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EVALUATION OF PROXIMATE AND MINERAL COMPOSITION OF *Hibiscus physaloides* Guill. & Perr LEAVES

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Abstract
Hibiscus physaloides, a woody medicinal herb of the family Malvaceae used in treating parasitic infections, arthritis and pains was analyzed for its proximate and mineral composition in this study. The leaves were collected from the herbal garden of Biomedicinal Research Centre, Forestry Research Institute of Nigeria. They were washed, air dried and homogenized. Proximate and mineral compositions were determined using standard analytical procedures carried out in the laboratory. The proximate composition showed that the leaves are rich in carbohydrate (73.84±0.09%), moderate amounts of crude fibre (11.5±0.05%) and ash (7.49±0.21%) were detected. Crude fat, crude protein and moisture were also present at considerable amounts of 0.6±0.02%, 2.77±0.04% and 3.8±0.11% respectively. For mineral elements, K, Ca, Fe, Mg, Na, and P were present at varying amounts of 5.90±0.03 mg/g, 2.94±0.002 mg/g, 2.05±0.005 mg/g, 1.44±0.003 mg/g, 1.30±0.06 mg/g and 1.20±0.02 mg/g respectively. Mn, Zn and Cu had relatively low concentrations of 0.1±0.00 mg/g, 0.08±0.001mg/g and 0.02±0.001mg/g respectively. Findings from this study also showed that *Hibiscus physaloides* leaves have several nutrients like other species in its genus. Hence, *Hibiscus physaloides* leaves are repositories of nutrients which can be exploited for human and animal benefits.

Keywords: Malvaceae, medicinal plant, proximate analysis, mineral elements.

Introduction

Medicinal plants are plants that have medicinal properties. Their cultivation dated back to approximately 60,000 years ago (Solecki and Shanidar, 1975; Jamshidi-Kia et al., 2018). Scripts on medicinal plants in Egypt, China and India were written around 5000 years ago, while those found in Greece and Central Asia date back to at least 2500 years ago (Ang-Lee et al., 2001). They are made up of active compounds that have direct and indirect therapeutic and physiological effects on living organisms. As a result, they are materials for manufacturing drugs. Different parts of these plants such as the leaves, fruit, seeds, flowers, stem bark and the whole plants are used for medicinal purposes. Their acceptance across the world has increased (Jamshidi-Kia et al., 2018) with Africa not being left out (Mahomoodally, 2013).

Hibiscus physaloides Guill. & Perr., of the family Malvaceae is one of the medicinal herbs found in tropical Africa, the Canary and Cape Verde Islands. It is also known as wild okra, having irritating hairs with a height of about 2m. Its leaves are used in the treatment of cutaneous and subcutaneous parasitic infections, while the flowers are edible (Royal Botanic Gardens, 2018). The Yoruba tribe of Nigeria refers to it as "Ewe-ina" and it's used by the tribe for curing arthritis and pains.

Dearth of scientific information on the proximate and mineral composition of its leaves has necessitated this study. Knowledge of nutrients inherent in *H. physaloides* leaves can help to foster its use in maintaining good health and optimal physiological performance of both man and animal.

Materials and Methods

Sample Collection and Preparation: *H. physaloides* leaves were collected from the herbal garden of Biomedicinal Research Centre, Forestry Research Institute of Nigeria Ibadan, Oyo State, Nigeria. They were identified and authenticated at the Forest Herbarium Ibadan (FRIN) with voucher number FHI-112089. They were washed using running water so as to remove debris and dried to constant weight for about 2 weeks. They were homogenized (blended) using Rico MG '601' grinder mixer and stored in an air-tight bottle before analyses.

Determination of Proximate Composition: The proximate composition of the leaf samples was evaluated using the standard methods of Association of Official Analytical Chemists (AOAC, 2000) as adopted by Adeniyi and Ariwoola (2019).

Mineral Analysis: This was determined using wet digestion method (concentrated nitric acid and perchloric acid). Concentration of Fe, Ca, Mg, Mn, Cu, Zn were determined with the aid of a Bulk Atomic Absorption Spectrophotometer, P was estimated using the Vanodomolybdate method, while Na and K were determined with the aid of Jenway flame photometer (AOAC, 1990).

Results

Proximate Composition

The results of the proximate analyses of the leaf samples of the species under study are presented in Table 1. The dried leaves are made up of 3.8±0.11% moisture, ash content of 7.49±0.21%, 2.77±0.04% crude protein, a low crude fat of 0.6±0.02%, 11.5±0.05% crude fibre and 73.84±0.09% carbohydrate.

