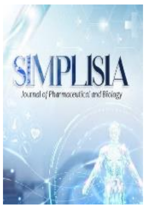

ISSN 2964-7959 (Online)
SIMPLISIA (Journal of Pharmaceutical and Biology)
Vol. 1 Issue. 1, (2023)
https://journal.jfpublisher.com/index.php/jpb

Seasonality Effect on Minerals and Phytochemicals Composition of Cymbopogon Citratus and Moringa Oleifera Leaves

David Christopher Bando[1*], Jesse Shingu Polly[2], Odiba Emmanuel Ogu[3], Ajiduku Leyoa Abershi[4], Blessing Smart Aigbogun[5], Rebecca Ayodele Shegun[6], Haruna Gambo Peace[7], Hannah Nuhu Tubasen[8]

[1]bandomidase@gmail.com

[1,2,3,5,6,7,8]Bioresources Development Centres-National Biotechnology Development Agency Taraba Nigeria, [4]Department of Biochemistry-Taraba State University Nigeria

*Corresponding Author: David Christopher Bando
Email: bandomidase@gmail.com

ABSTRACT

Phytochemical quality and quantity; and minerals varied in plants with respect to seasons. This study investigates the level of the secondary metabolites and minerals in Cymbopogon citratus and Moringa oleifera in dry and wet season. Phytochemical and minerals screening revealed the presence of phenolics, flavonoids, tannins, alkaloids, glycosides and K, Ca, Na, Fe, Zn respectively in both Cymbopogon citratus and Moringa oleifera. Moringa oleifera show higher quantity of phytochemicals compare to that of Cymbopogon citratus in both wet and dry seasons. Phytochemical content detected in both Cymbopogon citratus and Moringa oleifera samples follow this order: Cymbopogon citratus; Phenolics>Flavonoids>Alkaloids>Tannins>Glycosides, Moringa oleifera; Phenolics>Flavonoids>Alkaloids>Tannins>Glycosides and mineral contents in both Cymbopogon citratus and Moringa oleifera are in the increasing order: K>Ca>Na>Fe>Zn. The number of phytochemicals and minerals in Cymbopogon citratus and Moringa oleifera are slightly higher during rainy season.

Keywords: *Cymbopogon Citratus, Minerals, Moringa Oleifera, Phytochemicals, Seasonality*

INTRODUCTION

Since ancient times, plants have served as a significant source of medicine. The World Health Organization (WHO) reports that up to 80% of individuals still predominantly use conventional medicine like herbs for their medications today (Unuigbe et al., 2019) (Ekor, 2014). These plants have therapeutic potential because of a wide range of phytochemicals and the elements that make them up (Sheikh et al., 2013). Among these bioactive phytochemicals, alkaloids, tannins, flavonoids, phenolics, phlobatannins, saponins, and cardiac glycosides are the most significant (Edeoga & Gomina, 2001).

Although moringa oleifera was originally only found in the sub-Himalayan regions of India, Pakistan, Bangladesh, and Afghanistan, where it is used in traditional medicine, it is now widely cultivated around the world (Fahey, 2005) (T. Lockett, Christopher C. Calvert, 2000). Oleifera is known as a "miracle tree" or a "wonder tree" of major socioeconomic significance because of its numerous nutritional, medicinal, and industrial uses (Ginting et al., 2018). In addition to a composition of significant vitamins and minerals, this plant's leaves are a strong source of proteins, vitamins, beta-carotene, amino acids, and various phenolics (Bando et al., 2020).

Lemon grass, commonly known as Cymbopogon citratus, is a tropical perennial plant that is a member of the Poaceae family of plants that are known as genuine grasses (Uraku et al., 2015). It is a fragrant perennial tall grass used in traditional medicine to treat mental and gastrointestinal disorders, fever, and hypertension. It has rhizomes and a fibrous root that is densely tufted.

Crop output is significantly impacted by seasonality, a significant abiotic component. There are essentially two seasons in Nigeria: the rainy season and the dry season. Changes in temperature and rainfall are predicted to have a detrimental influence on a variety of agricultural operations. Over 30% and 70% of the decrease in productivity of field crops throughout the crop growth cycle is related to moisture and drought (insufficient water) stress (Kumaraswamy & Shetty, 2016). This research aimed to determine the impact of seasonal fluctuations.

