American Journal of Food and Nutrition, 2025, Vol. 13, No. 3, 74-79
Available online at http://pubs.sciepub.com/ajfn/13/3/1
Published by Science and Education Publishing
DOI:10.12691/ajfn-13-3-1

Biochemical Characterization and Nutritional Value of Peanut (*Arachis Hypogaea* L.) Leaves, Taro (*Colocasia Esculenta* L. Schott) and Pigeon Pea (*Cajanus Cajan* L. Huth)

OSSOKO Jean Paul Latran[1,2,*], OKANDZA Yves[1], TONI née GANONGO- PO Fanny[3], DELLAU Henrina[3], DZONDO Gadet Michel[3], MVOULA TSIERI Michel Didace[1,4]

[1]Laboratoire de Contrôle et Qualité des Aliments (ENSAF, Université Marien NGOUABI)
[2]Institut National de Recherche en Sciences de l'Ingénieur, Innovation et Technologie
[3]Ecole Nationale Supérieure Polytechnique (ENSP)
[4]Université Denis SASSOU NGUESSO
*Corresponding author: jplatran@yahoo.fr

Received April 14, 2025; Revised May 15, 2025; Accepted May 23, 2025

Abstract Among the least consumed local vegetables in Congo are peanut leaves (*Arachis hypogea* L.), pigeon pea leaves (*Cajanus cajan* L.Huth), and taro leaves (*Colocasia esculenta* L. Schott). Thus, the general objective of this study, which is to establish the biochemical characterization and nutritional value of peanut (*Arachis hypogaea*), pigeon pea (*Cajanus cajan*) and taro (*Colocasia esculenta*) leaves, among other things, was to use the standards established by the AOAC to achieve this objective, namely: the oven to determine the water content, the Soxhlet method to extract the fat, the Kjeldahl method to determine the total protein content, the muffle furnace to know the ash content, we deduced the carbohydrates content and finally we used spectrometry to identify the minerals in the ash. We obtained the following results: *A. hypogaea*: Water: 80.93±1.83%; Lipids: 1.46±0.12%; Proteins: 1.83±0.08%; Carbohydrates: 15.40±1.84%; Ash: 0.62±0.001%; Energy: 81.26±5.86 Kcal/100g. *C. esculenta*: Water: 84.89±0.57%; Fat: 1.32±0.07%; Protein: 0.88±0.01%; Carbohydrates: 11.54±0.57%; Ash: 1.37±0.01%; Energy: 61.55±2.43 Kcal/100g. *C. cajan*: Water: 68.13±0.46%, Fat: 0.38±0.13%; Protein: 23.00±0.33%; Carbohydrates: 6.44±0.67%; Ash: 2.16±0.02%; Energy: 120.94±1.56 Kcal/100g. Among the minerals sought, magnesium, calcium, potassium, and sodium are the most abundant in all the leaves studied. Pigeon pea leaves are the richest in protein and can be used more widely outside of their use as a forage plant.

Keywords: *Study, Edible Leaves, Nutritional Value, Congo, Mineral Fraction.*

Cite This Article: OSSOKO Jean Paul Latran, OKANDZA Yves, TONI née GANONGO- PO Fanny, DELLAU Henrina, DZONDO Gadet Michel, and MVOULA TSIERI Michel Didace, "Biochemical Characterization and Nutritional Value of Peanut (*Arachis Hypogaea* L.) Leaves, Taro (*Colocasia Esculenta* L. Schott) and Pigeon Pea (*Cajanus Cajan* L. Huth)." *American Journal of Food and Nutrition*, vol. 13, no. 3 (2025): 74-79. doi: 10.12691/ajfn-13-3-1.

1. Introduction

The foods consumed by humans are classified into three main groups: energy-producing foods (tubers, grains, oils, butter, etc.), building foods (legumes, meat, fish, milk, eggs, etc.), and protective foods (fruits, vegetables, green leaves, etc.), each contributing in its own way to human nutritional balance [1]. Green leaves are particularly important because they play a role not only as a maintenance food and a bulking agent that facilitates digestion, but also in the growth and development of the body. Nutritionally, green leaves are an important source of vitamins and minerals that the body needs to maintain health [1]. In Congo, several leafy vegetables are grown. Among the most consumed are the leaves of cassava *Manihot esculenta* (Saka-saka), the leaves of *Gnetum africanum* (Mfumbua) and the leaves of *Hibiscus sabdarifa* (Guinea sorrel). However, there is a category of vegetables that are not widely consumed locally or regionally, among which we have the leaves of *Arachis hypogaea*, *Colocasia esculenta* and *Cajanus cajan*. The objective of this work is to develop a biochemical characterization in order to establish the nutritional value of the leaves of *Arachis hypogaea*, the leaves of *Cajanus cajan* and the leaves of *Colocasia esculenta.*