Table 1: Proximate composition of *H. physaloides* leaves

Parameters	Composition (%)
Moisture content	3.8±0.11
Ash	7.49±0.21
Crude Protein	2.77±0.04
Crude fat	0.6±0.02
Crude fibre	11.5±0.05
Carbohydrate	73.84±0.09

Data are presented as mean ± standard deviation of three replicates

Mineral Composition

The results of the mineral analyses are presented in Table 2. The leaf samples analyzed contained a relatively high potassium concentration of 5.90±0.03 mg/g, 2.94±0.002 mg/g Ca, 2.05±0.005 mg/g Fe, Mg concentration of 1.44±0.003 mg/g, 1.30±0.06 mg/g Na, 1.20±0.02 mg/g P and relatively low concentrations of Mn - 0.1±0.00 mg/g, 0.02±0.001 mg/g Cu and 0.08±0.001 mg/g Zn.

Table 2: Mineral composition of *H. physaloides* leaves

Parameter	Concentration (mg/g)
Na	1.30±0.06
Ca	2.94±0.002
Mg	1.44±0.003
K	5.90±0.03
Fe	2.05±0.005
Cu	0.02±0.001
Mn	0.1±0.00
Zn	0.08±0.001
P	1.20±0.02

Data are presented as mean ± standard deviation of three replicates

Discussion

The moisture content discovered in dried leaves of *H. physaloides* was 3.8±0.11%, this is lower than 7.70±0.014% discovered in Raw Dried Leaf Powder (RDLP) of *H. rosa-sinensis* analyzed by Eze and Nwibo (2017). Ayodeji et al., (2018) reported the presence of 8.45±0.02% moisture in dried leaves of *H. sabdariffa*. On the other hand, Asaolu et al., (2012) reported the presence of 10.02% moisture in dried leaves of *Vernonia amygdalina* (bitter leaf) a leafy vegetable of a different family and genus. Moisture content has an inverse relationship with dry matter; hence it is of high importance to the consumer and processor (Adeniyi and Ariwoola, 2019). Ash content of 7.49±0.21% was discovered in this study. This is similar to 7.34±0.01% reported by Ayodeji et al., (2018) for *H. sabdariffa* leaves, while Eze and Nwibo (2017) reported a value of 11.18±0.042% for RDLP of *H. rosa-sinensis.* Onwordi et al., (2009) observed an ash content of 26.30±4.20% in *Amaranthus cruentus* a leafy vegetable. Ash content gives an insight to the non-organic matter component of the dry matter present in food (Adeniyi and Ariwoola, 2019). Proteins supply amino acids, energy and nitrogenous substances (enzymes and antibodies) that are needed for normal body functions (Adeniyi and Ariwoola, 2019). A low crude protein value of 2.77±0.04% was present in the leaves studied, this is similar to 2.60±0.014% reported by Eze and Nwibo (2017) for RDLP of *H. rosa-sinensis*, while Ayodeji et al., (2018) reported 11.75±0.01% for *H. sabdariffa* leaves. Asaolu et al., (2012) discovered a higher amount of 50.64% crude protein in *V. amygdalina*. *H. physaloides* leaves had a low crude fat of 0.6±0.02% in this study. This is similar to 2.24±0.01% reported by Ayodeji et al., (2018) for *H. sabdariffa* and 1.58±0.028% reported by Eze and Nwibo (2017) for RDLP (Raw Dried Leaf Powder) of *H. rosa-sinensis*. A low crude fat of 3.51% was also detected in *Gongronema latifolium* (Bushbuck) analyzed by Asaolu et al., (2012). Fats act as vehicles for fat soluble vitamins A, D, E and K (Adeniyi and Ariwoola, 2019; Reboul, 2017). They also act as repositories of energy (Knight, 2018). Crude fibre helps to increase water retention capacity during passage of food along the human gut (Adeniyi and Ariwoola, 2019). The percentage crude fiber of 11.5±0.05 detected in the leaves of the species in this study was higher than 3.15±0.021% reported by Eze and Nwibo (2017) for RDLP of *H. rosa-sinensis* and also higher than 7.35±0.01% reported in *H. sabdariffa* leaves by Ayodeji et al., (2018). *Celusia argenta*, a leafy vegetable from a different family has a similar crude fiber value of 11.70±0.80% (Onwordi et al., 2009). The amount of carbohydrate detected in *H. physaloides* (73.84±0.09%) is similar to what was obtained in other plants. The RDLP of *H. rosa-sinensis* had 73.81±0.127% (Eze and Nwibo, 2017) while 63.02±0.03% was found in H. *sabdariffa* leaves (Ayodeji et al., 2018). *Corchorus olitorius* studied by Onwordi et al., (2009) had a lower percentage carbohydrate of 31.30±1.50. Carbohydrates are rich in energy; they also help in proper functioning of the intestinal tract (Adeniyi and Ariwoola, 2019).