RESEARCH METHODOLOGY

Sample Collection

In August (the rainy season), 2021, and February (the dry season), 2022, leaf samples of the plants Cymbopogon citratus and Moringa oleifera growing in Jalingo Metropolis, Taraba, Nigeria, were obtained. The plants were identified in the botanic section of Taraba State University's biological sciences department in Jalingo. The leaves were homogenized into a coarse powder using a laboratory blender after being allowed to dry at room temperature for two weeks.

Samples Digestion

Homogeneous solutions of 2:1 strength ratio HNO_3 and H_2O_2 were generated. After being pre-weighed at 1 g, each sample was dried, powdered, and then dissolved in this solution. The sample solution was heated on a hot plate at 130 ° C until the volume was reduced to 3 ml in order to increase the solubility. Whatman 42 filter paper was used to filter the mixture into a 25 ml volumetric flask after it had been refrigerated. According to Matusiewick's statement, the filtrate's concentration was adjusted to the proper amount (Matusiewicz, 2003).

Determination of Mineral Content

Using an Atomic Absorption Spectrophotometer, a modified version of the AOAC (Association of Official Agricultural Chemists) standard method was used to estimate minerals. Each element's concentration in the sample solutions in the sample bottles was measured. Each element was distinguished using a different cathode discharge light. The discharge lamp produces radiation with a specific wavelength for each element being examined. This specificity can only be obtained from a pure sample of the element that has undergone electrical stimulation to produce an arc spectrum on it.

FAAS examined all of the sample solutions using a nitrous oxide (N_2O)-acetylene flame. The lowering conditions for the atomization of the targeted heavy metal were enhanced by the ignition chamber's temperature, which rose to around 270°C. Each sample solution was nebulized, produced into an aerosol, mixed with flame gases, and then split into atoms. Around 5% of the sample was aspirated, which greatly decreased interferences (Arslan, 1999). Analysis of all sample solutions was performed to determine the amounts of trace heavy metals such as sodium (Na), calcium (Ca), potassium (K), iron (Fe), and zinc (Zn).

Phytochemical Analysis

The two medicinal plants were analyzed for the amounts of simple phenols, flavonoids, tannins, alkaloids, and Glycosides, using standard procedures for the quantitative analysis of these phytochemicals already reported in a research by Obadoni and Ochuko (2002); Hussain et al. (2011); Krishnaiah et al. (2009)and Bando et al. (2020).

Statistical Analysis

Experimental results were expressed as means ± standard deviations (n = 3, from 3 independent experiments). Differences between phytochemical quantities of the plant leaf samples were determined using analysis of variance (ANOVA, SPSS). The values were regarded as statistically significant at $p < 0.05$.

RESULT AND DISCUSSION

The Research Results

A. The Result of Mineral Composition and Phytochemicals of Cymbopogon Citratus and Moringa Oleifera during Rainy Season

1. Mineral Composition of Cymbopogon Citratus and Moringa Oleifera during Rainy Season, The Data Source from Jalingo Metropolis

Table 1 indicated the result of mineral composition of *cymbopogon citratus* and *moringa oleifera* sourced from Jalingo Metropolis data during rainy season, revealed the mineral content in this order: *cymbopogon citratus*; K>Ca>Na>Fe>Zn, *moringa oleifera*; K>Ca>Na>Fe>Zn. Nothing significant difference across all samples for Ca, K, Na, Fe and Zn at $P < 0.05$.

Table 1.
The Sample of Minerals Composition (mg/100g)

	Mineral Composition (mg/100g)				
Samples	Ca	K	Na	Fe	Zn
Cymbopogon citratus	211.36 ± 0.01^{d}	616.50 ± 0.00^{e}	61.50 ± 0.00^{c}	4.72 ± 0.01^{b}	1.25 ± 0.00^{a}
Moringa oleifera	113.97 ± 0.01^{d}	256.80 ± 0.00^{e}	32.65 ± 0.00^{c}	7.80 ± 0.00^{b}	3.01 ± 0.01^{a}

The results are expressed in mean ± standard deviation of triplet determination. Results with same alphabet superscript shows no significant difference while results with different alphabet superscript within the row shows significant difference at $P < 0.05$.

2. Phytochemical Composition of Cymbopogon Citratus and Moringa Oleifera during Rainy Season, The Data Source from Jalingo Metropolis

The phytochemical content of cymbopogon citratus and moringa oleifera collected from the city of Jalingo during the rainy season was shown in Table 2 in the following order: Phenolics >

Flavonoids > Alkaloids > Tannins > Glycosides in Cymbopogon citratus and Moringa oleifera. Phenolics, Flavonoids, Alkaloids, Tannins, and Glycosides did not differ significantly across all samples at $P < 0.05$.

