anacardium occidentale l.*) An agricultural Processed Food Produce

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Citations - APA

Okolotu G. I., Adaigho D.O., Akwenuke O.M., Oluka S.I., Udom E.A., & Uguru H. (2024). Proximate Analysis of Processed Cashew Nut (anacardium occidentale l.) An agricultural Processed Food Produce. *International Journal of Engineering and Environmental Sciences, 7(1), 1-10. DOI: https://doi.org/10.5281/zenodo.10776017*

The Proximate analysis of the processed cashew nut is of great importance in identifying its major constituents. Prior sample collection and preparation, ash content, moisture content, fat/lipid content, crude fiber, crude protein, and carbohydrate content were proximately analyzed. The processed cashew fruit nut contained 11.0% ash, 4.95% moisture, 30.0% fat, 33.0% crude fiber, 0.36% protein and 20.69% carbohydrate. It was found that the processed cashew fruit nut possesses more crude fiber, lipid and carbohydrate. Based on the finding, extraction of these component nutrients from these processed agricultural food produce and their application in the synthesis of food supplement and ration will help in food supplementation. More improvement in the industrial processing capacity of this agricultural food produce is an ideal recommendation.

Keywords: *Proximate Analysis; Cashew Nut; Ash Content; Moisture Content; Fat/Lipid Content; Crude Fiber; Crude Protein; Carbohydrate Content*

Introduction

The need for production of agricultural processed food produce abound. In 2011, the value for non - timber forest products (NTFPs) worldwide reached 88 billion USD (Manourova *et al*. 2019). The impact of the cashew fruit nut, an agricultural processed food produce can be improved and more utilized.

Cashew fruit nut (*Anacardium occidentale L*.), belong to the Anacardiaceae family and is an evergreen native tree from northeast region of Brazil which expanded spontaneously in South American countries. They are native to South America, specifically Brazil and were introduced by colonists to Africa and India (Ware and RDM, 2018). From India, cashew trees spread all over Southeast Asia (Rico *et al.* 2015). A typical example of cashew fruit with nut can be seen in figure one (1) below;

Figure 1: Cashew Fruits with Nuts

The cashew nut (*Anacardium occidentale)* produces nuts, the kernels of which have increased considerably in economic importance over the past few decades (Nandi, 2023). Its utilization extends worldwide including in Africa. The processed cashew fruit nut is one of the most consumed nuts in the world. From 2017 to 2021, the top ten exporters of cashew nuts were Vietnam, India, the Netherlands, Germany, Brazil Ivory coast, Nigeria, Indonesia, Burkina Faso, and united states, with almost all cashews produced in between 2000 and 2019 exported as raw nuts which are much less profitable than shelled nuts (Wikipedia, 2023). Cashew nut refers to its kernel. Many scholars reported that cashew kernel is being considered as a high-value agricultural commodity, and interestingly increasing and expanding in international trade because global kernel demand is predicted to increase over the following decade (The World Bank, 2016).

Cashews have recently been used to make dairy alternatives, such as cashew milk, cashew - based cheese and cashew – based cream sauces and sour cream (ware and RDM, 2018). It is also processed to cashew butter and other products. Cashew nut processing methods have evolved over the years. There are five major processing steps are: preparation of the in-shell, removal of the shell, peeling, grading and packing. Frey (2022) noted that cashew nuts can be preserved for about three months if stored in an air tight container, at room temperature up to six months if stored in the refrigerator, and about one year if freeze. However, the best way to store this agricultural food produce is the first step.

Materials

The major materials used for this research are processed cashew nut. The processed cashew nut can be seen in figure two (2) below;

Figure 2: Cashew Nut and Processed Cashew Nut

Other materials include; Muffle furnace (Gallenkemp), Water Bath (PIO), Hot plate (YH-series), Electronic weighing balance (O'Harus), Oven (P6450 Hanau), Grinder (Heues), Crucible, 250ml conical flask, Test tubes, Beaker, Kjeldal flask, Distillation apparatus, Soxhlet extractor, Spatula, Volumetric Flask, Conical Flask, Measuring Cylinder, Thermometer, Petri dish, Titration Apparatus, Reagents like Ethanol (JHD Chemicals), Sulphuric Acid (Bio-Achez Laboratory Chemicals), Sodium Hydroxide (SCP chemicals), Sodium sulphate (SCP chemicals), Copper sulphate (M&B Lab Chemicals), Boric acid (Oxford lab Chemicals), Methyl red (Oxford lab Chemicals), N hexane (JHD Chemicals), Zinc metal (Oxford lab Chemicals), Distilled water.

Methods

Methodologies applied in this research include sample collection and preparation, and proximate analysis. These are presented below.

1. Sample Collection and Preparation 10 kg bag of the industrial cashew nuts were processed locally and taken to the laboratory for experimental analysis. The mechanical grinder was used to grind 5kg laboratory sample of the industrial processed cashew nut into powdered form. The grounded sample was properly sieved with a rubber sieve. The sieved sample was stored in a clean container and was used for the purpose of its proximate determination.