2. Materials and Methods

2.1. Plant Material

The plant material consisted of three types of fresh leaves, including *Cajanus cajan* leaves harvested in June in Brazzaville, *Arachis hypogaea* and *Colocasia esculenta* leaves purchased at the Mikalou market of Brazzaville from Lékana, in the Plateaux Department of the Republic of Congo.

Figure 1. *Arachis hypogaea* leaves (Henrina DELLAU, June 3, 2024)

Figure 2. *Cajanus cajan* leaves (Henrina DELLAU, June 4, 2024)

Figure 3. *Colocasia esculenta* leaves (Henrina DELLAU, June 5, 2024)

2.2. Methods

2.2.1. Physicochemical Characterization

2.2.1.1. Determination of Water Content (Wet Basis, WB)

To determine water content, 30 g (fresh mass) of each sample was weighed and then placed in an oven at 70°C. The oven was stopped when the sample mass remained constant.

Knowing the fresh mass (fm) and dry mass (dm) of the sample, the water content was determined using the following formula:

% Water = (mf-dm)/mf×100

2.2.1.2. Determination of Protein Content

Total nitrogen (protein) was determined using the Kjeldahl method.

The nitrogenous organic matter of the plant sample was mineralized using concentrated sulfuric acid. Nitrogen is recovered in ammonium form and then distilled in ammonia form before being measured by acid-base volumetric analysis.

In a matra, we introduced 0.5 grams of crushed and deoiled leaves, which we previously dried in an oven at 70°C for 24 hours. A spatula-shaped drop of mineralization catalyst and 10 mL of concentrated sulfuric acid were added, followed by a few glass beads and then placed on the mineralization ramp. Mineralization is carried out cold for 30 minutes. Then, it is heated to thermostat 7 and allowed to mineralize for 2 hours (hot mineralization). The supernatant should be clear and the residue white. We then cooled it, then added 20 mL of ultrapure water and 30 mL of sodium hydroxide at 400 g/L (until the solution turns brown). We steamed in the condenser by collecting the distillate in an Erlenmeyer flask or a 200mL flask containing 20mL of boric acid and a few drops of cresol green up to a volume of 125mL. We finally dosed the solution with N/20 sulfuric acid until the indicator (cresol green) turned from green to pink.

The protein content is determined using the following formula:

%N = (V H2SO4 x 0.07) / test sample

Protein content = %N x 6.25 (which is the multiplication factor)

2.2.1.3. Determination of Lipid Content

The oil extraction was carried out using the Soxhlet method [2] which is the reference method used for determining fat in dehydrated solid foods.

An empty 250 mL flask was weighed and its mass M_0 recorded. 200 mL of n-hexane was added to this flask. A cartridge containing a mass M equal to 15 grams of ground leaf material to be analyzed was placed in the extractor (Soxhlet). The extractor was positioned over the flask containing the elution solvent (hexane). The condenser, supplied with cold water, was placed on the extractor. After extracting the oil, the flask containing the solvent-oil mixture is recovered. The solvent is then separated from the oil using a rotary evaporator. Finally, the flask containing the oil is weighed and a new mass M_1 is recorded. The oil yield is calculated using the following formula:

%Lipids = (M1-M0)/M x 100

Where: %Lipids: lipid content (in %/100g DM); M: mass of the ground material (in g);

M0: mass of the empty flask (in g); M1: mass of the flask containing the oil (in g).

2.2.1.4. Determination of Crude Ash Content

Determining the ash content allows us to assess the mineral content of the sample. This operation consisted of incinerating the sample at a temperature of 550°C in an electrically heated muffle furnace until a constant mass was obtained. To do this, the empty crucibles were weighed, then 5g of the sample was weighed. The entire sample was placed in a muffle furnace for eight (8) hours. Afterwards, the crucible was allowed to stand until cooled, and then the crucible-sample assembly was weighed.

