Chemistry Research Journal, 2018, 3(3):168-178

Available online www.chemrj.org

Research Article

ISSN: 2455-8990
CODEN(USA): CRJHA5

Nutritive Mineral Content of *Dichrostachy cinerea* (Sickle bush) Seeds and Fruits

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Abstract The proximate chemical analysis of Seeds and Fruits of *D. Cinerea* for the first time was carried out using established methods. The analysis results obtained showed that the seeds and fruits moisture contents are 5% and 3.75%, respectively crude lipid of seeds; 7.3% crude protein of seeds and fruits; 22.13% and 10.84%, respectively crude fiber content of seeds and fruits 35.5% and 27.25%, respectively ash content of seeds and fruits are 18.5% and 10% respectively, carbohydrate content of seeds and fruits are 11.57% and 48.16% respectively. The elemental mineral analysis showed that the seeds contain 84.64±0.36 $mgKg^{-1}$ Na, 540.94± 4.05 $mgKg^{-1}$ Ca, 66.68 ± 0.55 $mgKg^{-1}$ Fe, and 738.43 ± 10.59 $mgKg^{-1}$ Mg, and the Fruits contain 0.81 ± 0.01 $mgKg^{-1}$ Na, 1.81 ± 0.04 $mgKg^{-1}$ Ca, 0.39 ± 0.02 $mgKg^{-1}$ Fe, and 2.89 ± 0.03 $mgKg^{-1}$ Mg. The high level of ash content is an indication that D. cinerea seeds are rich in mineral and can be good supplement the feed formulation in both man and animal nutrition.

Keywords *Dichrostachy cinerea*, fruits, nutrient, minerals, seeds

1. Introduction

A lot of proximate and minerals analysis had been carried out on different plants and animals in different parts of the world.

Ali [1] carried the proximate composition and minerals constituents of *Asparagus officinialis* stem were evaluated using standard methods. The stem contained; 10.70%, 32.69%, 3.44%, 18.50% and 34.67% ash, crude protein, crude lipid, crude fiber and carbohydrate respectively. Stem also has high energy value of 384.27Kcal/100g dry weight. Mineral ranges (in mg/100g dry Wt) where K (10.94), Na (1.84), Ca (0.67), Fe (0.19) and Zn (2.60). Comparing the tuber mineral content with recommended dietary allowances (RDA), the results indicated that *A. officinalis* stem could be a good supplement of nutrient such as protein, potassium and carbohydrate.

Akinniyi and Waziri [2] conducted an experiment on the proximate value and mineral content of the shoot of *Borassus ethiopumuant* (Ginginya). The experiments were carried out using standard techniques and results showed that *muruchi(Borassus ethiopumuant* seedling's name in Hausa language*)* has very high carbohydrate (83.00%) and low fat (1.49%), Moisture (50.40%), crude protein (4.90%). The concentration of minerals in part per million (ppm) as present in the *muruchi* are K (4600±150.30), Na (3150±9.22), Cu (500±31.05), Zn (35±1.36), Cd (20±80). *Muruchi* can therefore be used as supplementary carbohydrate and energy sources for human nutrition.

The proximate evaluation of chufa (*Cyperus esculentus*) by Shaker *et al* [3]. Tubers with emphasis on the characterization of its oil extraction as composition of both oils were analyzed by gas-liquid chromatography (GLC). Minerals content of chufa tubers were analyzed by atomic absorption spectrophotometer. Also amino acid content of chufa tuber was determined by amino acid analyzer, chufa tuber coated with chocolate was prepared from chufa tubers and sensory quantities were evaluated, as compared with commercial peanut coated with chocolate. Result indicated that chufa tubers were characterized by high level of starch (250/kg), and high fat content (30.10%).

Tubers contained significant amount of tuber (4.30%), rich in Ca (152.00ppm) P (123.00ppm) and Na (140ppm). Moreover, chufa tubers are good source of total amino acids. The Amino acids profile was dominated by aspartic acid which resulted from the conversion of asparagines [4]. Other important amino acids were Glu, which resulted from glutamine, followed by Leu, Ala and Arg, followed by remarkable that the chufa and olive oils are similar in fatty acid composition chufa and olive oils contained palmitic acid as the main saturated acid and oleic acid as the predominant unsaturated acid. The results obtain show that chufa coated with chocolate from tuber was cheaper, more nutritious and highly acceptable healthy food.

