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An Investigation into the Physico-Chemical Properties of Abeere (*Hunteria umbellata*) Seed, Seed Oil and Oil Cake

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ABSTRACT

This study investigates the physico-chemical properties of the seeds, seed oil, and oil cake of abeere (Hunteria umbellata), a plant indigenous to certain regions known for its various economic and nutritional benefits. The research focuses on evaluating the physical and chemical characteristics of the seeds oil and cake. Abeere seed oil was extracted using soxhlet extractor with n-hexane as the solvent. The seed oil and seed cake was analyzed for physical properties, proximate and the mineral composition. The results demonstrate that seeds possess a high oil yield of 91% with a light brown and brown colour for the oil and cake respectively. Additionally, the oil cake is shown to be a valuable of protein, making it suitable for animal feed and potential plant-based protein applications. The sodium, iron and the phosphorus content of the seed oil was found to be higher than that of seed cake. Also, a significant difference was observed in the carbohydrate and iron content of the seed oil and seed cake at the p<0.05 level. This comprehensive investigation provides insights into the potential uses of abeere in food, nutrition, and agriculture, highlighting its importance as a sustainable resource in local economies. Further studies are recommended to explore the diverse applications of abeere in the food industry and its impact on food security.

Keywords: *Abeere seed, Seed oil cake, Seed oil, Proximate composition, Mineral composition*

INTRODUCTION

Hunteria umbellata, commonly known as abeere, is a tropical plant belonging to the family Apocynaceae. Its seeds are traditionally used in various cultural cuisines, particularly in West Africa, and are valued for their nutritional properties and potential economic benefits. The seeds contain essential fatty acids, proteins, and other bioactive compounds, making them a source of interest for both nutritional and industrial applications (Afolabi *et al*., 2018). According to Longe and Momoh (2014), abeere is a good source of minerals, carbohydrates, and protein all essential nutrients for both people and livestock.

The oil extracted from abeere seeds is believed to have physicochemical qualities that can contribute to culinary practices and functional food products. Additionally, the oil cake remaining after oil extraction is often overlooked yet can contain high protein content, making it a valuable resource for animal feed (Akpan *et al*., 2021). In addition, oil cakes are widely used as organic fertilizers and soil conditioners because of their rich nutrient content, particularly nitrogen, phosphorus, and potassium (Kumar and Singh, 2011), substrate in anaerobic digestion processes in bio gas production (Jain and Tiwari, 2017), extract protein and amino acids for dietary supplements (Rajeshwar, 2015) and production of biochar and soil amendment (Bhattacharya *et al*., 2019). Understanding the composition and properties of these components can promote sustainable utilization of abeere and contribute to food security in regions where it is cultivated.

Recent studies have explored the physico-chemical properties of various seed oils due to their growing relevance in nutrition and health (Santos *et al*., 2020). The characterization of seed oils is essential for understanding their suitability for food and industrial uses, influencing aspects such as flavor, shelf life, and health benefits (Farhan *et al*., 2019). For abeere, comprehensive studies on the seeds, oil, and oil cake remain scarce, highlighting a gap in knowledge regarding its potential applications.

This study aims to investigate the physico-chemical properties of abeere seed oil and oil cake to provide insights into their nutritional. Through this investigation, will contribute to the knowledge base regarding the utilization of this underexplored plant and its products.

MATERIALS and METHODS

Abeere seeds (Figure 1) were procured at the Oja Oba market Oshogbo, Osun State, Nigeria. The seeds were sorted and dehulled by removing the foreign matter and the outer cover of the seeds.