Table 2.
The Sample of Quantitative Phytochemicals Composition (mg/100g)

	Quantitative phytochemicals Composition (mg/100g)				
Samples	Phenolics	Flavonoids	Tannins	Alkaloids	Glycosides
Cymbopogon citratus	20.06 ± 0.08^{e}	3.56 ± 0.01^{d}	2.55 ± 0.01^{b}	3.02 ± 0.02^{c}	0.18 ± 0.01^{a}
Moringa oleifera	31.68 ± 0.01^{e}	14.29 ± 0.01^{d}	3.00 ± 0.00^{b}	5.23 ± 0.01^{c}	0.90 ± 0.01^{a}

The results are expressed in mean ± standard deviation of triplet determination. Results with same alphabet superscript shows no significant difference while results with different alphabet superscript within the row shows significant difference at $P < 0.05$.

Table 3.
The Sample of Qualitative Phytochemicals Composition (mg/100g)

	Qualitative phytochemicals Composition (mg/100g)				
Samples	Phenolics	Flavonoids	Tannins	Alkaloids	Glycosides
Cymbopogon citratus	+++	+	+	+	-
Moringa oleifera	+++	+++	+	+	+

- = not detected, + = low quantity, ++ = Moderate quantity, +++ = high quantity

B. The Result of Mineral Composition and Phytochemicals of Cymbopogon Citratus and Moringa Oleifera in Dry Season

1. Mineral Composition of Cymbopogon Citratus and Moringa Oleifera during Dry Season, The Data Source from Jalingo Metropolis

Table 4 indicated the result of mineral composition of *cymbopogon citratus* and *moringa oleifera* sourced from Jalingo Metropolis during wet season, revealed the mineral content in this order: *cymbopogon citratus*; K>Ca>Na>Fe>Zn, *moringa oleifera*;

K>Ca>Na>Fe>Zn. There was significant difference across all samples for Ca, K, Na, Fe and no significant difference sample for Zn at P<0.05.

Table 4.
The Sample of Minerals Composition (mg/100g)

	Mineral Composition (mg/100g)				
Samples	Ca	K	Na	Fe	Zn
Cymbopogon citratus	192.93 ± 2.23^{c}	606.67 ± 7.31^{d}	56.96 ± 4.31^{b}	3.67 ± 0.08^{a}	0.98 ± 0.42^{a}
Moringa oleifera	109.97 ± 0.00^{b}	249.80 ± 1.41^{e}	30.85 ± 0.28^{c}	6.05 ± 0.35^{b}	2.96 ± 0.04^{a}

The results are expressed in mean ± standard deviation of triplet determination. Results with same alphabet superscript shows no significant difference while results with different alphabet superscript within the row shows significant difference at P < 0.05.

2. Phytochemical Composition of Cymbopogon Citratus and Moringa Oleifera during Dry Season, The Data Source from Jalingo Metropolis

The phytochemical content of Cymbopogon citratus and Moringa oleifera, both of which were obtained from Jalingo Metropolis during the dry season, was shown in Table 5 in the following order: Phenolics > Flavonoids > Alkaloids > Tannins > Glycosides are all components of Cymbopogon citratus and Moringa oleifera, respectively. Phenolics and flavonoids significantly differed across all samples, but alkaloids, tannins, and glycosides did not significantly differ across all samples (P < 0.05).

Table 5.
The Sample of Quantitative Phytochemicals Composition (mg/100g)

	Quantitative phytochemicals Composition (mg/100g)				
Samples	Phenolics	Flavonoids	Tannins	Alkaloids	Glycosides
Cymbopogon citratus	19.01 ± 0.16^{d}	3.09 ± 0.04^{c}	2.12 ± 0.00^{b}	2.96 ± 0.04^{c}	0.17 ± 0.01^{a}
Moringa oleifera	31.35 ± 0.09^{e}	13.90 ± 0.16^{d}	3.03 ± 0.01^{b}	5.23 ± 0.01^{c}	0.92 ± 0.02^{a}

The results are expressed in mean ± standard deviation of triplet determination. Results with same alphabet superscript shows no significant difference while results with different alphabet superscript within the row shows significant difference at $P < 0.05$.