Adinortery *et al*., [5], carried out the photochemical screening, proximate and mineral analysis of *Launea taraxacifolia* leaves. The result of the study indicates that *Launea taraxacifolia* leaves are good sources of useful nutrients and could be used to fulfill the growing demands of plant-based for Ghanaians. Analysis was carried out in Birnin Kebbi, Kebbi state on the level of trace metals in selected vegetable crops collected from Birnin Kebbi market by Omogbehin and Osesua [6] using atomic absorption spectroscopy (AAS). The result showed that the trace metals concentration in the vegetables were in the range of 0.15±0.04 – 0.21±0.05mg\kg for Cu, 0.52±0.03 – 2.70±0.45mg\kg for Zn, o.11±0.04 – 0.28±0.02mg\kg for Cr, 6.10±0.18 – 10.50±0.71mg\kg for Fe, 0.24±0.10 – 0.86±0.14mg\kg for Ni and Pb. They concluded that the level of these metals were low with respect to the proposed maximum acceptable concentration for human consumption.

The study was conducted to determine the proximate composition and mineral analysis of cinnamon [7] the caloric value was calculated from crude protein, crude fat, crude fiber, carbohydrate, moisture and ash content. The iron, zinc calcium, chromium, manganese and magnesium were determined by atomic absorption spectrophotometer, sodium by flame photometer, and phosphorous by spectrophotometer. The results revealed that cinnamon contain ash (24%), crude protein (3.5%), crude fat (4%), crude fiber (33.0%), moisture (5.1%), and carbohydrate (5.2%) while the mineral determination gave the data that cinnamon contain iron (7.0mg/g), zinc (2.6mg/g), calcium (85.5mg/g), chromium (0.4mg/g), manganese (20.1mg/g), magnesium (85.5mg/g), sodium (0.0mg/g), potassium (134.7mg/g) and phosphorus (42.4mg/g). The study conducted that the tested cinnamon contained highest amount of carbohydrate and lowest amount of ash. Similarly, among the minerals tested cinnamon contained highest amount of potassium and no sodium at all.

Proximate analysis of dragon fruit (*Hylecereous polyhizus*) were carried out in Maleka, Malaysia to determine the moisture content, water activity, ash, crude fiber, glucose and ascorbic acid by Ruzainah and Ahmad [8]. Ash, moisture, fat, and crude fiber were determined using the standard operation procedure (SOP) while the crude protein was determined using micro Kjeidhal method, water activity was determine using spring water activity equipment while ascorbic acid using reflectometer, glucose concentration was determined using 2g of fresh polyhizus stem. The results of this analysis showed 96% moisture, 0.270g of protein, $0.55gL^{-1}$ glucose per fruits; young stems were found to have higher value than the mature stem of the dragon fruit which may be helpful in preventing the risk factors of certain diseases.

Berezi *et al* [9], investigated the effect of processing on the nutrients value of *xanthosoma sagittifolium* and *colocasia esculenta* fresh leaves. In their conclusion, they said that *xanthosoma sagittifolium* and *colocasia esculenta* leaves contained a considerable amount of micronutrients and proteins and that the processing methods of blenching and drying significantly reduced the nutrient content of both species and were observed to be within the acceptable range of the daily dietary requirement that they can therefore serve as a good substitute for the conventional vegetables.

Awosanya *et al* [10] results of the proximate analysis of edible species of mushroom collected from Akoko land in Ondo Nigeria, indicated that *Termilomyces manmiforiuis* was a good source protein (37%), crude (7%), ash (10%), calcium (216mg/kg dry Wt), manganese (136mg/kg dry Wt). *Russsula Vesia* was the richest in carbohydrate (71%) and magnesium (14mg/kg), while *lactarices iriviralis* was richest in moisture (37%), iron (1230mg/kg) and copper (8mg/kg), it is also a good source of carbohydrate (64%), calcium (210g/kg) and manganese (120mg/kg). *Lentnus tigrinus* was however, richest in dry matter (94%) and also rich in carbohydrate (62%), magnesium (11g/kg), and copper (6mg/kg). It was observed that liquid, sodium and phosphorus contents of four species where generally very low.