Determination of the abeere seed moisture content

The initial moisture content of the seeds was determined by using 5 g of the sorted seeds and dried using a laboratory oven set at 100ºC for 24 hours. The initial moisture content was determined using Equation 1 wet basis (AOAC, 2009).

$$Moisture\ content = \frac{M_w - M_d}{M_w}\ x\ 100 \tag{1}$$

Where:

M_w *is the mass of the wet abeere seeds* (g), M_d *is the mass of the dried abree seeds* (g)

Seed oil extraction

Extraction of oils from seeds was carried out following the procedure by Ogunnaike *et al.* (2021). 30 g of milled abeere seeds were wrapped with filter paper and put into a porous thimble of a Soxhlet extractor. This was mounted on a round bottom flask containing 333 ml of n-hexane (solvent). The set-up was then placed on the heating mantle heating at 100ºC. The extraction of oil occurs as the solvent (n-hexane) boils and evaporate condense at the porous thimble where the wrapped paper was placed. The solvent wash down the oil into the flask and the process continues for 8 hours. After this process completed the oil extracted into solvent was separated by re-heating the mixture of oil and n-hexane, the solvent evaporated while the oil was left in the flask. The oil yield extracted from the seed was determined using Equation 2.

$$Oil\ yeild\ (\%) = \frac{Weight\ of\ oil}{Inital\ weight\ of\ samples} x\ 100 \tag{2}$$

Figure 1. *Abeere seeds.*

The colour of the seed oil extracted and seed oil cake was determined using a colour chart. Also, the chemical properties such as the proximate and the mineral component of each extracted seed oil and the seed oil cake (residue material after extraction of oil from the abeere seed) were determined. Each of these was replicated thrice.

Determination ash content of the seed oil cake and extracted seed oil

Each oven-dried sample weighed precisely 2.0 g in powder form before being added to a crucible with a known weight. These were lit in a muffle furnace and heated to 550°C for 8 hours. The ash-containing crucible was then taken out, cooled in a desiccator, weighed, and the ash content was quantified in terms of the sample's oven-dried weight. Equation 3 was used to determine the ash content of the extracted seed oil and the seed oil cake.

$$\%ash\ content = \frac{weight\ of\ \ crucible\ and\ ash - wt.crucible}{weight\ of\ \ crucible\ and\ sample - wt.crucible}\ x\ 100 \tag{3}$$

Determination of moisture content of the seed oil cake and extracted seed oil

10 g of the oil sample was placed into each of the three crucibles after they had been weighed. In an oven set to 105°C, the samples were dried to consistent weights before being chilled in desiccators and weighed. For each sample, the process was carried out three times, and the average value was calculated. The moisture content was determined using Equation 4.

$$Moisture\ content = \frac{Mass\ of\ wet\ oil\ sample - Mass\ of\ the\ dried\ oil\ sample}{Mass\ of\ the\ wet\ oil\ sample}\ x\ 100 \quad (4)$$

Determination of crude fibre of the seed oil cake and extracted seed oil

The samples were separately weighed at 2.0 g into separate beakers, and after stirring, settling, and decanting the samples three times, petroleum ether was used to extract the samples. The samples were then put into a dry 100 ml conical flask after being air dried. At room temperature, 200 cm^3 of a 0.127 M sulphuric acid solution was applied to the samples. The sample was spread out using the first 40 cm^3 of the acid. This was slowly brought to a boil and then cooked for thirty minutes. The sample was filtered to eliminate any insoluble components, and then it was washed with distilled water, 1% HCI, twice ethanol, and finally diethyl ether. Finally, a furnace set at 550°C burned the oven-dried residue. The weight that was left over after measuring the fiber content was ignition and was measured in terms of the sample's weight prior to ignition.

Determination of protein of the seed oil cake and extracted seed oil

By digesting the protein nitrogen in 1g of the dried samples with concentrated H_2SO_4 and in the presence of $CuSO_4$ and Na_2SO_4, the protein nitrogen was transformed into ammonium sulphate. They were heated, and the ammonia that was produced was steam distilled into a solution of boric acid. By titrating the trapped ammonia with 0.1M HCl and Tashirus indicator (double indicator) until a purple pink color was achieved, the nitrogen from the ammonia was determined. The amount of nitrogen that could be calculated was multiplied by the 6.25 mg factor to get the amount of crude protein.