The ash content was determined using the following formula:

Ash content (% DM) = (M2-M0)/(M1-M0) × 100

Where:

M_0: mass in grams of the empty crucible. M_1: Mass in grams of the incineration crucible loaded with sample

M_2: Mass in grams of the incineration crucible loaded with ash.

2.2.1.4.1. Mineral Determination

Mineral determination is performed after determining the ash content. This operation consists of dissolving 0.5 g of ash from each sample in 10 ml of hyaluronic acid and 10 ml of lanthanum chloride. The solution is allowed to evaporate at 105°C in an incubator for 1 hour, then the residue obtained after evaporation is dissolved in 0.10 mol/L nitric acid. After filtering the solution, the metal contents are determined using the acetylated air flame atomic absorption technique. Each element is determined at a given wavelength.

The minerals measured are: Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Iron (Fe), Manganese (Mn), Copper (Cu) and Zinc (Zn).

2.2.1.5. Determination of Total Carbohydrate Content

Carbohydrate content is calculated by subtracting the sum of moisture, fat (MF), protein (P), and ash (C) from 100.

G = 100 – (H + P +MF +C)

2.2.7. Energy Value

The total energy value was calculated using the method of Manzi (1999) cited by Koffi et *al.* [3].

It is determined using the following formula:

VE (Kcal/100g) = (CHO x 4) + (CL x 9) + (CP x 4)

With CHO corresponding to the percentage (%) of carbohydrates, CL corresponding to the percentage (%) of lipids, and CP corresponding to the percentage (%) of proteins.

Expression of results. The Gauss-Laplace law method was used to determine the repeatability of the operations (three times) [4]. The following values were considered: mean, standard deviation (mean ± standard deviation). This was done using the Excel Pro 2019 spreadsheet.

2.2.2. Statistical Studies and Expression of Results

All measurements were carried out four times each. Statistical data processing was performed using the Excel spreadsheet, version 7. The results are expressed as mean ± SEM. Comparisons between multiple means were performed using analysis of variance (ANOVA)

3. Results and Discussion

3.1. Physicochemical Characteristics

The results of the analyses on the leaves studied are presented in Table 1 below.

The water contents of the different samples are very high and prove that it is freshly harvested plant material. Of these three species, *C. esculenta* has the highest water content (84.89±0.57%), followed by *A. hypogaea* (80.93±1.83%) and finally *C. cajan* (68.13±0.46%). The water contents of these species are higher than that of *Gnetum africanum* studied in the Republic of Congo [5]. These water contents are, however, low compared to Gbolo [*Crassocephalum rubens* (Juss. ex Jacq.) and *C. crepidioides* (Benth.)] studied in Benin and who found values ranging from 86.79± 0.04% for *C. crepidioides* to 87.95% ± 0.07% for *C. rubens* [6]. Yao et *al.*, working on some of the most consumed leafy vegetables in Daloa in Ivory Coast, found very high levels in these vegetables ranging from 78.02 ± 0.25 to 93.75 ± 0.12% [7]. These levels are higher compared to the leaves of *C. cajan*. However, the water contents of *C. esculenta* and *A. hypogaea* are within this range. Mananga et *al.*, working on *A. hypogaea* and *C. esculenta* in Congo had found lower water contents (27.19% for *Arachis hypogaea* and 30.23% for *Colocasia esculenta*) on the same species included in this present study [8]. This difference could be explained much more by the harvest period of the different samples and by the nature of certain physical parameters of the different collection locations of the samples that were the subject of these studies. However, the samples that were the subject of this study are less hydrated than the leaves of *Pteridium aquilinum* studied by Mananga et *al.* and which had obtained a water content of 91.72% [8]. The leaves of *Moringa oleifera* studied in 2011 in Burkina Faso had a water content of 73.9% [9]. This value is lower than the values obtained on the leaves of *A. hypogaea* (80.93±1.83%) and *C. esculenta* (84.89±0.57%) but lower than the value obtained on the leaves of *C. cajan* (68.13±0.46%) of this present study.

