

Evaluation of the Mineral and Vitamin compositions of Leaves of *Alchornea cordifolia* and *Thaumatococcus daniellii*

ABSTRACT

The study was conducted to evaluate the vitamin and mineral compositions of leaf of *A. cordifolia* and *T. daniellii*. Standard methods were employed to determine the vitamin and mineral compositions of plant samples. Results obtained from the study showed that the concentration of Vit B6 ($4.46 \pm 0.02 \text{ mg/100g}$) was higher than those of other vitamins reportedly present in *A. cordifolia* leaf. However, the least in concentration of all the vitamins present being Vit C ($0.34 \pm 0.02 \text{ mg/100g}$). Results on the mineral compositions of leaf of *A. cordifolia* revealed that the leaf contains higher concentration of phosphorus ($4.58 \pm 0.13 \text{ mg/100g}$) compared to those of other minerals found present while zinc was found to be available at the least concentration of ($0.90 \pm 0.04 \text{ mg/100g}$). Furthermore, studies revealed that *T. daniellii* leaf contains considerable amount of Vit B12 ($7.87 \pm 0.07 \text{ mg/100g}$) and a minimal amount of vitamin B1 ($0.84 \pm 0.01 \text{ mg/100g}$). Results on the mineral compositions however, revealed that leaf of *T. daniellii* contains significant amount of calcium, phosphorus and potassium ($6.15 \pm 0.03 \text{ mg/100g}$) ($5.75 \pm 0.12 \text{ mg/100g}$) and ($5.30 \pm 0.14 \text{ mg/100g}$) respectively compared to another important element zinc reportedly present in the plant sample at the concentration of ($1.42 \pm 0.02 \text{ mg/100g}$). In conclusion, findings from this work have expanded the knowledge about *A. cordifolia* and *T. daniellii* while consolidating already established facts on their therapeutic potentials.

Keywords: vitamin, mineral, *A. cordifolia*, micronutrient

INTRODUCTION

Micronutrients are vitamins and minerals which are required in minute quantities for a healthy and effective growth of cellular components and tissue functions through its role in cellular metabolism and consequent generation of ATP [1]. Vitamins are organic substances that function as regulators or co-enzymes of enzymatic reactions in the body. They are categorized as fat soluble vitamins and water soluble vitamins [2]. While fat soluble vitamins are domiciled in the fat tissues and liver, water soluble vitamins occupy the aqueous cellular compartments such as mitochondria where they function in synergy with the enzymes of the respiratory chain synthesize ATP. [3]. Vitamins are considered critical to the overall well being of an individual.

Minerals are essential nutrients and represent about 5-6% of the total body weight. They are categorized as major or macro minerals and the trace or micro minerals and have been found to be useful as structural and regulatory molecules that have also taken active parts in many metabolic and immune functions [3]. Thus, their deficiencies can result to serious health issues.

Micronutrient malnutrition is common among the rural poor populace of developing countries of the world. It diminishes immune function and thus, predisposes a child to infections such as diarrhea a leading cause of death among children aged <5 years, delays full recovery, and increases the probability of development of severe illness [4]. This practice of using plants in the treatment of diverse forms of diseases plaguing mankind is predominant among those in the low income regions of developing countries [5].

The plant *Alchornea cordifolia* of the family Euphorbiaceae commonly known as the Christmas Bush is a medium-sized shrubby tree mostly found in marshy areas along the coastal regions of West Africa [6]. Its leaf has been used extensively in the treatment of notable human diseases including diarrhea [7].

T. daniellii, also known as the sweet prayers plant is a tropical rain forest, large rhizomatous flowering herb. The height of a fully grown *T. daniellii* plant is about 3-4m bearing some large papery leaves of about 46cm long with pale purple flowers and soft fruits containing a number of shiny black seeds [8]. The sweet prayers plant or Katemfe is found throughout the hot humid tropical rain forest and coastal zone of West Africa [9; 10]. It is particularly seen in the Southern parts of Ghana, Cote d'voire and Nigeria where it is used for wrapping food [11]. It is a source of thaumatin, an intensely sweet, non-toxic and heat stable protein used as a sweetening agent or taste modifier in beverages, desserts, chewing gums and pet foods. *T. daniellii* has been widely used in the treatment of diverse diseases ravaging mankind. For instance, the leaf sap of this plant has been used as an anti-dote against venoms, stings and bites, while the leaf and root sap have been used successfully as sedatives as well as in the treatment of mental illness [12].

Although, various parts of *Alchornea cordifolia* and *T. daniellii* have been used to meet several human needs, further researches targeted at some sparingly probed parts of these plants such as the leaf may suggest additional potentials to meet more human needs. More so, while the species *Alchornea cordifolia* is the most studied of the *Alchornea* genus, there is paucity of information on its micronutrient content and hence the need for these studies is undoubtedly imperative.

MATERIALS AND METHODS

Collection and Processing of Plant Material

300g of fresh mature leaves of *A. cordifolia* and *T. daniellii* used for the study were obtained from a farm land within Achara Uturu community of Isukwuato Local Government of Abia State. The plant materials were identified at the herbarium unit of Department of Forestry, Micheal Okpara University of Agriculture Umudike, Abia State Nigeria. The leaves were washed clean with tap water and allowed to dry at room temperature. Dried leaves were pulverized and properly stored in an airtight container.

