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Chemical Composition of the Leaves of Two Wild Plants Consumed by the Population of Kisangani (DR Congo)

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Abstract: ***The leaves of Combretum congolanum and Combretum smeathmanii, two wild plant species, are consumed less in Kisangani (DR Congo) as tea substitute and in traditional medicine. Chemical investigations were carried out on the leaves of these plant species in order to determine their nutrients and phytochemicals. These leaves contained proteins (4.62 – 4.70%), lipids (1.24 – 1.40%), fibers (4.62 – 5.21%), sugars (2.50 – 3.01%), minerals, vitamins, alkaloids, polyphenols, saponins, sterols and terpens. The mineral content (mg/100g) of these leaves varies: calcium (770.62 – 903.23), magnesium (190.11 – 285.09), iron (10.14 – 11.50) and phosphorus (75.04 – 92.12); that of vitamins (mg/100g) also varies: vitamin C (8.82 – 11.49), vitamin A equivalent (0.26 – 0.54), vitamin B_1 (0.21 – 0.32), vitamin B_2 (0.09 – 0.14) and vitamin B_6 (0.47 – 0.75). The presence of these nutrients and phytochemicals justifies the use of these leaves by some people of Kisangani as tea and to treat certain health problems.***

Keywords: Wild plants leaves, analysis, nutrients, phytochemicals, Kisangani

1. Introduction

Plants have always been very widely used by man as food sources and for their beneficial effects on his health. Humans depend on agricultural production and domesticated species for their food and therapeutic needs. However, access to these food resources remains a challenge in DR Congo where some people have difficulty accessing food due to the lack of substantial financial means.

One of the solutions to this problem would consist in introducing into food rations wild food plants which remain unknown or underutilized. Some of these plants are consumed both as vegetables and as tea substitute.

The leaves of *Combretum congolanum* and *Combretum smeathmanii*, two wild species of the Combretaceae family, are consumed in Kisangani region (DR Congo) as tea substitute and in traditional medicine. [1], [2] and [3] have reported the use of the leaves of certain species of the *Combretum* genus as tea substitute and in traditional medicine in Mali, Niger and Senegal.

Moreover, [4], [5] and [6] reported the use of the leaves of *Hymenocardia ulmoides* or *Piper guineense* in human food (vegetable or tea substitute) and in traditional medicine in DR Congo and Congo-Brazaville.

As tea substitute, these easily accessible leaves would be a potential source of nutrients and phytochemicals and can help expand the range of spontaneous species that can exert beneficial effects in human health.

In this study, it was aimed to investigate the composition of the leaves of these plant species in nutrients and phytochemicals.

2. Material and Methods

2.1. Plant material

The plant material submitted to our investigations consists of the leaves of *Combretum congolanum* and *Combretum smeathmanii*. Leaves of these plants were collected in Kisangani (DR Congo) and identified at the Faculty of Sciences of the University of Kisangani.

2.2. Chemical analyses

Moisture was determined by drying the samples at 105°C. Nitrogen, lipids and sugars were respectively determined by the Kjeldhal method, the Soxhlet extraction method and the method described by [7]. Nitrogen content was multiplied by 6.25 to obtain protein content.

Acid-base digestion was used for the determination of fibers and titrimetry for titratable acidity. Ashes were determined by incineration of samples in a muffle furnace at 550°C. These ashes were then dissolved in hot nitric acid and the dissolved mineral elements (Ca, Mg, Fe and P) were determined according to the methods described by [8].

Vitamins (A, B_1, B_2, B_6 and C) were determined by the methods described by [9]. Mayer and Drangedorff tests were used to detect alkaloids. Foam test and ferric chloride test were used to detect saponins and polyphenols respectively according to [10]. Terpens and sterols were detected according to [11]. Oxalates, cyanides, nitrates and nitrites were detected by the methods described by [12].

3. Results and Discussion

Chemical analyzes of the leaves of two wild plants consumed in Kisangani were carried out, the results of these investigations appear in tables 1 to 5.

Table 1: Proximative composition of the analyzed leaves

Plant species	Humidity (%)	Proteins (%)	Lipids (%)	Ash (%)	Fibers (%)	Sugars (%)	Energy (KJ/100g)
C. congolanum	65.30	4.62	1.40	4.15	5.21	3.01	180.03
C. smeathmanii	76.02	4.70	1.24	5.07	4.62	2.50	166.99

As seen in table 1, water contents of the investigated leaves ranged from 65.30 to 76.02%, the highest content was observed in *C. smeathmanii*.

The range of protein content in the two plant species analyzed was between 4.62 and 4.70%. Compared with *Lippia multiflora* (herbal tea, proteins: 8.24%) and *Piper nigrum* L. leaves (17.46-20.30%) analyzed respectively by [13] and [14], the protein content of the wild plants studied was much lower. However, it was found to be higher than the values observed for the leaves of *Hibiscus sabdariffa L. (*3.9%) analyzed in 2009 by [15].