Table 1. Biochemical Composition and Nutritional Value of the Different Samples

Samples	Water (%)	Protein (%)	Lipids (%)	Ash (%)	Carbohydrates (%)	Energy Value (Kcal/100 g)
A. hypogaea	80.93±1.83	1.83±0.08	1.46±0.12	0.62±0.001	15.40±1.84	81.26±5.86
C. cajan	68.13±0.46	23.00±0.33	0.38±0.13	2.16±0.02	6.44±0.67	120.94±1.56
C. esculenta	84.89±0.57	0.88±0.01	1.32±0.07	1.37±0.01	11.54±0.57	61.55±2.43

The protein content of peanut leaves is low (on average 1.83%). This value, however, is very high compared to *C. esculenta* leaves but very low compared to *C. cajan* leaves. This allows us to conclude that *A. hypogaea* and *C. esculenta* leaves do not constitute fodder, with a protein content approaching 20%. The protein content of *C. cajan* leaves, on the other hand, is a quality fodder.

Matoumouene Goma et *al.*, while characterizing *Gnetum africanum* leaves in Congo Brazzaville, found very high values (16.61%) [5]. This value is very high compared to the vegetables studied in this study, except for *C. cajan*, whose average protein content is 23.00±0.33%.

Coulibaly et *al*., working on *Moringa oleifera* leaves in the Bamako District of Mali, found a protein content of 22.2±3.00% [10]. This value is very high compared to the leaves of *A. hypogaea* and *C. esculenta* studied, but it is slightly low compared to the leaves of *C. cajan*, which were the subject of this study. Nimeza et *al.*, who conducted a study on basella leaves from Burkina Faso, found a protein content of 1.9% [11]. This value is higher than the values found in this study. KABORE, from November 2009 to May 2010, conducted a study that showed that basella leaves contain protein levels of 1.8%. This value is also high compared to the taro leaves that were the subject of this study [12].

Adjantin et *al*., by characterizing the leaves of Gbolo (*Crassocephalum crepidioides*, *Crassocephalum rubens*) from Benin, found an average protein content of 27.13±0.01%. This value is higher than all the values found in all the leaves in this study [6]. Yao et *al*., working on some leaves consumed in Daloa, Ivory Coast, obtained protein contents ranging from 1.82 ± 0.12 to 5.22 ± 0.18% [8]. These values are lower than the protein content of *C. cajan* and much higher than the protein content of *C. esculenta* in this present study but take into account the value found in the leaves of *A. hypogaea*. A similar study conducted in Congo [8], gave the following results in proteins: Ferns (*Pteridium aquilinum*): 0.61%; Peanuts (*Arachis hypogaea* L.): 0.33% and Taros (*Colocasia esculenta* L.) Schott: 0.56%. The results of this study confirm that peanut and taro leaves are not good sources of protein although the values obtained in the recent study are higher [8]. The *Moringa oleifera* leaves studied in Burkina Faso had a protein content of 11.90% [9]. These leaves are therefore richer in protein than the leaves of *A. hypogaea* (1.83±0.08%) and *C. esculenta* (0.88±0.01%) but less rich than the leaves of *C. cajan* (23.00±0.33%) which were the subject of this study.

The *Myrianthus arboreus* leaves yielded a protein content of 57.02% [13]. This value is very high compared to the leaves of *C. cajan*, *C. esculenta*, and *A. hypogaea*, which were the subject of this study. *Myrianthus arboreus* leaves are higher in protein than *C. cajan* leaves. Lepengue *et al.*, working on the leaves of wild pepper (*Piper guineensis*) from the forests of Gabon, found an average protein content of 26.04% [14]. This value is higher than any of the values found in the leaves studied in this study.

The lipid contents of the leaves studied were 0.38±0.13% for *C. cajan*, 1.32±0.07% for *C. esculenta* and 1.46±0.12% for *A. hypogaea*. These results show that the leaves studied are very low in lipids. However, *A. hypogaea* leaves are richer in lipids than *C. esculenta* leaves, which are richer in lipids than *C. cajan* leaves.

Windépagnagdé Yaméogo et *al.* in Burkina Faso had a lipid content of 1.10% [9]. These leaves are therefore less rich in lipids than *A. hypogaea* leaves (1.46±0.12%) and *C. esculenta* leaves (1.32±0.07%) but richer than *C. cajan* leaves (0.38±0.13%), which were the subject of this study.