An analysis was carried out in Minna, Niger State in Nigeria for the proximate and mineral analysis of *Telfairia occidentalis* leaves using AOAC [11]. Crude fiber content of 20.17 ± 0.12% in the leaves of *Telfairia occidentalis* indicated that the leaves of this plant are good sources of dietary fibers compared to the RDA [15]. Higher carbohydrate of 39.64 ± 0.01% lead to a corresponding increase of energy. Mineral analysis gave the result as K; 2760.05 ± 0.02mg/L 100g, Cu; 1.72 ± 0.02/mg/100g, Mg; 76.46 ± 0.012mg/100g, which indicates that the leaves of *Telfairia occidentalis* are good source of K, Cu, Fe, and Mn, so also its serve as moderate source of Mg and Zn when compared to their RDA and it was concluded that they are essential in human and animal nutrition [12]. Proximate and mineral analysis was carried out in Pakistan on Roasted and defatted cashew nut (*Anarcadium occidentas*) flour by Aregheore [13]. The proximate composition (%) was as follows; moisture, 5.52 ± 0.2, ash, 4.41 ± 0.1, crude fat, 34.95 ± 0.2, crude protein, 27.31 ±0.0, crude fiber, 1.52 ± 0.2 carbohydrate (by difference) 25.39 and energy (Kcal) 534.35. The result of the mineral composition (mg/100g) showed that roasted and defatted cashew nut flour contains calcium (21.4 ± 0.23) potassium (38.5 ± 0.1) magnesium (36.4 ± 0.3) iron (0.8 ± 0.1) zinc (0.9 ± 0.1) sodium (22.6 ± 0.2) copper (0.4 ± 0.1). It was concluded that the flour is a good source of energy, protein and minerals. The instrument used in the analysis of minerals was the atomic absorption spectrophotometer.

Gafar, *et al* [14] studied the Foliage of hairy indigo (*Indigofera astragalina*) obtained from Sokoto State for their nutritional values. The proximate composition revealed that the presence of moistures, ash, crude lipid, crude fiber, crude protein and carbohydrate is higher than RDA [15] values. The energy value was found to be 578.87kcac/100g. The minerals analysis revealed that potassium 14.55±0.17mg/100g, sodium 0.33±0.16mg/100g, calcium 11.4 ± 0.01mg/100g, copper 0.02±0.00mg/100g, zinc 0.11±0.00mg/100g, iron 20.95±3.84mg/100g, and manganese 0.43±0.01mg/100g. The estimation of the various food parameters in

Indigofera astragalina plant, was carried out using the method of AOAC [11]. While the mineral analysis was determined, using atomic absorption spectrophotometer (AAS). The results showed that leaves of hairy *indigofera astragalina* contained essential nutrients which compete favourably well with those of wild edibles leaves.

Nigerian green vegetables were intercropped with *Raphia palms*. The leaves of the vegetables and *Raphia* were harvested. The proximate and mineral content of the leaves were analyzed by standard method. The proximate composition was determined by standard method [11]. The proximate composition results (mean) range between 72.9-91.2 % moisture 1.3-3.0 %, protein 0.3-3.0 %, lipid 1.5-4.2 %, crude fiber 1.0-4.0 %, ash and 2.5-10.0 %, carbohydrate. The mineral elements detected were in various concentrations and the health implications in the nutrients were detected in human physiology [16]

An analysis was carried out in Birnin Kebbi; Kebbi State in Nigeria on the level of Trace metals in selected vegetable crops collected from Birnin Kebbi Market by Omogbehin and Osesua [6] using Atomic absorption spectrophotometer (AAS). The result showed that the trace metals concentration in the vegetables were in the range of 0.15±0.04 – 0.21 ± 0.05 mg/kg for Cu, 0.52±0.03 – 2.70± 0.45 mg/kg for Zn, 0.11 ±0.04 – 0.28± 0.02 mg/kg for Cr, 6.10± 0.18 – 10.50±0.71 mg/kg for Fe, 0.24±0.010 – 0.86± 0.14 mg/kg for Ni and Pb. They concluded that level of these metals were low with respect to the proposed acceptable concentration for human consumption.

