Scientific Research Publishing

Food and Nutrition Sciences, 2022, 13, 835-841
https://www.scirp.org/journal/fns
ISSN Online: 2157-9458
ISSN Print: 2157-944X

Evaluation of the Value Nutritious Leaves Five Varieties Taro (*Colocasia esculenta*) Cultivated in Burkina Faso

Boampoundi Hélène Ouoba[1], Amana Metuor Dabire[1,2], Sidnooma Véronique Zongo[2*], Hemayoro Sama[3], Samson Guenne[3], Renan Ernest Traore[4], Jacques Simpore[2]

[1]University of Dedougou, Dedougou, Burkina Faso
[2]Laboratory of Molecular Biology and Genetics (LaBioGene), Ouagadougou, Burkina Faso
[3]Laboratory of Biochemistry and Applied Chemistry (LABIOCA), Ouagadougou, Burkina Faso
[4]Biosciences Laboratory, Ouagadougou, Burkina Faso
Email: *vero.zongo.94@gmail.com

How to cite this paper: Ouoba, B.H., Dabire, A.M., Zongo, S.V., Sama, H., Guenne, S., Traore, R.E. and Simpore, J. (2022) Evaluation of the Value Nutritious Leaves Five Varieties Taro (*Colocasia esculenta*) Cultivated in Burkina Faso. *Food and Nutrition Sciences*, **13**, 835-841.
https://doi.org/10.4236/fns.2022.1310060

Received: August 29, 2022
Accepted: October 17, 2022
Published: October 20, 2022

Abstract

Taro is a perennial herbaceous plant whose large leaves are mainly used as vegetables in human food in several tropical countries. However, young taro leaves are not eaten very much in Burkina Faso unlike other countries which have made them a staple diet. In the present work, we collected leaves of taro varieties cultivated in the provinces of Comoe and Kenedougou. Our study aimed to determine the biochemical composition of these leaves in order to detect their nutritional quality. For this purpose, we first determined the total sugars in our different samples; then quantify the proteins and finally assay the lipids contained in the leaves of the different varieties of taro harvested. Analysis of the organic constituents gave the following results: proteins (186.29 to 265.23 µg EQ/100mg fresh leaves), fats (0.28% to 1.90%), carbohydrates (183.03 to 238.57 µg EG/100mg fresh leaves). The highest energy value was obtained with the variety BF/CO/06 (1728.71 kcal/kg) and the lowest with BF/CO/04 (272.15 kcal/kg). This study allowed us to conclude that the taro leaves (*Colocasia esculenta*) studied are of nutritional interest with regard to their biochemical composition.

Keywords

Colocasia esculenta, Nutritional Value, Leaves

1. Introduction

Burkina Faso is a country with a predominantly agricultural economy. The agri-

cultural sector employs nearly 90% of the working population and contributes 29.7% to the Gross Domestic Product (GDP) [1]. However, the yield of Burkinabe agriculture hardly allows it to be self-sufficient in food due to climatic constraints such as insufficient and irregular rains and also poor soils. In addition, Burkina's agriculture is based mainly on cereal crops with research institutions and agricultural extension services focused on cereal crops with less attention to tubers. While many countries have been able to achieve food security and guarantee their economic growth by improving cereal yields, this is not the case with Burkina Faso, which still remains in poverty and undernourishment despite the efforts made in matter [2]. In 1985, the Food and Agriculture Organization of the United Nations (FAO) therefore encouraged the diversification of food production, with an emphasis on promoting local crops, including plants with roots and tubers. *Colocasia esculenta* commonly called taro is a plant cultivated in Burkina Faso for its edible tubers. Unfortunately, its culture is in sharp decline to the point of being threatened with extinction. This regression is linked, among other things, to competition from crops such as cereals and cotton, to its ignorance by urban populations and to the lack of genetic improvement. Therefore, the cultivation of this plant is done in a traditional way. However, *C. esculenta* has good agronomic potential if its ecological requirements are met. It also has high nutritional and therapeutic values. Cultivation of *C. esculenta* can be done for supplementary feeding. Several varieties of taro are cultivated in Burkina Faso and their tubers are consumed throughout the country. However, we have to admit that taro leaves, as edible as tubers, are ignored; perhaps because of the lack of information on their nutritional value.

This study seeks to assess the nutritional value of taro leaves cultivated in Burkina Faso in order to thus contribute to the increase in agricultural production and food diversification.