Gbolo leaves (*Crassocephalum crepidioides* and *Crassocephalum rubens*) consumed in Benin are richer in lipids than the leaves that were the subject of this study with contents ranging from 2.75±0.01% for *Crassocephalum rubens* to 3.45±0.00% *Crassocephalum crepidioides* [6]. Kossiwa et *al*., working on taro leaves (*Xanthosoma sagittifolium*) in Togo had obtained an average lipid content of 0.55 ± 0.08% [15]. This value is higher than that of the leaves of *C. cajan* studied but very low compared to the leaves of *C. esculenta* and *A. hypogaea* that were the subject of this study. Yao et *al*., by characterizing some of the most consumed leafy vegetables in the city of Daloa (Centre-West, Ivory Coast) found lipid contents ranging from 0.29 ± 0.02 to 0.69 ± 0.04% [7]. These leafy vegetables have very low lipid contents compared to the leaves that were the subject of the present study. Mananga et *al*., by characterizing ferns (*Pteridium aquilinum*), peanuts (*Arachis hypogea* L.) and taros (*Colocasia esculenta* (L.) Schott found the following average lipid contents: 9.45% for *Pteridium aquilinum*, 16.21% for *Arachis hypogaea* and 4.46% for *Colocasia esculenta* [8]. These leafy vegetables are richer in lipids than the leaves of *C. cajan*, *A. hypogaea* and *C. esculenta* which were the subject of this study. This value is very high compared to the values obtained in this present study. We can thus say that the leaves of *Pteridium aquilinum* are richer in lipids than the leaves of *C. cajan*, *C. esculenta* and *A. hypogaea* which were the subject of this study. These leaves studied are also less rich in lipids compared to the leaves of *Gnetum africanum* [5] and which had obtained an average content of 7.34%.

The ash contents of the leaves studied are as follows: 0.62±0.00% for *A. hypogaea*; 2.16±0.02% for *C. cajan* and 1.32±0.07% for *C. esculenta*. It appears from these results that the leaves of *C. cajan* are richer in ash than the leaves of *C. esculenta* and the latter are richer in ash than the leaves of *A. hypogaea*. The leaves of Gbolo (*Crassocephalum crepidioides* and *Crassocephalum rubens*) studied in Benin have ash contents ranging from 19.02±0.01% to 19.76±0.05% [6]. These leaves are very rich in ash compared to the leaves studied in this present study. We can therefore conclude that Gbolo leaves are very rich in minerals compared to the leaves studied.

The leaves studied are also less rich in ash than the *Gnetum afrcanum* leaves [5]. Taro (*Xanthosoma sagittifolium*) leaves, found an ash content of 1.07 ± 0.00% [15]. This content is low compared to that of *C. cajan* leaves (2.16±0.02%) and *C. esculenta* leaves (1.32±0.07%) but high compared to *A. hypogaea* leaves (0.62±0.00%). Yao et *al*., working on some of the most consumed leafy vegetables in the town of Daloa in Ivory Coast, found ash contents ranging from 0.79 ± 0.01 to 0.95 ± 0.01% [7]. The leafy vegetables studied in Ivory Coast have ash contents higher than those of *A. hypogaea* but lower than those of *C. cajan* and *C. esculenta* in this present study. Lepengue et *al*., working on wild pepper

(*Piper guineense*; *Piperaceae*) from the Gabonese forest, found a value of 3.4% crude ash [14]. This value is very high compared to the values found in this study in the leaves of *A. hypogaea* (0.62± 0.12%), *C. cajan* (2.16± 0.02%) and *C. esculenta* (1.32± 0.12%). The wild pepper leaves studied in Gabon are richer in minerals than the leaves that were the subject of the present study.

The leaves studied had carbohydrate contents of: 15.40±1.84% for *A. hypogaea*; 11.54±0.57% for *C. esculenta*; and 6.44±0.67% for *C. cajan*. Based on the results obtained in this study, we can conclude that the leaves studied are not a good source of carbohydrates. From these results, we conclude that *A. hypogaea* leaves are richer in carbohydrates than *C. esculenta* leaves, and *C. esculenta* leaves are richer in carbohydrates than *C. cajan* leaves. Gbolo leaves (*Crassocephalum crepidioides* and *Crassocephalum rubens*) from Benin, on the other hand, have carbohydrate contents ranging from 42.22 ± 0.04% for *C. crepidioides* to 43.11 ± 0.10% for *C. rubens* [6].