An analysis was carried out in Bauchi on the Nutritional composition of *Vitex doniana* (Black plum) fresh leaves. AOAC [11] method was used in the analysis. The result showed crude fiber – 109/63 gkg^{-1}, crude lipid –51.87 gkg^{-1}, total ash – 352.00 gkg^{-1} and non reducing sugar – 13.70gkg^{-1}. These values suggested that these leaves too can be used as nutrient supplement. Similarly, mineral content were: phosphorous – 180 $mgkg^{-1}$, iron -135.00 $mgkg^{-1}$, potassium – 55.2 $mgkg^{-1}$, sodium – 53.20 $mgkg^{-1}$, and Manganese 0.03$mgkg^{-1}$. The rich iron content of 135.00 $mgkg^{-1}$ suggested that black plum could be a good source of iron for anaemics [17].

1.1. Aim

To determine the proximate contents of seeds and fruit of *D. cinerea.*

1.2. Objectives

The objectives of the research are:

i. To determine % of Moisture contents in *D. Cinerea* seeds and fruit
ii. To determine % of Crude protein content *D. Cinerea* seeds and fruit
iii. To determine % of Ash content *D. Cinerea* seeds and fruit
iv. To determine % of Carbohydrate content *D. Cinerea* seeds and fruit
v. To determine % of fat (lipid)
vi. To determine % of minerals (Fe, Na, Ca, and Mg) content of the seeds and fruit of *D. Cinerea*

1.3. Significance of the Study

This study will help in determining the nutritional content of the seeds and fruit of *D. Cinerea* which will help in the proper utilization of the seeds and fruit, and it will provide more information about its importance in the society as food and medical purposes. And it will also serve as a reference for further work on the *D.Cinerea* seeds and fruit analysis.

1.4. Statement of the Problem

The *D. cinerea* seeds and fruit are popularly used as agricultural fodder in animal rearing but it is nutritional value and mineral content of the seeds and fruit is not known based on the available literature. Therefore there is need to provide much information about the plant to harness its potential benefits.

1.5. Scope and Limitation of the Study

This work will be limited to the study of nutritional value of *D. cinerea* seeds and fruit from Malam Sidi village in Kwami local government area of Gombe state, Nigeria. The data generated from this study will not be enough to conclude on the nutritional content of the seeds and fruit of *Dichrostachys* species because there are many different varieties (species) in different part of the world beside, the soil differences that the plant grow on may affect the mineral and protein content of the species under study (*D. Cinerea*) therefore the result may not be the same for the specie grown under different soils and possible weather factors.

2. Experimental Work

2.1. Sampling (Data Collection and Preparation)

The fresh seeds and fruit of *Dichrostachys cinerea* were collected in Malam-Sidi Kwami, L.G.A of Gombe State, of Nigeria. The seeds were obtained from the fruit by hand picking. The seeds were air dried, and crushed into fine powder using laboratory mortar and pestle, like-wise the fruits coat were also air dried and crushed into fine powder using laboratory motar and pestle.

2.2. Materials

All the materials and reagents used for the study were of analytical grade. Sulphuric acid, sodium hydroxide, ethanol, hydrochloric acid, nitric acid, petroleum ether, distilled water,

2.3. Apparatus

The instrument used in the analysis includes:
Laboratory motar and pestle, Muffle furnace, Oven, Micro-Kjedhal instrument, UV/visible spectrophotometer, model PFP7, filter paper, conical flask, beakers, round-bottom flasks, soxhlet extractor, electronic weighing balance, whatman filter paper, test tubes, burette, atomic absorption spectrophotometer, fume cupboard and desiccators.

2.4. Proximate Analysis

All the analyses were carried out in triplicate.