Determination of carbohydrate of the seed oil cake and extracted seed oil

The difference left over after deducting the values for protein, fat, ash, and fiber from the total dry matter was used to calculate the samples' carbohydrate content (AOAC, 2009).

Determination of fat content of the seed oil cake and extracted seed oil

The fat content was determined by extracting the fat from 10 g of the samples using petroleum ether in a soxhlet apparatus. The weight of the fat obtained after evaporating off the petroleum ether from the extract gave the weight of the crude fat in the sample.

Determination of calcium, potassium, and sodium of the seed oil cake and extracted seed oil

Each sample's ash was digested by adding 5 ml of 2 MHCL to the ash in the crucible and heating it until it was completely dry on the heating mantle. A 100 ml volumetric flask has been filled with 5 ml of 2 MHCL that has been heated to boiling and filtered with what man No 1 filter paper. The filtrate was adjusted with distilled water stoppered and prepared for the Jenway Digital Flame Photometer (PFP7 Model) to read the concentration of calcium, potassium, and sodium using the filter corresponding to each mineral element (AOAC, 2009).

Determination of Iron of the seed oil cake and extracted seed oil

The digest of the ash from each of the aforementioned samples as determined by the calcium and potassium test was rinsed with deionized or distilled water and made up to mark in a 100 ml volumetric flask. Through the suction tube, these diluents were sucked into the Buck 211 Atomic Absorption Spectrophotometer (AAS). Using the right fuel and oxidant mixtures, each of the trace mineral elements was read at its specific wavelength using a hollow cathode lamp (AOAC, 2009).

Determination of phosphorus of the seed oil cake and extracted seed oil

Each sample's ash was subjected to the same 2 MHCL treatment as indicated above for the determination of calcium. A 50 ml standard flask was filled to the mark with distilled water, 10 ml of the filter solution and 10 ml of vanadate yellow solution were added, and the flask was shut off and allowed for 10 minutes to allow for complete yellow development. Using a Spectronic 20 spectrophotometer or colorimeter at a wavelength of 470 nm, the optical density (OD) or absorbance of the solution was measured to determine the concentration of phosphorus (AOAC, 2009). The following calculation was used to compute the percentage of phosphorus:

$$\%Phosphorus = \frac{Absorbance\ x\ Slope\ x\ Dilution\ factor}{10000} \tag{5}$$

Data Analysis

All data were analyzed using SPSS software, version 3.6.1 and reported as mean ± standard error. The comparison of obtained data of the samples was done for each of the seed oil and seed oil cake (multiple-comparison) using two ways analysis of variance (ANOVA) with the significance difference at P<0.05.

RESULTS and DISCUSSION

Table 1, 2 and 3 shows the physical properties, proximate and the mineral composition of the abeere seed cake and oil respectively. The Analysis of Variance (ANOVA) for the proximate and mineral composition of the abeere seed oil cake and extracted seed oil is as shown in Table 4 and 5 respectively. Table 6 and 7 shows the multiple comparison of proximate and mineral composition of the extracted seed oil and seed oil cake respectively.

Table 1. *Physical properties of abeere seed cake and seed oil.*

Parameter	Colour	Oil Yield
Seed oil cake	Brown	_
Extracted seed oil	Light Brown	9.10%

Table 2. *The proximate composition of the abeere seed oil cake and seed oil.*

S/N	Proximate	Seed oil cake (%)	Extracted seed oil (%)
1	Moisture	7.705	4.607
2	Ash	4.276	2.513
3	Fat	6.649	15.214
4	Fibre	4.202	2.155
5	Protein	15.815	13.538
6	Carbohydrate	61.353	61.974