The leaves investigated showed a low lipid content (1.24%-1.40%). The observed content was lower than that of the leaves of *H. sabdariffa L. (*2.6%) and *L. multiflora* (2.9%) analyzed respectively by [15] and [13].

The ash content was within the range of 4.15–5.07%. The contents obtained were lower than that of *H. sabdariffa L. (*6.9%) or *L. multiflora* (12.06%) analyzed respectively by [15] and [13].

The fiber content of the leaves of *C. congolanum* (4.62% and 5.21%) was lower than that of *P. nigrum* L. leaves (10.64-13.62%) analyzed by [14].

The sugar content of the leaves analyzed was in the range from 2.50 to 3.01%, the sugar content of the leaves of *L. multiflora* (2.77%) analyzed by [15] was in this range.

Table 2: Mineral content of the analyzed leaves

Plant species	Ca (mg/100g)	Mg (mg/100g)	Fe (mg/100g)	P (mg/100g)
C. congolanum	903.23	285.09	10.14	92.12
C. smeathmanii	770.62	190.11	11.50	75.04

As shown in table 2, *C. congolanum* had higher content of calcium and magnesium when compared with *C. smeathmanii*. These calcium and magnesium contents were higher than those of *Lippia sidoides* Cham leaves (577 and 271 mg/100g) and *Cymbopogon citratus* Stapf leaves (278 and 90 mg/100g) analyzed in 2019 by [16]. These leaves were also found to contain much calcium and magnesium than the leaves of *Aspalathus linearis* (179.2 and 170.4 mg/100g) and *Cyclolia sp* (188.6 and 90.8 mg/100g) analyzed by [17].

The investigated leaves contained more iron than *L. multiflora* (3.25 mg/100g) analyzed by [13]. Their iron content was found to be similar to that of the leaves of *A. linearis* (11.7 mg/100g) and *Cyclosia sp* analyzed (9.16mg/100g) analyzed [17].

Phosphorus contents of the investigated plants were higher when compared with the leaves of *A. linearis* (68 mg/100g) and *Cyclosia sp* (53.2 mg/100g) consumed as tea in South Africa and analyzed by [17].

Table 3: Vitamin content of the analyzed leaves

Plant species	Vit C mg/100g	EqVit A mg/100g	Vit B1 mg/100g	Vit B2 mg/100g	Vit B6 mg/100g	EqAC cit g/100g
C. congolanum	8.82	0.26	0.32	0.09	0.75	0.42
C. smeathmanii	11.49	0.54	0.21	0.14	0.47	0.36

Legend: EqVit A and EqAc Cit mean respectively Vitamin A equivalent and Citric acid equivalent

As seen in table 3 show, Vitamin C was found to be 8.82 mg/100g in *C. congolanum* and 11.49 mg/100g in *C. smeathmanii*. Compared to *Aspilla africana* leaves (26.42 mg/100g) and *P. nigrum* leaves (234.80 mg/100g) analyzed respectively by [18] and [14], the vitamin content of the investigated leaves was found to be low.

C. smeathmanii (11.49 mg/100g) had the highest vitamin A equivalent level. Leaves of *C. congolanum* showed the highest vitamin B_1 content (0.32 mg/100g). This content was higher than those of *Bryophyllum pinnatum* (0.18 mg/100g) and *H. sabdariffa* (0.2 mg/100g) analyzed respectively by [18] and [15]. These leaves are however less rich in vitamin B_1 than *P. nigrum* leaves (1.14 mg/100g) analyzed in 2013 by [14].

The vitamin B6 contents of the leaves of *C. congolanum* and *C. smeathmanii* studied were respectively 0.75 mg/100 g and 0.47 mg/100 g. For titratable acidity, *C. congolanum* leaves showed the highest value (0.42 g/100g).

Table 4: Phytochemical groups of the analyzed leaves

Plant species	Alkaloids	Polyphenols	Saponins	Quinones	Sterols and terpens
C. congolanum	+	+	+	-	+
C. smeathmanii	+	+	+	-	+

Legend: + and-mean respectively presence and absence

As shown in table 4, alkaloids, polyphenols, saponins, sterols and terpens were present in the leaves of the invetigated plant species. [1] reported the presence of these phytochemicals in the leaves of *Combretum glutinosum* and *Combretum micranthum*, two plant species of *Combretum* genus used in traditional medicine in Niger. Polyphenols was be found in the leaves of *H. ulmoides*. It is known that polyphenols present in foods play a role in the prevention of various diseases associated with oxidative stresses [5]. The other secondary medabolites play also a role in the human health.