2.4.0 Moisture content determination

This is a measure of the % moisture lost due to drying at a temperature of 105 ^{o}C. This was done according to Udo and Ogundele [18]. 2g of the fresh seeds and fruit of *Dichrostachys cinerea* were weighed (W_1) into weighed

crucible (W_0) and placed into a hot drying oven at 105°C for 24hours. The crucible was removed, cooled in a desiccators and reweighed. The processes of drying, cooling and weighing were repeated until a constant weight (W_2) was obtained. The weight loss due to moisture was obtained by the equation.

$$\% \text{ Moisture} = \frac{W_2 - W_0}{2g} X\ 100\ \% \quad (1)$$

Where

W_0 = Weight of the empty crucible, (g)
W_1= Weight of fresh sample 2g+ empty crucible, (g)
W_2 = Weight of dried sample + empty crucible (g)

2.4.1. Determination of Ash Content

This is the measure of the residue remaining after combustion of the dried sample in a furnace at a temperature of 600°C for 3 hours. This was done according to James [19]. 2g of the powdered seeds and fruit sample was weighed (W_1) into weighed empty crucible (W_0) and placed into a muffle furnace at 600°C for 3 hours. The ash was cooled in a desiccator and weighed (W_2). The weight of the ash was determined by the difference between the powdered seeds and fruit sample, weighed crucible and the ash in the crucible percentage ash was obtain by equation (2).

$$\% \text{ Ash } = \frac{W_2 - W_0}{2g} X\ 100\ \% \quad (2)$$

Where

W_0 = Weight of empty crucible, (g)
W_1 = Weight of crucible and powdered sample, (g)

2.4.2. Fatty materials Content Determination

Two (2) gram of the *Dichrostachys cinerea* seeds and fruit sample was place on a filter paper and put into the extractor of the soxhlet extractor and extracted into a weighed round bottom flask with low boiling point petroleum ether (40-60 °C) using a soxhlet extractor for 8 hours. The solvent was recovered by rotary evaporation, and drying was completed in a freeze dryer. Finally the flask and its content were heated at 90 °C in an oven for 2 hours, and cooled in a desiccator and weighed. The process of heating and cooling were repeated until a constant weight was obtained.

$$\% \text{ Fatty material } = \frac{\text{Weight of fatty material}}{5g} X\ 100\ \% \quad (3)$$

2.4.3. Crude Protein Determination.

Crude protein was determined using the micro-Kjedhal method as described by AOAC [11]. The principle of this method is based on the transformation of nitrogen of protein and that of the other nitrogen containing organic compounds, other than nitriles and nitrates into ammonium sulphate by acid digestion.

$$\text{Sample Nitrogen} + H_2SO_4\ (aq.) \longrightarrow (NH_4)_2SO_4\ (aq.)$$
$$(NH_4)_2SO_4(aq) + 2NaOH \longrightarrow 2NH_3(aq) + 2H_2O + Na_2SO_4(aq)$$
$$NH_3 + H_3BO_3(aq) \longrightarrow NH_4^+ + H_2BO_3(aq)$$
$$4H_4(aq) + H_2BO_3(aq) \longrightarrow NH_4^+ + H_2BO_3^-(aq)$$

The sample (2g) was weighed along with 20cm^3 of distilled water into a micro Kjedhal digestion flask. It was shaken and allowed to stand for some time. One tablet of selenium catalyst was added followed by addition of 20cm^3 conc. H_2SO_4. The flask was heated on the digestion block at 100°C for 4 hours until the digest became clear. The flask was removed from the block and allowed to cool. The content was transferred into 50cm^3 volumetric flask and diluted to the mark with water. An aliquot of the digest (10cm^3) was transferred into another micro Kjedhal flask along with 20cm^3 of distilled water and placed in the distilling outlet of the micro-Kjedhal distillation unit. A conical flask containing 20cm^3 of boric acid indicator (2% boric acid contains bromo-cresol green methyl red

indicator) was placed under the condenser outlet. Sodium hydroxide solution ($20cm^3$, 40%) was added to the content in the Kjedhal flask by opening funnel stop cock. The distillation started and the heat supplied was regulated to avoid sucking back. When all the available distillate was collected in $20cm^3$ of boric acid, the distillation was stopped. The nitrogen in the distillate was determined by titrating with 0.01M of H_2SO_4. The end point was obtained when the colour of the distillate change from green to pink.

Crude protein is a measure of nitrogen in the sample. It was calculated by multiplying the total nitrogen content by a constant 6.25. this is based on the assumption that protein contain about 16% N which include both true protein and non-protein N and does not make a distinction between available or unavailable protein [18].