2. Proximate Analysis Proximate analysis prior this research involves the determination of the constituents of the following parameters: ash content, moisture content, fat/lipid content, crude fiber, crude protein, and carbohydrate content. These analyses were in line with the guidelines of Joy *et al*. (2015), and Adoyo and Onyango, (2021). The methods used in obtaining the proximate analysis of these parameters are presented in sub - contents below;

i Ash Content: An empty platinum crucible was washed, dried and weighed and the weight was recorded. 2g of the sample was weighed and added to the crucible which was weighed again. The crucible was then placed in the Bunsen burner until it turned ash. The ashen material was weighed and the weight was recorded. The formula for the Ash content can be seen below:

$$\% \text{ Ash Content} = \frac{W_3 - W_1}{W_2 - W_1} \times \frac{100}{1} \quad \text{(Eq. 1)}$$

Where:

W_1 = Weight of Empty crucible

W_2 = Weight of crucible + Weight of Sample before Ashen

W_3 = Weight of Crucible + Weight of Ashen sample

Also;

$W_3 - W_1$ = Weight of Ash

$W_2 - W_1$ = Weight of Sample

ii Moisture Content: An empty petri dish was weighed and 1g of the sample was added to the petri dish. The petri dish containing the added sample was also weighed and the weights were recorded (Weight of petri dish with added sample minus weight of empty petri dish resulted to weight of sample). The sample was then subjected to oven drying for One hour (1hr), after which the weight was recorded (Within this period of the one hour oven drying, there were continuous weighing until a constant weight was obtained after 30minutes of the oven drying). The various weights obtained were applied in the moisture content formula below:

$$\% \text{ Moisture Content Loss} = \frac{W_1 - W_2}{W_1} \text{ x } \frac{100}{1} \text{ (Eq. 2)}$$

Where:

W_1 = Weight of petri dish + sample before drying

W_2 = Weight of Petri dish + sample after drying

$W_1 - W_2$ = Moisture Loss

iii Fat Content: The extraction of fat was carried out using soxhlet extractor which consists of condenser, hot plate, thimble, *etc.* 5g of the sample were wrapped in a filter paper and placed in the soxhlet extractor and N - haxane was placed on the flask below the thimble. The system was allowed to recycle within 8 - 9 times upon which the maximum quantity of oil was obtained and the solvent recovered. An empty beaker was weighed and the solution containing the oil was poured into it, subjecting the beaker to heating for hours until the remaining N - haxane evaporated from the oil. The beaker containing the oil was allowed to cool and weighed. The formula for the fat content can be seen below;

$$\% \text{ of oil and fat} = \frac{W_o}{W_s} \text{ x } \frac{100}{1} \text{ (Eq. 3)}$$

Where:

W_o = Weight of oil

W_s = Weight of sample

And;

Weight of sample = 5g

Weight of oil = $W_{ob} - W_b$

Where:

W_b = Weight of empty beaker

W_{ob} = Weight of oil + beaker

iv Crude Fiber 2g of the sample was weighed in a 250ml conical flask and 1.25% H_2SO_4 was added to it and heated for 30 minutes (a process known as acid treatment). The solution was filtered followed by washing off the residue

with hot water in order to neutralize the acidic solution. The residue was re-soaked with 200ml of 1.25% of NaOH and was heated for 30 minutes. A filter paper was weighed and used to filter the solution, after which it was dried in an oven and weighed again. The dried sample on the paper was transferred to already weigh crucible placed in a Bunsen burner for ashing. The crucible was cooled using the desiccators and was weighed again. The formula for the Crude fiber content can be seen below:

$$\% \text{ Crude fiber} = \frac{W_F}{W_S} \text{ X } \frac{100}{1} \text{ (Eq. 4)}$$

Where:

Weight of sample (W_S) = 2g

Weight of fiber (W_F) = $W_R - W_A$

And:

Weight of residue (W_R) = $W_2 - W_1$

Where;

W_1 = Weight of filter paper

W_2 = Weight of residue + Weight of filter paper after oven drying

Also;

Weight of ash (W_A) = $W_4 - W_3$

Where;

W_3 = Weight of Empty crucible

W_4 = Weight of crucible + Weight of ash after ashing

v Crude Protein 1g of the sample was weighed into a kjethahyl flask. 10g of sodium sulphate, 1g of copper sulphate and 20ml of sulphuric acid were added to the flask which was subjected to heating until the solution turned bluish green (that is complete digestion). The mixture was allowed to cool for 24hrs and 200ml of distilled water was added to dissolve the mixture. A distillation set up was made and 20ml of the digested solution was measured and poured into the flask with additional 10ml of 40% sodium hydroxide solution; 0.5kg grounded pieces of Zinc metal were added. In the other receiving flask, 5ml of 1% Boric acid was added with 2 drops of methyl red indicator. Complete distillation was observed immediately the solution turned yellow from the receiving end of the distillation flask. The yellow solution formed was titrated with 0.1M HCl. The end point was recorded at a pink color observation. The same procedure was used for the blank test. The formula for the crude protein content can be seen below:

% Crude Protein = %N x 6.25 (Eq. 5)

Where:

%N = percentage Nitrogen

6.25 = Standard for crude Protein

And;

$$\%N = \frac{(V_A - V_b) \times C_{HCL} \times M_N}{1 \times 1000}$$

Where:

V_A = Volume of acid used (HCL solution consumed during titration)

V_b = Volume of standard HCL solution consumed during titration for blank

C_{HCL}= concentration of HCL (mol/l)

M_N = Nitrogen molar mass (g/mol)

vi Carbohydrate Content The carbohydrate content was calculated by adding the entire nutrient values, and subtracting the obtained value from 100. This can be represented below;

Carbohydrate = 100 - (Ash + Moisture + Lipid + Fiber + Protein) (Eq. 6)

Results

The results obtained from this research are presented below:

Table 1: The results of the proximate analysis for various agricultural food parameters

S/N	TEST	RESULT
1	Ash content	11.0%
2	Moisture content	4.95%
3	Fat/Lipid content	30.0%
4	Crude fiber	33.0%
5	Protein content	0.36%
6	Carbohydrate	20.69%

The percentage (%) values of the nutrients in the agricultural processed food produce are presented in the figure one to seven (1 – 7) below;

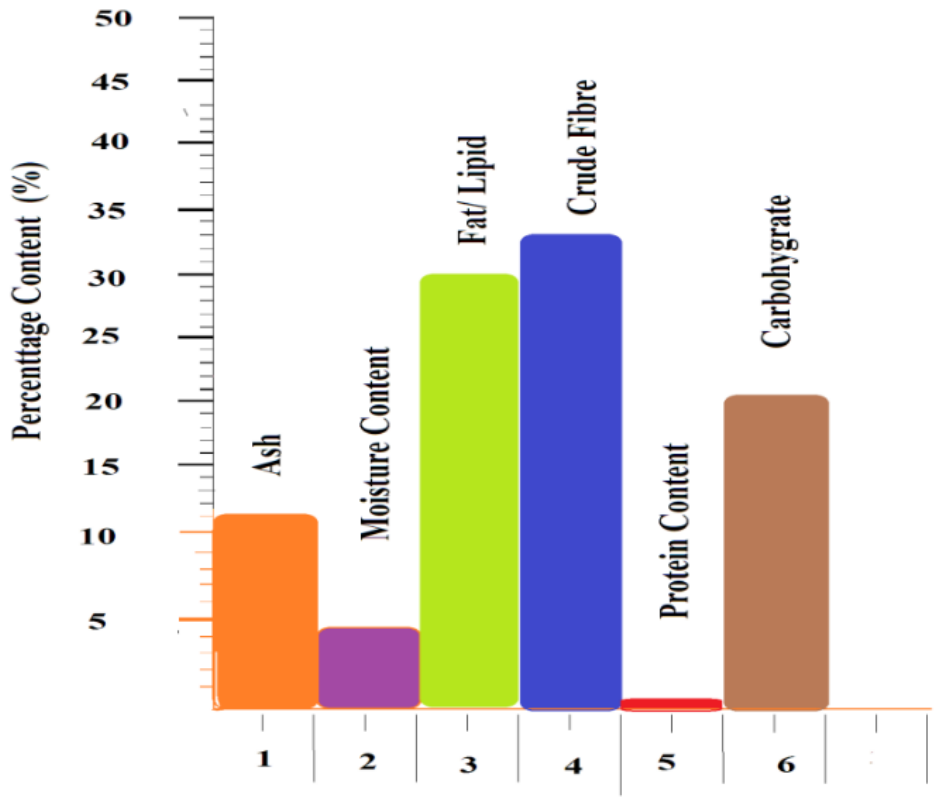

Figure 2: Percentage (%) values of the nutrients in the processed cashew nut

Discussion

The processed cashew fruit nut contained 11.0% ash, 4.95% moisture, 30.0% fat, 33.0% crude fiber, 0.36% protein and 20.69% carbohydrate. Thus, the crude fiber content was higher than the other analyzed components in the cashew fruit nut, while the protein content showed the least value. Other component values were in between. Nandi (2023) noted that cashew nut comparative nutritive values are: protein 21.2, fat 46.9, fiber 1.3, and carbohydrate 22.3. He also noted that wide differences in the protein content ranging from 13.13 to 25.03% have been reported from various region of India. Both values were at close range except for protein value. Bhat (2008) noted that kernel compositions of Cashew nuts were 21.0% protein, 47.0% fat, 22.0% carbohydrate, 1.3% fiber. He did not report moisture content value. Carbohydrate was above both range by 2 %, fat was high in all results.

Conclusions

With the presence of these notable contents of nutrient parameters analyzed in the samples, a conclusion was thus summarized that "the processed agricultural food produce (cashew nut) possess appreciable amounts of nutrients which are of great nutritional benefits to both humans and livestock. It was found that: the processed cashew fruit nut possesses more content of crude fiber, lipid and carbohydrate.

Recommendations

Base on the finding, improvement in the industrial processing capacity of this agricultural food produce is an ideal recommendation.

Extraction of these component nutrients from this processed agricultural food produce and their application in the synthesis of food supplement and ration will help in food supplementation.

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