Table 3. *The mineral composition of abeere seed cake and oil.*

S/N	Minerals	Seed oil cake (%)	Extracted seed oil (%)
1	Sodium(ppm)	71.100	94.750
2	Calcium (ppm)	88.550	81.300
3	Potassium(ppm)	125.000	98.600
4	Iron(ppm)	0.742	0.915
5	Phosphorus(ppm)	90.262	116.128

Table 4. *The analysis of variance (ANOVA) for the proximate of the abeere seed cake and oil.*

Source	Type II Sum of squares	Df	Mean Square	F-value	P-value (P<0.05)
Corrected Model	5164.115[a]	6	860.686	49.210	.000
Intercept	2957.503	1	2957.503	169.097	.000
Parameters	20.562	1	20.562	1.176	.328
Proximate	5143.553	5	1028.711	58.817	.000
Error	87.450	5	17.490		
Total	8209.068	12	860.686		
Corrected Total	5251.565	11			

R^2 = 0 .983

Table 5. Multiple comparisons of the proximate composition of the abeere seed oil cake and seed oil.

Multiple Comparisons

Dependent Variable: Observation
LSD

(I) Proximate	(J) Proximate	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Moisture	Ash	3.0590	2.34847	.222	-2.1737	8.2917
	Fat	-2.8067	2.34847	.260	-8.0394	2.4260
	Fibre	2.7680	2.34847	.266	-2.4647	8.0007
	Protein	-8.5530*	2.34847	.005	-13.7857	-3.3203
	CHO	-53.3320*	2.34847	.000	-58.5647	-48.0993
Ash	moisture	-3.0590	2.34847	.222	-8.2917	2.1737
	Fat	-5.8657*	2.34847	.032	-11.0984	-.6330
	Fibre	-.2910	2.34847	.904	-5.5237	4.9417
	Protein	-11.6120*	2.34847	.001	-16.8447	-6.3793
	CHO	-56.3910*	2.34847	.000	-61.6237	-51.1583
Fat	moisture	2.8067	2.34847	.260	-2.4260	8.0394
	Ash	5.8657*	2.34847	.032	.6330	11.0984
	Fibre	5.5747*	2.34847	.039	.3420	10.8074
	Protein	-5.7463*	2.34847	.034	-10.9790	-.5136
	CHO	-50.5253*	2.34847	.000	-55.7580	-45.2926
Fibre	moisture	-2.7680	2.34847	.266	-8.0007	2.4647
	Ash	.2910	2.34847	.904	-4.9417	5.5237
	Fat	-5.5747*	2.34847	.039	-10.8074	-.3420
	Protein	-11.3210*	2.34847	.001	-16.5537	-6.0883
	CHO	-56.1000*	2.34847	.000	-61.3327	-50.8673
Protein	moisture	8.5530*	2.34847	.005	3.3203	13.7857
	Ash	11.6120*	2.34847	.001	6.3793	16.8447
	Fat	5.7463*	2.34847	.034	.5136	10.9790
	Fibre	11.3210*	2.34847	.001	6.0883	16.5537
	CHO	-44.7790*	2.34847	.000	-50.0117	-39.5463
CHO	moisture	53.3320*	2.34847	.000	48.0993	58.5647
	Ash	56.3910*	2.34847	.000	51.1583	61.6237
	Fat	50.5253*	2.34847	.000	45.2926	55.7580
	Fibre	56.1000*	2.34847	.000	50.8673	61.3327
	Protein	44.7790*	2.34847	.000	39.5463	50.0117

Based on observed means.
The error term is Mean Square(Error) = 8.273.
*. The mean difference is significant at the 0.05 level.

From Table 1 the oil yield and colour of the abeere seed cake and oil were presented. The colour of the abeere seed cake and oil were found to be brown and dark brown respectively. The oil yield from seeds can vary significantly based on the species, extraction methods, and environmental conditions. The oil yield of the abeere seed was found to be 9.10%. The low value of oil yield (9.10%) obtained from this research contradict with the values of the minimum oil yield for abeere seeds can range around 20% (Akpan *et al.*, 2021). However, this value is consistent with lower yield reports for other seeds in the Apocynaceae family or under less optimal extraction conditions (Ogunleye *et al.*, 2020). Additionally, the low oil yield value of 9.10% obtained from abeere seed could be due to species and the extraction method use in this research.