The crude protein was calculated using the equation;

% crude protein = % N × 6.25

The nitrogen content of the sample is given by the formula below.

$$\% = \frac{\mathrm{TV} \times \mathrm{Na} \times 0.014 \times \mathrm{V_1} \times 100}{G\ X\ V_2} X\ 100\ \% \qquad (4)$$

Where

TV = Titre value of acid (cm^3)

N_a = concentration or Normality of acid.

V_1 = Volume of distilled water used for distilling the digest ($50cm^3$) V_2 = Volume of aliquot used for distilling the digest ($10cm^3$)

2.4.4. Determination of Crude fibre Content

Percentage of crude fiber was determined by the method described in Udo and Ogundele (1986) [18]. In which 2g of ground sample was weighed (W_o) into a $1dm^3$ conical flask. Water ($100cm^3$) and $20cm^3$ of 20% H_2SO_4 were added and boiled gently for 30minutes. The content was filtered through whatman No.1 filter paper. The residue was scrapped back into the flask with a spatula and $100cm^3$ of water and $20cm^3$ of 10% NaOH were added and allowed to boil gently for 30minutes. The content was filtered and residue was washed thoroughly with hot distilled water, then rinsed once with 10% HCl and twice with ethanol and finally 3 times with petroleum ether. It was allowed to dry and scrapped into the crucible and dried over night at 105 ^oC in an air oven. It was then removed and cooled in a desiccator. The sample was weighed (W_1) and ash at 600 ^oC for 90 minutes in a muffled furnace. It was finally cooled in a desiccator and weighed again (W_2). The percentage crude fiber was calculated using equation.

$$\%\ \mathrm{Moisture} = \frac{W_1 - W_2}{W_0} X\ 100\ \% \qquad (5)$$

Where

W_0 = weight of sample (2g)

W_1 = weight of dried sample, (g)

W_2 = weight of ash sample, (g)

2.4.5. Determination of Carbohydrates by Difference

The method of James [19] was adopted where the total proportion of carbohydrate in the seeds and fruit sample was obtained by calculation using the percentage weight method. That is by subtracting the % ash from 100%. This is done by using the equation below.

% CHO = 100% - (% crude protein+ % crude fiber+ % ash+ crude lipid+ % moisture).

2.4.6. Mineral Analysis

This was carried out in Soil and Plant Analysis laboratory of the School of Agriculture in Abubakar Tafawa Balewa University Bauchi, Nigeria.

2.4.7. Digestion of Sample

The digestion was done using the triple acid digestion method of Sahrawat *et al* [20]. The triple acid digestion method of Sahrawat *et al* [20] was employed. The dried leaves sample (2.0g) was weighed into a micro-Kjedhal digestion flask to which $24cm^3$ of a mixture of concentrated HNO_3, H_2SO_4 and 60% HCO_4 were added. The flask was put on a heating block and digested to a clear solution, cooled and the content transferred into a $50cm^3$

volumetric flask and made –up to the volume mark with water. The solution was used for determination of mineral elements, calcium, magnesium, iron, and sodium.

2.4.8. Elemental Determination

Atomic Absorption Spectrophotometry (AAS) model 210VGP BULK SCIENTIFIC was used for this analysis. The method gives a good precision and accuracy (Ojeka and Ayodele, 1995) [21]. The principle of the method is based on nebulizing a sample solution into an air acetylene flame where it is vapourised. Elemental ions were then atomized and atoms then absorb radiation of a characteristic wavelength from hallow-cathode lamp. The absorbance measured, is proportional to the amount of analyte in the sample solution. This atomic absorption spectrophotometer has a computer containing a soft ware attached to it. The software interprets the absorbance and concentrations of the standard solutions and gives the result of the sample as conventions.

3. Results

Table 3.1: Results of the proximate analyses of Seeds in % (percentage)

Parameters	Percentage
Moisture content	5.0 ± 0.33 %
Ash content	18.5 ± 0.67 %
Crude fiber content	35.5 ± 1.0 %
Crude lipid content	7.3 ± 0.23 %
Crude protein content	22.13 ± 0.35 %
Carbohydrate content	11.57 ± 4.53%

Table 3.2: Results of the proximate Analyses of Fruit in % (percentage)

Parameters	Percentage
Moisture content	3.75 ± 0.17 %
Ash content	10.0 ± 0.33 %
Crude fiber content	27.25 ± 0.33%
Crude protein content	10.84 ± 0.28 %
Carbohydrate content	48.41 ± 1.0 %