2. Materials and Methods

2.1. Sample Collection

The study took place in 2019 between September and December. The leaves of five varieties of *Colocasia esculenta* were collected from a field experiment of the University Joseph Ki Zerbo located in Gampela located 25 Km to the east of the capitale of Burkina Faso (Ouagadougou). A pair of scissors were used for the harvest and the leaves were put in plastic bags, closed and labeled. They were then crushed using a grinder (Moulinex) and placed in a refrigerator until use. (Table 1)

Table 1. Description of cultivated varieties.

Varieties	Native country
BF/KE/09	Kenedougou
BF/CO/06	Comoe

Continued

BF/CO/04	Comoe
BF/CO/01	Comoe
BF/KE/07	Kenedougou

All samples were analyzed in triplicate for each parameter studied.

2.2. Determination of Total Sugars

One hundred milligrams of ground material from each variety was homogenized in 5 ml of 80% ethanol and then boiled for 30 minutes. After cooling, the homogenate was centrifuged at 3000 rpm for 10 minutes. The supernatant was used for the estimation of total sugars according to the Phenol-sulfuric acid method described by Dubois *et al.*, [3]. In the presence of concentrated sulfuric acid, the oses are dehydrated into compounds of the family of furfuralan derivatives ($C_5H_6O_2$). These products condense with the phenol to give yellow-orange complexes. The quantity of complexes is obtained by measuring the optical density of the solution at 490 nm with a spectrophotometer. The total sugars content was determined using a glucose calibration curve and was expressed in µg glucose equivalent/100mg of taro leaves.

2.3. Protein Quantification

Proteins were extracted from fresh crushed taro leaves in 0.9M NaCl solution. About 500 mg of crushed leaves were homogenized in 5 ml of the extraction solution and then centrifuged at 3000 rpm for 10 minutes. After centrifugation, the supernatant was nt was collected and it was added 5 ml 0.9M NaCl in you be containing the crushed and put in agitation for 24 hours. The whole was then centrifuged again at 3000 rpm for 10 minutes, and the second supernatant was collected. The supernatants are mixed for the assay. This extract was used to determine the protein content. Total proteins were assayed by the method of Bradford [4] using bovine serum albumin (BSA) as a standard. A volume of 50 µl of the supernatant was mixed with 250 µl of Bradford's reagent in a 96-well microplate and the absorbance was read at 595 nm. The protein content of taro leaves is determined using a calibration curve produced with BSA (Bovine Albumin Serum) and expressed in µg quercetin equivalent/100mg of taro leaves.

2.4. Dosage of Lipids

The oil content of the leaves was estimated according to the AOAC 960.39 method as described by Turinayo *et al.*, [5]. For each sample, 5 g of the crushed leaves was taken and placed in a cellulosic cartridge, which was introduced into an extractor of the soxhlet type. The soxhlet extractor is equipped at its base with a flask into which 200 ml of hexane is introduced and whose empty mass has been noted beforehand. The temperature of the hotplate was set to about 65˚C and the extraction lasted 6 hours. After extraction, the solvent was separated from

the lipids in vacuo on a rotary evaporator until the solvent evaporated completely. The estimated percentage leaf oil content was obtained using the formula:

$$\text{Fat content } \% = \left(M_1 - M_0 / M_{\text{sample}}\right) * 100$$

M_1: Mass of the balloon after extraction;

M_0: Mass of the vacuum flask;

M_{sample}: Mass of crushed leaves.

2.5. Energetic Value

The energy value was calculated using the following formula

E = mP * 4 Kcal; E = mG * 4 Kcal; E = mL * 9 Kcal; mE = A * 7 Kcal

m: mass in grams;

P: Protein; *G*: Total Sugar; *L*: Lipids.

2.6. Analyse Statistiques

All results were analyzed according to the ANOVA test.

3. Results and Discussion

3.1. Total Sugars

The total sugar content of the different varieties of *C. esculenta* is given in **Table 2**. The results obtained for the determination of the total sugars in the leaves of the different varieties of *C. esculenta* showed a high concentration in the variety BF/CO/04 (238.57 µg EG/100mg fresh leaves) and a low concentration in the variety BF/KE/07 (183.03 µg EG/100mg fresh leaves).