Table 5: Undesirable or toxic substances of the analyzed leaves

Plant species	Oxalates	Nitrates	Nitrites	Cyanides
C. congolanum	-	-	-	+
C. smeathmanii	-	-	-	+

Legend: + and-mean respectively presence and absence

The results presented in table 5 showed that the leaves investigated were free oxalates, nitrites and nitrates. Cyanides present in these leaves could be eliminated during the preparation of the tea substitute by decoction.

4. Conclusion

The presented results showed that the leaves analyzed were interest for their nutrients and phytochemicals which may play a role in human health and could contribute to the diversification of the tea substitute consumed in Kisangani (DR Congo).

References

[1] Diarra, N., Togola, A., Denou, A. et Willicox, M., 2016. Etude ethnobotanique des plantes alimentaires utilisées en période de soudure dans les régions Sud du Mali, Int. J. Biol. Chem. Sci.10 (1): 184-197.

[2] Chaibou, M., Bamba, A. N. M., Moussa, I., Ilagouma, A. T. et Khalid, I., 2020. Etude Bibliographique et Phytochimique de quelques plantes Médicinales utilisées pour le traitement de certaines maladies par les Tradipraticiens de la Zone de l'Azawagh au Niger, European Scientific Journal, 16 (6): 126 – 151.

[3] Pousset, J. L., Plantes médicinales africaines, tome 1-Utilisation pratique, 1989. ACCT, Paris, 156p.

[4] Andzouana, J. B., and Mombouli, J. B, 2011. Chemical Composition and Phytochemical Screening of the Leaves of Hymenocardia ulmoides and Vitex ferruginea, Pakistan Journal of Nutrition 10 (12): 1183-1189.

[5] Bamawa, C. M., Ndjele, L. M., and FOMA, F. M., 2013. Characterization of leaf phenolic compounds of *Hymenocardia ulmoides* (Wild plant tea) by HPLC-MS^n, International Journal of Pharmaceutical and Biological Research (IJPBR), 4 (4): 170-174.

[6] Termote, C., Van Damme, P. et Dhed'a, B. D., 2011. Eating from the wild: Turumbu, Mbole and Bali traditional knowledge on non-cultivated edible plants, District Tshopo, DR Congo, Genet Resour Crop Evol, 58: 585-618

[7] Dubois, M., Gilles, K. A., Hamilton, P. A., Ruberg A. and Smith, F., 1956. Colorimetric method for determination of sugars and related substances, Analytical chemistry 28 (3): 350 – 356.

[8] Jeffery, G. H., Bassett, J., Mendham, J. and Denney, H., 1989. Vogel's Textbook of Quantitative analysis, 5th edition, Longman Group UK, England, 877p.

[9] Welcher, F. J., 1963. Standard methods of chemical analysis, 6th ed., Vol.2, Part B, Van Nostrand Reinhold Compagny, London, 2541p.

[10] Bruneton, J.2009. Pharmacognosie, 4è édition, Tec. & Doc. Lavoisier, 1269p.

[11] Weast, P. B. and Robert, C., 1970. Hand-book of chemistry and physics, 50th ed., The Chemical rubber Company, Chevelend, 1170p.

[12] Svehla, G., 1979. Vogel's Textbook of Macro and Semimicro qualitative inorganic analysis, 5th edition, Longman Group UK, England, 605p.

[13] Ekissi, A. C., Yao-Kouamé A., Kati-Coulibaly S., 2017. Determination of the Minerals of the Herbal Tea and Tea Green from *Lippia multiflora*, American Journal of Plant Sciences, 8: 2608-2621.

[14] Nwofia, G. E., Kelechukwu, C. and Nwofia, B. K., Nutritional composition of some *Piper nigrum* L accessions from Nigeria, 2013. Int. J. Med. Arom. Plants., 3 (2): 247-254.

[15] Cissé, M., Dornier, M., Sakho, M., Ndiaye, A., Reynes, M. et Oumar Sock, O., 2009. Le bissap (*Hibiscus sabdariffa* L.): composition et principales utilisations, Fruits, vol.64 (3): 179-193.

[16] Fernandes, M. F. L, Moraes, S. M., Paulo Henrique Machado de Sousa, P. H. M, Magalhaes, C. E. C, Almeida, M. M. B, Silva, M. G. V, 2019. Characterization of leaves used in infusion preparation grown in northeastern Brazil by chemometric methods based on their multi-elemental composition Food Sci. Technol, Campinas, 39 (Suppl.1): 309-315.

[17] Olivier J., Symington, E. A., Jonker, C. Z., Rampedi, I. T., Van Eeden, T. S., 2012. Comparison of the mineral composition of leaves and infusions of traditional and herbal teas, S Afr J Sci.; 108 (1/2), http: //dx. doi. org/10.4102/sajs. v108i1/2.623.

[18] Okwu, D. E. and Josiah, C.2006. Evaluation of the chemical composition of two Nigerian medicinal plants, African Journal of Biotechnology Vol.5 (4): 357-361.