Table 3.3: Result of Minerals Analyses of fruit in $mgKg^{-1}$

Minerals	($mgkg^{-1}$)
Iron (Fe)	0.39 ±0.02
Magnesium (Mg)	2.89 ±0.03
Sodium (Na)	0.81 ±0.01
Calcium (Ca)	1.81 ±0.04

Table 3.4: Results of Minerals Analyses of the Seeds in mg/Kg^{-1}

Minerals	($mgkg^{-1}$)
Iron (Fe)	66.68 ±0.55
Magnesium (Mg)	738.43 ± 10.59
Sodium (Na)	84.65 ± 0.36
Calcium (Ca)	540.94 ± 4.05

4. Discussion

4.1. Moisture Content

From **table 3.1** and **table 3.2** the discovered moisture content in this study showed 5.0% in seeds and 3.75% in the fruits of *D. cinerea* sample, which are lower compared to that in the shoot of *Borassus a ethiopumuant* reported by Akinniyi and Waziri [2] The moisture content is very low, it therefore indicates that it has good storage viability

with minimum fungal and bacterial attacks, since the moisture content is the measure of stability of microbial contamination [22].

4.2. Ash Content

From **table 3.1** and **table 3.2**, this study revealed the ash content in the seeds is (18.5%) and fruits is (10.0%) of *D. cinerea* and higher compared to 1.8% reported in sweet potato leaves [23]. It's also higher than that of *Brachetagia eurycoma* (8.35%) [24]. This indicates that the higher level of ash content of *D. cinerea* is rich in mineral contents.

4.3. Crude fiber content

From **table 3.1** and **table 3.2** the crude fiber content is 35.5% in the seeds and 27.25% in the fruits of *D. cinerea* examined in this research are found to be higher compared to 18.5% *Asparagus officinialis* stem [1] and 1.0-4.0% in the vegetables and *Raphia palms* detected by (Obahiagbon and Erhabor, 2010) [16]. Dietary fiber helps reduce serum cholesterol level, risk of coronary heart disease, colon and breast cancer and hypertension (Ganong, 2003) [25].

4.4. Crude protein content

From **table 3.1** and **table 3.2** the protein content of the samples for the seeds and fruits are 22.33 and 10.83 respectively, are higher than that registered by Umar *et al* [38]. 6.30% in water spinach, 4.6% in *Monordica foecide* leaves consumed in Swaziland [26]. The amount of protein required in person's diet is determined in large part by overall energy intake, the body's need for nitrogen and essential amino acids, body weight and composition, rate of growth in the individual, physical activity level, individual's energy and carbohydrate intake as well as the presence of illness or injury [27-28]. The generally accepted daily protein dietary allowance, measured as intake per kilogram of body weight, is 0.08g/kg [28]. However, this recommendation is based on structural requirement, but disregards use of protein for energy metabolism [29]. This requirement is for a normal sedentary person (Several studies have concluded that active people and athletes may require elevated protein intake (Compared to 0.8g/kg) due to increase in muscle mass and sweet losses, as well as need for body repair and energy source [28-30].

Suggested amount vary between 1.6g/kg and 1.8g/kg [30]. While a proposed maximum daily protein intake would be approximately 2 to 2.5g/kg [29]. However many questions still remain to be resolved [30]. Protein deficiency and malnutrition can lead to variety of ailments including mental retardation and *kwashiorkor* [31].

4.5. Crude lipid content

From **table 3.1** seeds of *D. cinerea* contain 7.3% of crude lipid which is higher compared to 5.0% contained in *Indigofera astragalina* [14] and lower compared to 11% in water spinach leaves and 12% in *Senna obtusfolia*. Crude lipids are principal sources of energy but should not exceed the daily recommended dose of 30Kcal so as to avoid obesity and other related diseases. One gram of lipid provides about 8.37Kcal [23]. This indicates that 5.0g of *D. cinerea* seeds should provide 41.85Kcal.