Several studies on the content of total sugars in various edible leaves have been carried out around the world and have revealed high levels of soluble sugars. This is the case of the leaves of *Vigna unguiculata* (cowpea) in which Sombie *et al.*, [6] found a value of 431 µg EG/100mg of fresh leaves. A significant difference in the content of total sugars in cowpea leaves and other leaves, for example our taro, could be attributed to the variable rate of photosynthesis [7]. Still, the amount of sugar in taro leaves could be helpful for the body. In fact, 80 to 90% of the energy supplied by carbohydrates is absorbed in the form of glucose and constitutes the primary source of energy for all cells in the body [8]. In addition, carbohydrates participate in the synthesis of certain molecules (RNA and DNA, cerebrosides, glycoproteins of cell membranes, collagen, extracellular matrix) [8] and in the purification of toxic products for the organism (glycuroconjugates in bile, NH3 radicals in the form of glutamic acid, H + radicals in the form of lactic acid).

3.2. The Proteins

The results of the analysis of the protein parameter are given in **Table 3**.

The results obtained from this analysis gave values ranging from 186.29 (BF/KE/09) to 265.23 (BF/CO/04) with an average of 163.08 µg EQ/100mg of fresh

Table 2. Results of the quantification of total sugars of different varieties.

Varieties	Total sugar content (µg EG/100 mg of fresh leaves)
BF/KE/09	185.19
BF/CO/06	232.49
BF/CO/04	238.57
BF/CO/01	228.84
BF/KE/07	183.03

Table 3. Results teneur protein varieties analyzed.

Varieties	Protein content (µg EQ/100 mg of fresh leaves)
BF/KE/09	186.29
BF/CO/06	235.19
BF/CO/04	265.23
BF/CO/01	235.66
BF/KE/07	241.71

leaves. Chay-prove *et al.*, Found a proportion of 4.4% protein in taro leaves in 2004, a value much higher than ours. In addition, in a study on *Xanthosoma sagittifolium*, another species of taro, carried out by Go-Maro *et al.* [9] it was found a proportion of 3.63% of protein which is also higher than our values. This could be explained by the nature of the soil or the substrate used. The high protein content of crops that used substrates is due to the increased nitrogen supply, which has a primary effect on protein synthesis [10]. In Burkina Faso, the work of Sombie *et al.* [6] on the determination of the nutritional value of the leaves of *Vigna unguiculata* had shown a protein content of 13998 µg EQ/100mg. Like cowpea leaves which are consumed on a large scale, taro leaves also contain protein, although in lesser quantities and can help diversify the diet. The proteins being involved in all the major physiological functions (tissue structure, enzymatic activities, hormones, antibodies, etc.), necessary for: the growth and development of the body; maintenance, healing and replacement of worn or damaged tissue; the production of metabolic and digestive enzymes; the constitution of hormones such as thyroxine and insulin and can also provide energy [11], our taro leaves would then be recommended in the diet.

3.3. The Fat

The assay of the lipids of the different varieties gave the results shown in **Table 4**. We found values between 0.28% and 1.90% for the varieties BF/CO/04 and BF/CO/06 respectively. These values are more or less similar to those found by Chay-prove *et al.*, Who found an average value of 1.8% in the leaves of *Colocasia esculenta* in 2004 in Australia. Our values are higher than that of Go-Maro *et al.*, [9] who found a value of 0.55% in a study on the chemical composition of taro

Table 4. Result of the lipid content.

VARIETIES	Lipid content (%)
BF/CO/04	0.28
BF/CO/01	0.78
BF/CO/06	1.90
BF/KE/09	0.44
BF/KE07	1.02

Table 5. The energy value of the five varieties of taro.

VARIETIES	Energy intake of sugars	Energy supply from proteins	Energy intake of lipids	Total intake (kcal/kg)
BF/CO/04	9.54	10.61	252.00	272.15
BF/CO/01	9.15	9.43	701.86	720.44
BF/CO/06	9.30	9.41	1710.00	1728.71
BF/KE/09	7.41	7.45	396.00	410.86
BF/KE07	7.32	9.67	917.45	934.44

leaves (*Xanthosoma sagittifolium*). The taro leaves studied here constitute a remarkable source of lipids and therefore of energy, and could play an important role in the diet as a vehicle for fat-soluble vitamins, A, D, E, K, at the same time as they protect them, against oxidation [12].