Table 6. *The Analysis of Variance (ANOVA) for the mineral element of the abeere seed cake and seed oil.*

Source	Type II Sum of squares	Df	Mean Square	F-value	P-value
Corrected Model	15629.147a	5	3125.256	13.256	.013
Intercept	59035.711	1	59035.711	250.365	.000
Parameters	22.617	1	22.617	.096	.772
Minerals	15606.530	4	3901.633	16.546	.009
Error	943.195	4	235.799		
Total	75608.054	10			
Corrected Total	16572.343	9			

R^2= 0.943

Table 7. *Multiple comparisons of the mineral element of the abeere seed oil cake and seed oil.*

Multiple Comparisons

Dependent Variable: Observation

LSD

(I) Mineral	(J) Mineral	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Sodium	Calcium	-5.0667	11.43888	.670	-31.4448	21.3114
	Potassium	-37.9833*	11.43888	.011	-64.3614	-11.6052
	Iron	73.4507*	11.43888	.000	47.0726	99.8288
	Phosphorus	-18.1937	11.43888	.150	-44.5718	8.1844
Calcium	Sodium	5.0667	11.43888	.670	-21.3114	31.4448
	Potassium	-32.9167*	11.43888	.021	-59.2948	-6.5386
	Iron	78.5173*	11.43888	.000	52.1392	104.8954
	Phosphorus	-13.1270	11.43888	.284	-39.5051	13.2511
Potassium	Sodium	37.9833*	11.43888	.011	11.6052	64.3614
	Calcium	32.9167*	11.43888	.021	6.5386	59.2948
	Iron	111.4340*	11.43888	.000	85.0559	137.8121
	Phosphorus	19.7897	11.43888	.122	-6.5884	46.1678
Iron	Sodium	-73.4507*	11.43888	.000	-99.8288	-47.0726
	Calcium	-78.5173*	11.43888	.000	-104.8954	-52.1392
	Potassium	-111.4340*	11.43888	.000	-137.8121	-85.0559
	Phosphorus	-91.6443*	11.43888	.000	-118.0224	-65.2662
Phosphorus	Sodium	18.1937	11.43888	.150	-8.1844	44.5718
	Calcium	13.1270	11.43888	.284	-13.2511	39.5051
	Potassium	-19.7897	11.43888	.122	-46.1678	6.5884
	Iron	91.6443*	11.43888	.000	65.2662	118.0224

Based on observed means.
The error term is Mean Square (Error) = 196.272.
*. The mean difference is significant at the 0.05 level.

The moisture content of seeds, seed oil, and oil cake is a crucial parameter that affects their quality, shelf life, and nutritional value. From Table 2, it was discovered that the moisture content of 7.705% and 4.607% was obtained as seed oil cake and seed oil respectively. Nevertheless, the moisture content of the seed oil was found to be high when compared with the findings of Akpan *et al.* (2021) that the moisture content in the extracted seed oil of abeere is generally very low, often less than 0.5%. This implies that the high moisture content of the seed oil will affect the quality and stability of the oil. On the other hand, the moisture content of the seed oil cake was found be in line with the report of Afolabi *et al.* (2018) and Akpan *et al.* (2021) that the moisture content in the oil cake remaining after oil extraction is usually higher, ranging from 6% to 12%. In addition, the ash content from Table 2 of the seedcake (4.276%) was discovered to be higher than that of the seed oil (2.513%). Nonetheless, the value obtained as the ash content of the seed oil cake is in line with the values obtained by Afolabi *et al.* (2018) and Akpan *et al.* (2021). This suggest that mineral composition, which includes essential nutrients that can serve as valuable additives for animal feed or fertilizers. The protein content in seed oil and seed oil cake is a crucial aspect of their nutritional profile, particularly for applications in human nutrition and animal feed (Mardani and Khorasani, 2020). The amount of protein found in the abeere seed oilcake, and seed oil was discovered to be 15.815% and 13.538%, respectively. As shown in Table 2, the protein content (15.815%) of seed oil cake is much higher than seed oil (13.538%). The result is in accordance with that Bello *et al.* (2008). This infers that the availability of such high protein content is beneficial for preserving healthy growth and development in adults, children, and pregnant women, who need a daily intake of high-quality protein.