4.6. Carbohydrate Content

From **table 3.1** and **table 3.2** the carbohydrate content in the seeds (11.57%) and fruits (48.16%) of *D. cinerea* is considered higher compared to 2.5-10% in vegetables and *Raphia palms* reported by Obahiagbon and Erhabor [16] and lower than 64.0% in *Termilamyces manmiforiuis* [10] and 83.0% in *Borassus a ethiopumant* according to Akinniyi and Waziri, [2]. Carbohydrates and lipids are the principal sources of energy, since carbohydrate content is the most abundant in the fruits, this shows that the fruits of *D. cinerea* can serve as a good source of energy to animal body.

4.7. Minerals Analysis

4.7.1 Iron (Fe)

From **table 3.3** and **table 3.4** the iron content in the seeds and fruits are 66.68 $mgkg^{-1}$ and 0.39 $mgkg^{-1}$ respectively which is higher than that of reported by Ngaski [32] which are 2.8mg/100kg, lettuce 7$mgkg^{-1}$ (0.7mg/100kg) and cabbage 3mg/kg^{-1} 0.3mg/100g . The RDA value of iron for Male adult is 10-15mg [15]. Iron plays an important role in forming complexes with molecular oxygen in hemoglobin these compound are common oxygen transport proteins in vertebrates.

4.7.2. Sodium (Na)

From **table 3.3** and **table 3.4** the Sodium content in the samples (Seeds and Fruits) are 84.65 and 0.81, which is lower compared with 430.0 $mgkg^{-1}$ (43.0mg/100g) in *Moringa oleifera* seed [33], but falls within the range 201500 $mgkg^{-1}$ for vegetables [34]. The (RDA) Value for Sodium is 500mg (NRC) [15] which is lower, despite its lower than the RDA per day it could be a good source of sodium for hypertensive patients.

4.7.3. Calcium (Ca)

From **table 3.3** and **table 3.4** the calcium content in the samples (Seeds and Fruits) 540.94 and 1.81 is very low compared to that 9410 $mgkg^{-1}$ in the *Momordica balsamina* L. leave reported by Hassan *et al* [35]. The (RDA) value for calcium per day is 1,200 mg. The Ca value of D. cinerea seeds and fruits is lower than the RDA value. Ca is needed for growth and maintenance of bone, teeth, muscles and blood clothing.

4.7.4 Magnesium (Mg)

From **table 3.3** and **table 3.4** the magnesium content in the sample (seeds and fruits) are 788.43 and 2.89 which in (for the seeds), and is lower compared with 4000mg/kg^{-1} in *Cessia siamea* leaves [32]. The RDA value of magnesium for adult male is 350mg [15]. This implies that this sample (seeds) is good of magnesium supplement for human diet.

5. Conclusion

Seeds of *D. cinerea*, is rich in Mg, Na, Fe and Ca therefore it could be a good source of minerals. *D. cinerea* seeds contain 66.68 $mgkg^{-1}$ Fe, 738.43 $mgkg^{-1}$ Mg, 84.65 $mgkg^{-1}$ Na, and 540.94 $mgkg^{-1}$ Ca. fruits of *D. cinerea* contains 0.39 $mgkg^{-1}$ Fe, 2.89 $mgkg^{-1}$ Mg, 0.81 $mgkg^{-1}$ Na and 1.81 $mgkg^{-1}$ Ca, therefore it is a very poor source of minerals. However, seeds of *D. cinerea* contain 18.5% ash content, 35.5% crude fiber, 7.3% crude lipids, 11.57% carbohydrate, 5% moisture content and 22.13% crude protein content. It implies that seeds of *D. cinerea* has good moisture content, moderate fiber content and protein content but lower in ash, carbohydrate and crude lipid content. Fruits of *D. cinerea* contain 48.16% carbohydrate, 27.25% crude fiber, 10.84% crude protein, 10% ash content, and 3.75% moisture content. These entails that fruits of *D. cinerea* are rich in carbohydrate and has good ash content and moisture content but poor source of protein and fiber content.

6. Recommendations

It could be recommended that:

- Seeds and Fruits of *D. cinerea* are good sources for feed formulation of animals.
- More analysis should be carried out on *D. cinerea* proteins to ascertain its classes of protein present.
- Seeds of *D. cinerea* would be a good source of minerals such as; Mg, Na, Ca and Fe, for both Animal and Man.
- More research should be carried out to determine which class of carbohydrate is present in seed and fruit of *D. cinerea*

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