3.4. Energetic Value

The energy value of a food is the amount of energy that can be removed from it through digestion. It is expressed in kilojoules (KJ) or in kilocalories (kcal). The contents of lipids, total sugars and proteins allowed us to calculate the energy value of the five varieties of taro. Our values are expressed in kcal/kg of fresh material and are reported in **Table 5**. The highest value was obtained with the variety BF/CO/06 and the lowest with BF/CO/04. In view of these values, we retain that the consumption of taro leaves is not only a plus for food diversification, but also an important source of energy for the body.

4. Conclusion

Malnutrition remains one of the major problems responsible for infant mortality in Burkina Faso. This is linked not only to the quantity and quality of food that is ingested by the population, but also to the lack of information and popularization of the country's cultures. From our study, we retain that young taro leaves (*Colocasia esculenta*) are of nutritional interest in view of their nutrient composition. They are an important source of organic substances (sugars, proteins and lipids). It will help us to solve the problem of malnutrition by producing food

supplements based on taro leaves.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Consulté le (sept. 15, 2019) Disponible sur. [En ligne]. http://www.cia.gov/library/publications/the-world-factbook/gocs/uv.hthn

[2] Bambara, H. (2009) Caractérisation, agromorphologique d'une collection de taro (*Colocasia esculenta* (L.) Schott) originaire des domaines soudanien et soudano-guinéen du Burkina Faso.

[3] DuBois, M., Gilles, K.A., Hamilton, J.K., Rebers, P.A. and. Smith, F. (1956) Colorimetric Method for Determination of Sugars and Related Substances. *Analytical Chemistry*, **28**, 350-356. https://doi.org/10.1021/ac60111a017

[4] Bradford, M.M. (1976) A Rapid and Sensitive Method for the Quantitation of Microgram Quantities of Protein Utilizing the Principle of Protein-Dye Binding. *Analytical Biochemistry*, **72**, 248-254. https://doi.org/10.1016/0003-2697(76)90527-3

[5] Turinayo, Y.K., Kalanzi, F., Mudoma, J.M., Kiwuso, P., *et al.*, (2015) Physicochemical Characterization of *Jatropha curcas* Linn Oil for Biodiesel Production in Nebbi and Mokono Districts in Uganda. *Journal of Sustainable Bioenergy Systems*, **5**, 104-113. https://doi.org/10.4236/jsbs.2015.53010

[6] Sombié, P.A.E.D., Sama, H., Sidibé, H. and Kiendrébéogo, M. (2019) Effect of Organic (Jatropha Cake) and NPK Fertilizers on Improving Biochemical Components and Antioxidant Properties of Five Cowpea (*Vigna unguiculata* L. Walp.) Genotypes. *Journal of Agricultural Science*, **11**, 48-62. https://doi.org/10.5539/jas.v11n10p48

[7] Mondal, T., Datta, J. and Mondal, N. (2015) Chemical Fertilizer in Conjunction with Biofertilizer and Vermicompost Induced Changes in Morpho-physiOlogical and Bio-Chemical Traits of Mustard Crop. *Journal of the Saudi Society of Agricultural Sciences*, **16**, 135-144. https://doi.org/10.1016/j.jssas.2015.05.001

[8] Bierman, E.L. (1979) Carbohydrates, Sucrose, and Human Disease. *The American Journal of Clinical Nutrition*, **32**, 2712-2722. https://doi.org/10.1093/ajcn/32.12.2712

[9] Go-Maro, K.W., Bilabina, I., Osséyi, E. and Lamboni, C. (2014) Composition chimique et transformation des feuilles de taro (Xanthosoma Sagittifolium) en conserve de ragout. *Journal de la Société Ouest-Africaine de Chimie*, **38**, 50-56.

[10] Fadlalla, H.A., Abukhlaif, H.A.A. and Mohamed, S.S. (2016) Effects of Chemical and Bio-Fertilizers on Yield, Yield Components and Grain Quality of Maize (*Zea mays* L.). *African Journal of Agricultural Research*, **11**, 4654-4660. https://doi.org/10.5897/AJAR2016.11619

[11] Guéguen, J., Walrand, S. and Bourgeois, O. (2016) Les protéines végétales: contexte et potentiels en alimentation humaine. *Cahiers de Nutrition et de Diététique*, **51**, 177-185. https://doi.org/10.1016/j.cnd.2016.02.001

[12] Burr, G.O. and Burr, M.M. (1973) A New Deficiency Disease Produced by the Rigid Exclusion of Fat from the Diet. *Nutrition Reviews*, **31**, 148-149. https://doi.org/10.1111/j.1753-4887.1973.tb06008.x