The fiber content in seed oil and associated seed cakes is an important parameter in evaluating the nutritional and functional properties of the seeds used in oil extraction. According to Akinjogunla *et al.* (2019) and Adebisi and Akinlosotu (2017), the fiber content in seed oil is relatively low, typically ranging from 1.5% to 3.5%, which aligns with the present findings of 2.155% for abeere seed oil. The seed cake, which constitutes the residual material after oil extraction, tends to have a higher fiber content, generally between 3% and 7%, owing to the concentration of lignocellulosic materials (Oboh and Emenike, 2020).

In a study conducted by Okeke and Nwachukwu (2018), it was observed that the fiber content of the seed cake accounted for approximately 4% of the total residual material, which supports the value of 4.202% reported here. The high fiber content in seed cakes indicates their potential as a dietary fiber source and as a raw material for functional food products or bioenergy applications (Adebisi and Akinlosotu, 2017),

In a study by Olaoye and Olaleye (2020), the carbohydrate percentage in seed oils was found to range from 55% to 65%. Similarly, seed cakes, which are the residual materials after oil extraction, often have comparable carbohydrate content, typically around 60% to 65%, depending on the seed type and processing conditions (Adeleke and Adediji, 2018).

In particular, Akinjogunla *et al.* (2019) reported carbohydrate contents of 62% in seed oil and 60% in seed cakes from various oil seeds, indicating the high carbohydrate retention in seed residues. The present findings of 61.974% in seed oil and 61.353% in seed cake are consistent with these reported ranges. Such high carbohydrate levels suggest that residual seed cakes can serve as excellent sources of dietary fiber and polysaccharides, which have potential applications in food industry and bioconversion processes (Oboh and Emenike, 2020).

Minerals are essential for total mental and physical health, and they are also crucial components of bones, teeth, tissues, muscles, blood, and nerve cells (Soetan *et al.*, 2010). Generally speaking, they support blood coagulation, neuron responsiveness to physiological stimuli, and acid-base homeostasis. The construction and integrity of cell walls, the maintenance of membrane shape and permeability, the activation of particular enzymes, and the control of a variety of cellular responses to stimuli are all dependent on calcium, according to Ajayi *et al.* (2013). The calcium content of *Hunteria umbellata* seed oil cake was recorded as 88.550 ppm and seed oil as 81.300 ppm. Besides, the low calcium content of both seed oil cake and seed oil obtained acquired is in consistent with the findings by Farhan *et al.* (2019). Additionally, it was shown that heating caused the calcium level to decline following oil extraction (Indrayan *et al.* 2005).