Table 6.
The Sample of Qualitative Phytochemicals Composition (mg/100g)

	Qualitative phytochemicals Composition (mg/100g)				
Samples	Phenolics	Flavonoids	Tannins	Alkaloids	Glycosides
Cymbopogon citratus	++	+	-	+	-
Moringa oleifera	+++	+++	-	+	-

- = not detected, + = low quantity, ++ = Moderate quantity, +++ = high quantity

The Research Discussion

This research established the fact that season variability is a major contributory factor in the mineral and phytochemical content of plants. A number of studies have reported changes in bioactivity as plant samples collected in different seasons showed some disparities in their phytochemical compositions (Peters et al., 2018). Our research findings show the presence of various minerals and phytochemicals in *Cymbopogon citratus* and *Moringa oleifera* during wet and dry season. Potassium (K) and calcium (Ca) are found to be higher in quantity in both seasons. Although the level of the minerals decreases in dry season; K (606.67±7.31), Ca (192.93±2.23) compare to the wet season; K (616.50±0.00), Ca (211.36±0.01) respectively and it cut across minerals analyzed in the samples. The minerals in both *Cymbopogon citratus* and *Moringa oleifera* are in the increasing order; K>Ca>Na>Fe>Zn. Generally, the mineral content of *Cymbopogon citratus* is higher compare to that of *Moringa oleifera* in both wet and dry season. Mineral elements are vital to the human system, such as boosting immune system, bone development; serve as body electrolytes and as coenzymes.

Medicinal Plants possess various phytochemicals or secondary metabolites. Phytochemical screening revealed the presence of phenolics, flavonoids, tannins, alkaloids, in both *Cymbopogon citratus* and *Moringa oleifera* and low number of glycosides in *Moringa oleifera* during wet season this is in agreement to report by Bando *et al*. (2020). Tannin and glycosides were not detected in both samples during dry season. High quantity of flavonoids and phenolics are detected in *Moringa oleifera* in both seasons while only phenolics are detected in high quantity in *Cymbopogon citratus* in rainy season (Ozioma et al., 2022). Low amount of alkaloid is detected in both samples for both seasons.

Phytochemical content detected in both *Cymbopogon citratus* and *Moringa oleifera* samples follow this order: *Cymbopogon citratus*; Phenolics>Flavonoids>Alkaloids>Tannins>Glycosides, *Moringa oleifera*; Phenolics>Flavonoids>Alkaloids>Tannins>Glycosides. *Moringa oleifera* show higher quantity of phytochemicals compare to that of *Cymbopogon citratus* in both wet and dry seasons. Phenolics; wet season (*Cymbopogon citratus*: 20.06±0.08, *Moringa oleifera*: 31.68±0.01); dry season (*Cymbopogon citratus*: 19.01±0.16, *Moringa oleifera*: 31.35±0.09) are the highest detected phytochemicals in samples and glycosides: wet season (*Cymbopogon citratus*: 0.18±0.01, *Moringa oleifera*: 0.90±0.01); dry season (*Cymbopogon citratus*: 0.17±0.01, *Moringa oleifera*: 0.92±0.02) with minimal or none. The results of this research are in agreement with the findings of the already reported findings, although with different plant species (Sahoo *et al*., 2012; Peters *et al*., 2018). This research findings show that the amount of mineral content and phytochemical content changes with season.

CONCLUSION

This results of the research indicated the critical significance that both rainy and dry seasons have on the mineral and phytochemical composition of plants. In comparison to the dry season, the rainy season is characterized by an increase in phytochemical quantity and quality as well as mineral bioavailability in plants.

ACKNOWLEDGEMENT

The researchers would like to acknowledge the management and staff of Bioresource Development Center Jalingo, Taraba, Nigeria for their support in creating an enabling environment for the research.