Gbolo leaves are therefore very rich in carbohydrates compared to the leaves studied in this study. The *Gnetum africanum* leaves have a carbohydrate content of 17.95% [5]. This content is also higher than the contents of the leaves studied in this study. Kossiwa et *al*., working on taro leaves from Togo, obtained a carbohydrate content of 11.05 ± 0.365% [15]. This value is essentially identical to the carbohydrate content of *C. esculenta* in this study, but it is lower than that of *A. hypogaea* and higher than the value obtained in the leaves of *C. cajan* in this current study. Yao et *al*., working on some of the most commonly consumed leafy vegetables in the town of Daloa in Côte d'Ivoire, found carbohydrate contents ranging from 71.26 ± 0.25 to 90.85 ± 0.12% in these vegetables (taro, spinach, potato, and cassava) [7].

The leafy vegetables studied in Côte d'Ivoire are richer in carbohydrates than the leaves that were the subject of this study. Kouame et *al*., working on the leaves of *Myrianthus arboreus* (Ticliti), obtained a carbohydrate content of 1.04% [13]. This value is very low compared to the values found in the leaves of this current study. Thus, we say that the leaves of *Myrianthus arboreus* (Ticliti) are very low in carbohydrates compared to the leaves of *A. hypogaea*, *C. cajan* and *C. esculenta* which were the subject of this study.

Lepengue et *al*., working on wild pepper (*Piper guineense*; *Piperaceae*) from the Gabonese forest, found a carbohydrate content of 21.48% [14]. This value is very high compared to the values found in this study in the leaves of *A. hypogaea* (15.40±1.84%), *C. cajan* (6.44±0.67%), and *C. esculenta* (11.54±0.57%). The wild pepper leaves studied in Gabon are richer in carbohydrates than the leaves that were the subject of this study.

Windépagnagdé Yaméogo et *al.* in Burkina Faso had a carbohydrate content of 10.60% [9]. These leaves are therefore less rich in carbohydrates than the leaves of *A. hypogaea* (15.40±1.84%) and *C. esculenta* (11.54±0.57%) but richer than the leaves of *C. cajan* (6.44±0.67%) which were the subject of this study.

The energy values of the leaves which were the subject of this present study are: 61.55±2.43 Kcal/100 g for *C. esculenta*; 81.26±5.86 Kcal/100 g for *A. hypogaea* and 120.94±1.56 Kcal/100 g for *C. cajan*. It appears from this study that the leaves of *C. cajan* are more energetic than the leaves of *A. hypogaea* and the latter are more energetic than the leaves of *C. esculenta*. However, the leaves of *Gnetum africanum* studied in Congo are more energetic than all these previous leaves with an energy value of 204.28 Kcal/100g [5]. Adjatin et *al.* had found in the leaves of *Crassocephalum Crepidioides* and *Crassocephalum rubens* the energy values ranging from 302.91±0.56 Kcal/100g for *Crassocephalum rubens* to 308.45±0.28 Kcal/100g for *Crassocephalum crepidioides* [6]. All these values are very high compared to the leaves of *A. hypogaea*, *C. esculenta* and *C. cajan* which were the subject of the present study. Yao et *al.*, working on some of the most consumed leafy vegetables in the town of Daloa in Ivory Coast, the following values were found: 349.69±2.65 Kcal/100 g for Taro leaves; 373.30±0.43 Kcal/100 g for Spinach leaves; 344.84±0.92 Kcal/100 g for Potato leaves and 311.75±0.52 Kcal/100 g for Cassava leaves [7].

Comparison of the ash contents of these three species shows that *C. cajan* leaves are richer in minerals than *C. esculenta* leaves and the latter are richer in minerals than *A. hypogaea* leaves. The minerals sought in this study are: Calcium, Magnesium, Sodium, Potassium, Iron, Manganese, Copper and Zinc. Among the minerals identified in *A. hypogaea* leaves, potassium is the most represented chemical element, followed by calcium, then magnesium, sodium, iron; the other elements are in trace form. However, in *C. cajan* leaves, the most represented chemical element is potassium, followed by magnesium, calcium, sodium, iron, manganese; the others are in trace form. On the other hand, in *C. esculenta* leaves, sodium is the most represented chemical element, followed by calcium, potassium and magnesium; the others are in trace form. From the above, we can say that *C. cajan* leaves are richer in calcium and magnesium, potassium, iron, and zinc than *A. hypogaea* leaves and the latter are richer than *C. esculenta* leaves. However, *C. esculenta* leaves are richer in sodium than *C. cajan* leaves, followed by *A. hypogaea* leaves. Manganese and copper exist in trace amounts in all the leaves that were the subject of this study.