H. physaloides leaves like the other species in its genus are rich in mineral elements. A concentration of 5.90±0.03 mg/g was detected for potassium which is lower than 181.00 ± 0.50 mg/g that was obtained by Inyang et al., (2016) in *H.rosa-sinensis* leaves. Asaolu et al., (2012) reported a potassium concentration of 73.25 mg/100g in *V. amygdalina*. Potassium is essential for cellular enzymatic reactions, glycogenesis and osmotic pressure regulation (Adeniyi and Adam, 2019). It is also necessary for the heart, kidney and proper functioning of other organs (Odewale and Lawal, 2018). Calcium had a concentration of 2.94±0.002 mg/g, this is also lower than 772.57 ± 0.01 mg/g present in *H.rosa-sinensis* leaves (Inyang et al., 2016). Onwordi et al., (2009) also discovered a high concentration of 27.80±1.30 mg/g calcium in *C. argenta*. Calcium is needed for blood clothing and enzyme activation, it is also present in the teeth and bones (Soetan et al., 2010; Adeniyi and Adam, 2019). A concentration of 2.05±0.005 mg/g of iron was detected in the leaves, 31.17±0.21 mg/g was present in *H.rosa-sinensis* leaves reported by Inyang et al., (2016), Ayodeji et al., (2018) discovered a value of 13.36±0.01 mg/100g in *H.sabdariffa* leaves. Onwordi et al., (2009) reported a lower iron concentration of 0.39±0.04 mg/g in *C. argenta*. Concentrations of 1.44±0.003 mg/g, 1.30±0.06 mg/g and 1.20±0.02 mg/g were detected for magnesium, sodium and phosphorus respectively. *H.rosa-sinensis* leaves had 90.33 ± 0.03 mg/g, 0.38 ± 0.09 mg/g and 42.38 ± 0.01 mg/g (Inyang et al., 2016), while *H. sabdariffa* leaves contained 12.28+0.01 mg/100g magnesium and 125.58+0.01 mg/100g phosphorus (Ayodeji et al., 2018). Asaolu et al., (2012) detected concentrations of 27.51 mg/100g magnesium, 15.01 mg/100g sodium and 15.38 mg/100g phosphorus in *Basella alba* (Indian spinach). Magnesium prevents growth retardation and gonadal atrophy (Ayodeji et al., 2018), it also influences bone metabolism and prevents bone fragility (Odewale and Lawal, 2018). Phosphorus acts as a buffer, it is a component of the high energy compound ATP (Casiday and Frey 2012; Adeniyi and Adam, 2019), it combines with calcium to form calcium phosphate which is used for the development of bones and teeth (Odewale and Lawal, 2018); while sodium aids the transmission of nerve impulses Soetan et al., 2010; Adeniyi and Adam, 2019). Manganese, Copper and Zinc on the other hand had low concentrations of 0.1±0.00 mg/g, 0.02±0.001 mg/g and 0.08±0.001 mg/g respectively. Inyang et al., (2016) reported a value of 2.40 ± 0.03 mg/g for manganese in *H.rosa-sinensis* leaves; while Ayodeji et al., (2018) discovered 25.56+0.01 mg/100g manganese and 6.36+0.01 mg/100g zinc in *H. sabdariffa* leaves. Asaolu et al., (2014) reported that *V. amygdalina* leaves contained 3.16 mg/100g manganese and 1.06 mg/100g copper. *C. olitorius* on the other hand was found to contain 0.05± 0.00 mg/g zinc (Onwordi et al., 2009). Zinc is essential for male fertility and proper nerve function (Ayoola et al., 2010; Ayodeji et al., 2018); Copper is needed for myelin sheaths formation in the nervous system (Adeniyi and Adam, 2019) while manganese aids carbohydrate and fat metabolisms (Soetan et al., 2010; Adeniyi and Adam, 2019).