REFERENCES

Arslan, Z. (1999). Determination of calcium, magnesium and strontium in soils by flow injection flame atomic absorption spectrometry. *Talanta*, *50*(5), 929–937. https://doi.org/10.1016/S0039-9140(99)00187-3

Bando, D. C., Tutuwa, J. A., Ogu, E. O., Nuhu, I., & Mbaragbog, S. J. (2020). Phytochemical screening, proximate nutritional analysis and anti-nutrient analysis of tiger nut (Cyperus esculentus). *International Journal of Advanced Scientific Research*, *5*(4), 53–60. https://www.allscientificjournal.com/download/373/5-4-32-394.pdf

D., K., T., D., A., B., & R., S. (2009). Studies on phytochemical constituents of six Malaysian medicinal plants. *Journal of Medicinal Plants Research*, *3*(2), 067–072. https://academicjournals.org/journal/JMPR/article-full-text-pdf/F4F3EDC14712

Edeoga, H. O., & Gomina, A. (2001). Nutritional values of some non conventional leafy vegetables of Nigeria. *Journal of Economic and Taxonomic Botany*, *25*(2), 439–447. https://eurekamag.com/research/003/866/003866482.php

Ekor, M. (2014). The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. *Frontiers in Pharmacology*, *4*. https://doi.org/10.3389/fphar.2013.00177

Fahey, J. W. (2005). Moringa oleifera: A Review of the Medical Evidence for Its Nutritional, Therapeutic, and Prophylactic Properties. Part 1. In *Trees for Life Journal*. https://www.tovshop.be/shops/tovshop/cms/fahey-jed-w-moringa-oleifera-a-review-of-the-medic.pdf

Ginting, N., Ginting, N., Aulia, D. N., & Hidayati, J. (2018). Utilization of Moringa (Moringa Oleifera) as A Multi Function Plant for Conservation Land in Lumban Suhi-Suhi Village, Samosir Regency. *Journal of Saintech Transfer*, *1*(2). https://talenta.usu.ac.id/jst/article/view/465/567

Hussain, I., Ullah, R., Ullah, R., & Khurram, M. (2011). Phytochemical analysis of selected medicinal plants. *African Journal of Biotechnology*, *10*(38), 7487–7492.

Kumaraswamy, S., & Shetty, P. K. (2016). Critical abiotic factors affecting implementation of technologicalinnovations in rice and wheat production: A review. *Agricultural Reviews*, *37*(4). https://doi.org/10.18805/ag.v37i4.6457

Matusiewicz, H. (2003). *Wet digestion methods* (pp. 193–233). https://doi.org/10.1016/S0166-526X(03)41006-4

Obadoni, B. O., & Ochuko, P. O. (2002). Phytochemical Studies And Comparative Efficacy Of The Crude Extracts Of Some Haemostatic Plants In Edo And Delta States Of Nigeria. *Global Journal of Pure and Applied Sciences*, *8*(2). https://doi.org/10.4314/gjpas.v8i2.16033

Ozioma, E. P., Bando, C. D., David, E. H., & Choji, S. (2022). Comparative analysis of some selected minerals in Costus afer leaf and stem in Abakaliki, Nigeria. *International Journal of Advanced Biochemistry Research*, *6*(2), 57–59. https://doi.org/10.33545/26174693.2022.v6.i2a.138

Peters, K., Gorzolka, K., Bruelheide, H., & Neumann, S. (2018). Seasonal variation of secondary metabolites in nine different bryophytes. *Ecology and Evolution*, *8*(17), 9105–9117. https://doi.org/10.1002/ece3.4361

Sheikh, N., Kumar, Y., Misra, A. K., & Pfoze, L. (2013). Phytochemical screening to validate the ethnobotanical importance of root tubers of Dioscorea species of Meghalaya, North East India. *Journal of Medicinal Plants Studies*, *1*(6), 62–69. https://www.plantsjournal.com/vol1Issue1/Issue_nov_2013/5.1.pdf

T. Lockett, Christopher C. Calvert, C. (2000). Energy and micronutrient composition of dietary and medicinal wild plants consumed during drought. Study of rural Fulani, Northeastern Nigeria. *International Journal of Food Sciences and Nutrition*, *51*(3), 195–208. https://doi.org/10.1080/09637480050029700

Unuigbe, C., Enahoro, J., Erharuyi, O., & Okeri, H. A. (2019). Phytochemical analysis and antioxidant evaluation of lemon grass (Cymbopogon citratus DC.) Stapf leaves. *Journal of Applied Sciences and Environmental Management*, *23*(2), 223. https://doi.org/10.4314/jasem.v23i2.4

Uraku, A. J., Onuoha, S. C., Edwin, N., Ezeani, N., Ogbanshi, M. E., Ezeali, C., Nwali, B. U., & Ominyi, M. C. (2015). Nutritional and Anti-Nutritional Quantification Assessment of Cymbopopgon citratus Leaf. *Pharmacology & Pharmacy*, *06*(08), 401–410. https://doi.org/10.4236/pp.2015.68041