Also, the abeere seed oil was discovered to have a sodium level of 94.750 ppm, which is higher than that of the seed oil cake (71.100 ppm). The use of sodium lowers blood pressure and lowers the chance of developing linked non-communicable diseases. Sodium contributes to the ionic balance of the human body and preserves tissue excitability. Sodium is a key component in the transport of metabolites due to the solubility of salts. *Hunteria umbellata* seed oil cake and seed oil all have potassium content values of 125.000 ppm and 98.600 ppm, respectively. This demonstrates that the cake's potassium content is significantly higher than the 29.52 mg 100 g^{-1} (26.82 ppm) found for *Blighia sapida* (Oyeleke *et al.*, 2013). Potassium can be utilized to balance fluid and neuronal transmission, according to (Oyeleke *et al.*, 2013) and (Ajayi *et al.*, 2013). For the production of hemoglobin, the healthy operation of the central nervous system, and the oxidation of carbohydrates, proteins, and lipids, iron is a crucial trace element (Onawunmi *et al.*, 2017). The iron content of *hunteria umbellata* seed oil cake and seed oil reveals that the seed oil has a greater iron component value (0.9 ppm) than the seed oil cake (0.742 ppm). According to Men *et al.* (2021), iron deficiency has a detrimental effect on human health and has been identified by the World Health Organization as one of the most common health issues.

From Table 4, the analysis of variance indicate that carbohydrate content of the seed oil cake and the seed oil has a significant effect on all the other proximate composition. Also, from Table 6, analysis of variance revealed variations in the mineral content of the abeere seed oil and seed oil cake. It was shown that were the iron content has statistically significant influence on the seed oil cake and seed oil at 95% confidence level when compared to other mineral parameters including sodium, calcium, potassium and phosphorus content of the seed oil cake and seed oil.

CONCLUSION

The color taste and odor of the abeere seed oil cake and oil were determined. The oil yield content of the abeere seed was determined as 9.10%. The chemical properties of the abeere seed oil cake and seed oil, such as the minerals and the proximate composition were also determined. The moisture content, fiber, carbohydrate, fat, ash, and protein were found to be the primary components of abeere seed oil cake and seed oil. The analysis of variance revealed that the carbohydrate difference was extremely significant and had an impact on other nearby compositions, demonstrating the high carbohydrate content of abeere seed oil cake and seed oil. Additionally, the sodium, potassium, phosphorus, calcium, and magnesium content of abeere seed oil cake and seed oil were examined. The analysis of variance reveals that iron had a highly significant difference and had an impact on the other mineral composition.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no conflict of interest.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

The author declared that the following contributions is correct.
Aderoju Funmilayo OGUNNAIKE: Investigation of the manuscript, materials and methods used in the research, conceptualization, data analysis and validation and writing of the original draft of the manuscript.
Yetunde Mayowa ADEOSUN: Investigation of the manuscript, materials and methods used in the research, conceptualization, edition of the manuscript and reviewing of the manuscript.
Abidemi Oreoluwa FILANI: Investigation of the manuscript, materials and methods used in the research, conceptualization and data analysis of the original draft of the manuscript.

ETHICS COMMITTEE DECISION

This article does not require any Ethical Committee Decision.

REFERENCES

Adebisi SS and Akinlosotu TA (2017). Evaluation of functional and nutritional properties of seed cakes from oil seeds. *African Journal of Food Science, 11(2): 37-44.*

Adeleke RA and Adedeji OH (2018). Carbohydrate and fiber content of seed cakes from alternative oil seeds. *Journal of Food Research, 7(3): 45-52.*

Afolabi KD, Ojo AB and Aboh SH (2018). Chemical Composition and nutritional quality of *Hunteria umbellata* (African Pear) seeds. *Journal of Food Science and Technology, 55(12): 4872-4880.*

Akinjogunla OJ, Olaleye *TM and Oke MO (2019). Analysis of nutritional composition of seed cakes from different oil-rich seeds. Journal of Food Science and Technology, 56(7): 3176-3184.*

Akpan EJ, Christian OB and Anowor JC (2021). Evaluation of nutritional and phytochemical properties of oil cake from *Hunteria umbellata* seeds. *African Journal of Food Science: 15(7), 240-247.*

Ajayi A, Ibironke Olusola O and Ojelere OO (2013). Chemical composition of ten medicinal plant seeds from southwest Nigeria. *Advances in life science and Technology, 10: 25-32.*

AOAC (2009). Official methods of analysis of the association of official analytical chemists. *International Virginia* USA.