Table 2. Results of the mineral dosage of the different samples

Samples	Ash content (%)	Ca (%)	Mg (%)	Na (%)	K (%)	Fe (%)	Mn (%)	Cu (%)	Zn (%)
hypogaea	0.622	0.041	0.0224	0.00483	0.216	0.001	0.00023	0.000064	0.00032
C. cajan	2.17	0.065	0.18	0.012	0.69	0.003	0.001	0.00043	0.0027
C. esculenta	1.37	0.031	0.011	0.053	0.03	0.0003	0.0002	0.00004	0.00021

Adjatin et *al.*, showed by working on the leaves of Gbolo (*Crassocephalum Crepidioides* and *Crassocephalum rubens*) in Benin that the most represented chemical elements in leaves are: Potassium (K) with values of 2291.86±0.11 for *C. crepidioides* and 4469.91±0.11 for *C. rubens*, followed by Calcium (Ca), with a value of Calcium (Ca) 1012±0.06 for *C. crepidioides* and 3845.88±0.20 for *C. rubens* and Sodium (Na) with a value of 2213.45±0.73 for *C. crepidioides* and 2129.04±0.01 for *C. rubens* and finally Magnesium (Mg) with a value of 336.46±0.35 for *C. crepidioides* and 434.13±0.10 for *C. rubens* [6]. We can thus conclude that the leaves of green plants are good sources of potassium, calcium, sodium and magnesium. Other minerals exist in small proportions. Kossiwa et *al*., working on freshly harvested Taro leaves, obtained high levels of potassium (468 mg/100g), calcium (107.09 mg/100g), magnesium (19.20 mg/100g) [15]. Windépagnagdé Yaméogo et *al.*, working on *Moringa oleifera* leaves, found the following minerals in the center: Calcium with a content of 847.10mg/100g; Magnesium with a content of 151.30mg/100g; Potassium, with a content of 549.60 mg/100 g. *Moringa oleifera* leaves are richer in calcium, potassium, and magnesium than the leaves of *C. cajan*, *C. esculenta*, and *A. hypogaea*, [9] which were the subject of this study.

These results obtained by these different authors further demonstrate that these chemical elements are generally present in high levels in the leaves of green plants.

Based on the results presented in this table, we can say that *Cajanus cajan* leaves are a significant source of minerals and are therefore recommended for human and animal nutrition.

Based on the results presented in this table, we can say that *Colocasia esculenta* leaves are a good source of minerals and are therefore recommended for human nutrition.

Conclusion and Outlook

Based on this study, the results show that peanut leaves and taro leaves are not fodder plants. However, Nkassa leaves, in which we found a high protein content, are important fodder plants for human and animal consumption. However, the leaves studied are good sources of minerals, therefore essential for human and animal nutrition.

In the future, we plan to:

Conduct chemical screening of the different leaves to identify biomolecules useful in medicine and establish the profile of the amino acids present in these leaves;

Define the vitamin profile of the leaves studied; determine the nutritional profile of the leaves in the treatment of certain diseases such as sickle cell disease and anemia.

References

[1] **Rotsart de Hertaing, Courtejoie**. Nutrition, l'éducation nutritionnelle dans la pratique journalière. Ed. BERPS Kangu-Mayombé, République du Zaïre. (1975); 287p.

[2] **NF ISO 8262-3, (2006).** Détermination de la teneur en matière grasse. Association Française de Normalisation (AFNOR), Paris France. *Journal home page : www.elsevier.com/locate/foodchem.*

[3] **Diallo Koffi S., Koné Kisselmina Y., Soro Doudjou, Assidjo Nogbou E., Yao Kouassi B. et Gnakri Dago (2015).** Caractérisation Biochimique et Fonctionnelle des graines de sept (7) cultivars de Voandzou (*Vigna subterranea* L. Verdc. Fabaceae) Cultivés en Côte d'Ivoire. *European Scientific Journal*. V11(27), pp : 288-304.

[4] **Larrieu J (1988).** Utilisation de la statistique en gestion de qualité. In: Biotechnology, Scriban R. coordonnateur; Technique et Documentation-Lavoisier, Troisième Edition, Paris, pp. 661-679.

[5] **Matoumouene Goma. A.M, Leckoundzou Ayessa, Ossoko Jean Paul et Yoka Joseph. (2023).** Nutritional Quality of *Gnetum africanum* Welw Leaves Harvested in Makoua and sold on the Markets of Brazzaville. *EAS J Nutr Food Sci*; Vol-5, Iss-2: 45-50.

