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

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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 amount of phytochemicals and minerals in *Cymbopogon citratus* and *Moringa oleifera* are slightly higher during wet season.

Keywords: *Cymbopogon citratus, Minerals, Moringa oleifera, Phytochemicals, seasonality.*

1.0 INTRODUCTION

Plants have been an important source of medicine for thousands of years. Even today, the World Health Organization (WHO) estimates that up to 80% of people still rely primarily on traditional remedies such as herbs for their medicines [1]. The medicinal value of these plants is due to the presence of a variety of phytochemicals and their elemental composition [2]. The most important of these bioactive phytochemicals are alkaloids, tannins, flavonoids, phenolics [3], phlobatannins, saponins and cardiac glycosides [4].

Although *Moringa oleifera* is native to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan where it is used in folk medicine [5], it is now widely distributed all over the world [6]. *M. oleifera* is referred to as a "miracle tree" or a "wonder tree" [7] of significant socio economic importance because of its several nutritional, pharmacological [7] and industrial applications [8]. The leaves of this plant contain a profile of important trace elements, and are a good

source of proteins, vitamins, beta-carotine, amino acids and various phenolics [9].

Cymbopogon citratus, commonly known as lemon grass, is a tropical perennial herb belonging to the family Poaceae; grasses term as true grasses [10]. It is an aromatic perennial tall grass with rhizomes and densely tufted fibrous root and it is used in folk medicine in the treatment of nervous and gastrointestinal disturbances, fever and hypertension [4].

Seasonality is an important abiotic factor that affect crop yield. In Nigeria there are basically two seasons; Rainy (wet) and dry season. Temperature and rainfall changes are expected to significantly have negative impact on wide range of agricultural activities. Moisture and drought (insufficient water) stress accounts for about 30% to 70% loss of productivity of field crops during crop growth period [11]. This research aimed at investigating the effect of seasonal changes on the phytochemicals and minerals contents of *Cymbopogon citratus* and *Moringa oleifera*.

2.0 Materials and Methods

2.1 Sample collection

The leaves of *Cymbopogon citratus* and *Moringa oleifera* were collected from the plants growing within Jalingo metropolis, Taraba state, North-east, Nigeria in August (wet or rainy season), 2021 and February (dry season), 2022. The plants where identified at the botanic unit of the department of biological sciences, Taraba state university, Jalingo. The leaves were allowed to dry under room temperature for two weeks and homogenized into coarse powder with a laboratory blender.

2.2 Samples Digestion

HNO_3 and H_2O_2 were produced as homogenous solutions with a strength ratio of 2:1. Each sample was pre-weighed at 1 g, then dried, powdered, and then dissolved in this solution. The sample solution was heated on a hot plate at 130 °C until the volume was lowered to 3 ml in order to boost the solubility. The mixture was then chilled and filtered using Whatman 42 filter paper into a 25 mL volumetric flask. The filtrate was diluted to the appropriate level as described by Matusiewick (2003) [12].

2.3 Determination of mineral content

A modified version of the AOAC standard method was used to estimate minerals using an Atomic Absorption Spectrophotometer [13]. The concentration of each element was measured in the sample solutions in the sample bottles. A distinct cathode discharge lamp for each element was utilized to identify that element. Each element being analyzed has a certain wavelength of radiation that the discharge lamp generates. Only a pure sample of the element that has been electrically stimulated to create an arc spectrum on it can provide this specificity.

A nitrous oxide (N_2O)-acetylene flame was used by FAAS to examine all of the sample solutions. The ignition chamber's temperature, which reached about 270^0C, improved the reducing conditions for the targeted heavy metal's atomization. Each sample solution was nebulized, turned into an aerosol, combined with flame gases, and then transformed into atomic form. Aspiration was limited to a small portion of the sample, about 5%, which significantly reduced interferences [14;15]. All the sample solutions were analyzed for the estimation of trace heavy metals like sodium (Na), calcium (Ca), potassium (K), iron (Fe), and zinc (Zn).

2.4 Phytochemical analysis

The two medicinal plants were analysed 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, 2001; Hussain *et al*., 2011; Krishnaiah *et al*., 2009 and Bando *et al*., 2020[16;17;18;19].

2.5 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 $p < 0.05$.

3.0 Results

3.1 Wet Season

3.2. Results of mineral composition and phytochemicals of *Cymbopogon citratus* and *Moringa oleifera* in wet (rainy) season

3.2.1 Mineral composition of *Cymbopogon citratus* and *Moringa oleifera* in wet (rainy) season, sourced from Jalingo metropolis.

Table 1 show 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 no was significant difference across all samples for Ca, K, Na, Fe and Zn at $P<0.05$.

Table 1: Minerals Composition of samples (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]

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 $p < 0.05$

3.2.2 Phytochemical composition of *Cymbopogon citratus* and *Moringa oleifera* in wet (rainy) season, sourced from Jalingo metropolis.

Table 2 show the result of phytochemical composition of *Cymbopogon citratus* and *Moringa oleifera* sourced from Jalingo metropolis during wet season, revealed the phytochemical content in this order: *Cymbopogon citratus*; Phenolics>Flavonoids>Alkaloids>Tannins>Glycosides, *Moringa oleifera*; Phenolics>Flavonoids>Alkaloids>Tannins>Glycosides. There no was significant difference across all samples for Phenolics, Flavonoids, Alkaloids, Tannins and Glycosides at $P<0.05$.

Table 2: Quantitative phytochemicals Composition of sample (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]

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: Qualitative phytochemicals Composition of sample (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

3.3 Dry Season

3.4 Results of mineral composition and phytochemicals of *Cymbopogon citratus* and *Moringa oleifera* in dry season

3.4.1 Mineral composition of *Cymbopogon citratus* and *Moringa oleifera* in dry season, sourced from Jalingo metropolis.

Table 4 show 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: Minerals Composition of sample (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]

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 $p < 0.05$

3.4.2 Phytochemical composition of *Cymbopogon citratus* and *Moringa oleifera* in dry season, sourced from Jalingo metropolis.

Table 5 show the result of phytochemical composition of *Cymbopogon citratus* and *Moringa oleifera* sourced from Jalingo metropolis during wet season, revealed the phytochemical content in this order: *Cymbopogon citratus*; Phenolics>Flavonoids>Alkaloids>Tannins>Glycosides, *Moringa oleifera*; Phenolics>Flavonoids>Alkaloids>Tannins>Glycosides.

There was significant difference across all samples for Phenolics, Flavonoids and there was no significant difference in across all samples for Alkaloids, Tannins, Glycosides at $P<0.05$.

Table 5: Quantitative phytochemicals Composition of sample (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]

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: Qualitative phytochemicals Composition of sample (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

4.0 Discussion

This study 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 [20]. 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 amount of glycosides in *Moringa oleifera* during wet season this is in agreement to report by Bando *et al*., 2020[19]. 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 wet season. 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 [20;21]. This research findings show that the amount of mineral content and phytochemical content changes with season.

5.0 Conclusion

This research study proved that seasons; wet or dry, play vital role in the mineral and phytochemical contents of plants. Increased in phytochemical quantity and quality; and mineral bioavailability in plants are found in wet season compare to the dry season.

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