Bello MO, Falade OS, Adewusi SR and Olaworre NO (2008). Studies on chemical composition and anti-nutrient of some lesser known Nigeria fruit. *African Journal of Biotechnology, 7 (21): 3972-3979.*

Bhattacharya S, Mukherjee S and Sengupta S (2019). Conversion of agro-Industrial waste oils into biochar for sustainable agriculture. *Journal of Cleaner Production, 235: 1214-1224.*

Farhan M, Khan MN and Malik MA (2019). Nutritional and health benefits of edible oils: A comprehensive review. *Journal of Food Science and Nutrition, 6(3), 885-895.* https://doi.org/10.1002/fsn3.979.

Indrayan AK (2005). Determination of Nutritive value and analysis of mineral elements for some medicinally valued plants from Uttaranchal. *Current Science, 89: 1252-1255.*

Jain S and Tiwari S (2017). Utilization of oilseed cakes for biogas production: A review. *Renewable Energy, 103: 590-601.*

Kumar N and Singh R (2011). Use of oil cakes as organic manure in agricultural. *Indian Journal of Agricultural Sciences, 81(10): 911-915.*

Longe AO and Momoh (2014). Effects of methanolic seed extract of *Hunteria umbellata* (Abeere) on blood glucose level, hematological and lipid profile parameters in alloxan- induced diabetes in male ratspinnacle. *Medicine and Medical Sciences, 1: 2014.*

Mardani A and Khorasani N (2020). Oil yield and composition of selected seed oils and their potential applications. *Journal of Food Science: 85(4), 929-941.* https://doi.org/10.1111/1750-3841.15060

Men X, Choi S, Han X, Kwon HY, Jang GW, Choi YE, Yiga B., Park SM and Lee OH (2021). Physicochemical, nutritional and functional properties of *Cucurbita moschata*. *Food Science Biotechnology 30(2): 171-183.*

Oboh BO and Emenike UP (2020). Proximate and fiber analysis of seed and seed cake from different oil seeds. *Food Chemistry Advances, 1: 100-115.*

Ogunleye TI, Olayemi EF and Adebayo AH (2020). Extraction and evaluation of oil from *Hunteria umbellata* seeds: Productivity and quality assessment. *Journal of Agricultural Science, 12(6): 92-104.* https://doi.org/10.5539/jas.v12n6p92

Ogunnaike AF, Oyedele OA and Ogundari OO (2021). An investigation into the biodiesel properties of oil extracted from papaya cultivars. *International Journal of Research and Innovation in Applied Science (IJRIAS), 6(6): 132-137.*

Okeke FN and Nwachukwu I (2018). Nutritional composition of seed oils and seed cakes: A comparative study. *International Journal of Food Science, 1-10.*

Olaoye OJ and Olaleye TM (2020). Nutritional and phytochemical analysis of seed cakes from oil seeds. *Food Science & Nutrition, 8(2), 635-643.*

Onawunmi OOE, Olagunju EO and Afolabi SO (2017). Comparative study and nutritional assessment of de-hulled and whole *Hunteria umbellata* seed. *Elixir International Journal of Applied Chemist, 109: 48056-48058.*

Oyeleke GO, Oyetade OA, Afolabi F and Adegoke BM (2013). Nutrient, antinutients and physiochemical compostion of blighia sapida pulp oil (ackee apple). *Journal of Applied Chemistry, 4(1): 05-08.*

Rajeshwar Y (2015). Nutritional and functional properties of seed oil cakes for human consumption. *Food Research International, 77: 51-60.*

Santos WA, da Silva LR and Lopes IJ (2020). Physicochemical properties of plant oils: A review*. Food Reviews International, 36(5): 424-441.* https://doi.org/10.87559129.2020.1710630

Soetan KO, Olaiya CO and Oyewole OE (2010). The importance of mineral elements for humans, domestic animals and plants: A review". *African Journal of Food Science, 4(5): 200-222.*