[6] **A. ADJATIN, A. DANSI, E. BADOUSSI, A. F. SANOUSSI, M.DANSI, P. AZOKPOTA, H. AHISSOU, A. AKOUEGNINOU, K. AKPAGANA and A. SANNI (2013).** Proximate, mineral and vitamin C composition of vegetable Gbolo [*Crassocephalum rubens* (Juss. ex Jacq.) S. Moore and *C. crepidioides* (Benth.) S. Moore] in Benin. *Int. J. Biol. Chem. Sci. 7(1): 319-331.*

[7] **Yao N'zué Benjamin, Kpata-Konan Nazo Edith, Guetandé Koné Lacina, Tano Kablan (2020).** Caractérisation De Quelques Légumes-Feuilles Les Plus Consommés Dans La Ville De Daloa (Centre-Ouest, Côte d'Ivoire). *European Scientific Journal, ESJ ISSN: 1857-7881 (Print) e - ISSN 1857-7431. Vol.16, No.36.*

[8] **MANANGA Vital, ELENGA Michel, ITOUA OKOUANGO Yvon Simplice, MACKOSSO KAMBISSI Merveille Aurore (2023).** Caractérisation nutritionnelle de trois légumes feuilles consommés à Brazzaville : Cas de Fougères (*Pteridium aquilinum*), Arachides (*Arachis hypogea* L.) et Taros (*Colocasia esculenta* (L.) Schott. *Journal of Animal & Plant Sciences (J.Anim.Plant Sci. ISSN 2071-7024) Vol. 58(1): 10595 -10607 https://doi.org/10.35759/JAnmPlSci.v58-1.2.*

[9] **Windépagnagdé Yaméogo Charles, Daba Bengaly Marcel, Sawadogo Aly, Nikiéma Philippe Augustin and Traoré Sabadénédyo Alfred (2011).** Determination of Chemical Composition and Nutritional Values of *Moringa oleifera* Leaves. *Pakistan Journal of Nutrition 10(3): 264- 268, ISSN: 1680- 5194.*

[10] **Coulibaly D, Dembélé Y K, Touré O B, Iknane A A, Sanogo R (2022).** Caractérisation et composition biochimique et nutritionnelle du *Moringa Oleifera* récolté dans le district de Bamako, Mali en 2020. *MALI SANTE PUBLIQUE, Décembre 2022, TOME XII, N° 01.*

[11] **Claire NIMEZA, Patrice BIGUMANDONDERA et Fernand NDIKORYAYO. (2021).** Détermination de la valeur nutritive des feuilles de baselles. *Afrique SCIENCE 18(1), PP : 223 – 229. ISSN 1813-548X, http://www.afriquescience.net.*

[12] **KABORE M. (2009).** Analyses et évaluation de la qualité des légumes feuilles au cours de la conservation et de transformation.

[13] **KOUAME N'dri Marie-Thérèse, SORO Kafana , MANGARA Ali , DIARRASSOUBA Nafan, KOULIBALY Annick Victoire et BORAUD N'Takpé Kama Maxime (2015).** Étude physico-chimique de sept (7) plantes spontanées alimentaires du centre-ouest de la Côte d'Ivoire. *Journal of Applied Biosciences 90:8450 – 8463. ISSN 1997–5902.*

[14] **Alexis Nicaise LEPENGUE, Stéphane MOMBO, Aurélien MOKEA-NIATY, Bert Davis MBOUNGOU MBADOUMOU, Dhert Souviens Tshi-Tshi ONTOD, Ephrem NZENGUE, Alain SOUZA, et Bertrand MBATCHI (2019).** Morphometric Biochemical and Physicochemical data of Wild Pepper (*Piper guineense*; *Piperaceae*) of the Gabones Forest. *International Journal of Innovation and Applied Studies ISSN 2028-9324 Vol. 28 No. pp. 18-23. http://www.ijias.issr-journals.org/.*

[15] **Kossiwa Wolali Go-Maro, Idès Bilabina, Elolo Osséyi, Courdjo Lamboni (2014).** Composition chimique et transformation des feuilles de taro (*Xanthosoma Sagittifolium*) en conserve de ragout. ***J. Soc. Ouest-Afr. Chim., 038 : 50 – 56.***