Conclusion

Findings from this study revealed that *Hibiscus physaloides* leaves have many vital nutrients that are of great benefit to man and animals. It can be exploited as a natural resource in animal feed production; further research should be conducted to ascertain its anti-nutritional composition, toxicity and other bioactive/ pharmacological potentials, not undermining their mode or mechanisms of action.

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References

Adebayo, O. R., Farombi, A. G. and Oyekanmi, A. M., (2013). Proximate, Mineral and Anti-Nutrient Evaluation of Pumpkin Pulp (Cucurbita pepo). *Journal of Applied chemistry,* 4(5): 25- 28.

Adeniyi, O. and Ariwoola, O., (2019). Comparative Proximate Composition of Maize (Zea mays L.) Varieties Grown in South-western Nigeria. *International Annals of Science,* 7(1): 1-5.

Adeniyi, O. O. and Adam, A. A., (2019). Evaluation of Cucurbita pepo L.Fruit Shell by Proximate and Mineral Analyses. Journal of Herbal Drugs, 9(4): 217-221.

Ang-Lee, M. K., Moss, J. and Yuan, C. S., (2001). Herbal medicines and perioperative care. *American Medical Association,* 286(2):208-216.

Asaolu, S. S., Adefemi, O. S., Oyakilome, I. G., Ajibulu, K. E. and Asaolu, M. F., (2012). Proximate and Mineral Composition of Nigerian Leafy Vegetables. *Journal of Food Research,* 1(3): 214- 218.
Association of Official Analytical Chemist (AOAC). (1990). Official Methods of Analysis of AOAC International. Washington, DC. USA. 15th ed.

Association of Official Analytical Chemists (AOAC). (2000). Official Methods of Analysis of AOAC International. AOAC International, Gaithersburg, MD, USA. 17th ed.

Ayodeji, P. O., Aniebet, T. A., Onoja, U. S. and Olanrewaju, O. I., (2018). Proximate, Mineral and Vitamin Composition of *Sorghum Bicolor, Carica Papaya and Hibiscus Sabdariffa* leaves. *Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT),* 12(1):85-89.

Ayoola, P. B., Adeyeye, A. and Onawunmi, O. O., (2010). Trace Elements and Major Minerals Evaluation of *Spondias mombin, Vernonia amygdalina and Momordica charantia* Leaves. *Pakistan Journal of Nutrition,* 9(8): 755 -758.

Casiday, R. and Frey, R., (2012), Blood, Sweat and Buffers: pH Regulation during Exercise. Washington University. pp 1-12.

Eze, I. M., Nwibo, D. D., (2017). Effects of Processing on Proximate Composition of *Hibiscus rosa- sinensis* Leaf. *European Journal of Medicinal Plants,* 18(2): 1-13.

Inyang, J. U., Mayen, G. B., Christiana, U. E. and Adenugba, I. M., (2016). Phytochemical, proximate and antibacterial properties of *Hibiscus Rosa-sinensis* L. Leaf. *Journal of Medicinal Plants Studies,* 4(5): 193- 195.

Jamshidi-Kia, F., Lorigooini, Z. and Amini-Khoei, H., (2018). Medicinal plants: Past history and future perspective. *Journal of Herbmed Pharmacology,* 7(1): 1-7.

Knight, K., (2018). The biology of fat. *Journal of Experimental Biology,* 221: 1-4

Mahomoodally, M. F., (2013). Traditional Medicines in Africa: An Appraisal of Ten Potent African Medicinal Plants. *Evidence-Based Complementary and Alternative Medicine*, Hindawi Publishing Corporation, 2013: 1-14.

Odewale, M. O. and Lawal, I. O., (2018). Comparative Study of Macro and Micro Nutrients of Vermicast. *Journal of Forestry Research and Management,* 15(2): 85-94.

Onwordi, C. T., Ogungbade, A. M. and Wusu, A. D., (2009). The proximate and mineral composition of three leafy vegetables commonly consumed in Lagos, Nigeria. *African Journal of Pure and Applied Chemistry,* 3(6): 102- 107.

Reboul, E., (2017). Vitamin E Bioavailability: Mechanisms of Intestinal Absorption in the Spotlight. *Antioxidants,* 6: 95.

Royal Botanic Gardens, Kew (K), JSTOR, Global Plants. (2018). Hibiscus physaloides Guill. & Perr. [family Malvaceae]

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

Solecki, R. and Shanidar, I. V., (1975). Neanderthal flower burial in Northern Iraq. *Science,* 190(4217): 880-881.