Vitamin Analysis

The vitamins A, B1, B3, B5, B6, B12 and C content of *A. cordifolia* and *T. daniellii* were evaluated by the official methods of the Association of Official Analytical Chemists [13].

Determination of Minerals

Calcium (Ca), phosphorus (P), potassium (K) and Zinc (Zn) content of *A. cordifolia* and *T. daniellii* leaves were analyzed from solution obtained when 5g of the samples were digested with 10ml of 5N concentrated hydrochloride. The mixture was placed on a water bath and evaporated almost to dryness. The solution was cooled and filtered into 100ml standard flask and diluted to volume with distilled water. Atomic absorption spectrophotometer was used to analyze the minerals separately after acid digestion of the sample, as described in the official method of the Association of Official Analytical Chemists using atomic absorption spectrophotometer [13].

STATISTICAL ANALYSIS

Data generated from this study was analyzed using Statistical Package for Social Science. Values were expressed as mean \pm standard error of mean from three determinations.

RESULT AND DISCUSSION

Micronutrients are indispensable factors for any functioning living system. Their deficiency has resulted in several debilitating health conditions. They are found in different parts of plants and may be responsible for the therapeutic potentials of most plants. Table 1 shows the vitamin compositions of *A. cordifolia* leaf. Results generated from the

analysis carried out on plant sample showed that Vit B6 was present at a concentration of $(4.42 \pm 0.02 \text{mg}/100\text{g})$. This was followed by Vitamins B3, B12 and A $(3.30 \pm 0.12 \text{mg}/100\text{g})$, $(2.62 \pm 0.01 \text{mg}/100\text{g})$ and $(2.27 \pm 0.09 \text{mg}/100\text{g})$ respectively. All other vitamins evaluated were present at concentrations less than $1.00 \text{mg}/100\text{g}$. Results from this study are consistent with the findings Ezeokeke *et al* [14] which have demonstrated the antioxidant property of *A. cordifolia* leaves which may be attributed to the presence of vitamins such as vitamin B6 etc.

Table 2 shows the mineral compositions of *A. cordifolia* leaf. The outcome of the analysis shows that *A. cordifolia* leaf contains phosphorus at the concentration of $(4.58 \pm 0.13 \text{mg}/100\text{g})$, followed by potassium and calcium which were reportedly present at concentrations of $(2.32 \pm 0.05 \text{mg}/100\text{g})$ and $(1.79 \pm 0.12 \text{mg}/100\text{g})$ respectively and zinc being the least at the concentration of $(0.90 \pm 0.04 \text{mg}/100\text{g})$. These results are in tandem with findings of Joseph *et al* [15] which showed that extracts of *Alchornea cordifolia* can ameliorate diarrhea, a condition exacerbated in micronutrient deficiencies.

Table 3 shows the vitamin compositions of *T. daniellii* leaf. Results generated from the analysis carried out on plant sample showed that leaf of *T. daniellii* contains considerable amount of vitamin B12 content $(7.87 \pm 0.07 \text{mg}/100\text{g})$ followed by vitamins A and C which were found to be present at varying concentrations of $(3.00 \pm 0.01 \text{mg}/100\text{g})$ and $(2.25 \pm 0.22 \text{mg}/100\text{g})$ respectively. Other vitamins reportedly present in the leaf of *T. daniellii* are Vit B1, B3 and B5 but were found to be present at concentrations less than $2.00 \text{mg}/100\text{g}$. Results from this study are consistent with the findings of Shalom *et al* [16] which have shown leaf of *T. daniellii* possesses antioxidant property which may be attributed mainly to its rich vitamin B12 content.

Table 4 shows the mineral compositions of *T. daniellii* leaf. The outcome of the analysis conducted on sample material shows leaf of *T. daniellii* contains higher concentrations of calcium, phosphorus and potassium $(6.15 \pm 0.03 \text{mg}/100\text{g})$, $(5.75 \pm 0.12 \text{mg}/100\text{g})$ and $(5.30 \pm 0.14 \text{mg}/100\text{g})$ respectively but however has low zinc $(1.42 \pm 0.02 \text{mg}/100\text{g})$. These results are in tandem with the finding of Shalom *et al* [17] which showed *T. daniellii* leaf is a dependable source of certain minerals.

Table1: Vitamin compositions of *A. cordifolia* Leaf

Vitamins	Concentrations(mg/100g)
A	2.27±0.09
B1	0.84±0.01
B3	3.30±0.12
B5	0.36±0.03
B6	4.42±0.02
B12	2.62±0.01
C	0.34±0.02

Values are expressed as mean±SEM from three determinations

Table2: Minerals compositions of *A. cordifolia* Leaf

Minerals	Concentrations(mg/100g)
Calcium	1.79±0.12
Phosphorus	4.58±0.13
Potassium	2.32±0.05
Zinc	0.90±0.04

Values are expressed as mean±SEM from three determinations

Table3: Vitamin compositions of *T. daniellii* leaf

Vitamins	Concentration (mg/100g)
A	3.00±0.09
B1	1.07±0.01
B3	1.32±0.02
B5	1.11±0.02
B6	1.34±0.02
B12	7.87±0.07
C	2.25±0.22

values are expressed as mean ± SEM from three determinations

Table 4: Mineral compositions of *T. daniellii* leaf

Minerals	Concentration (mg/100g)
Calcium	6.15±0.03
Phosphorus	5.75±0.12
Potassium	5.30±0.14
Zinc	1.42±0.02

values are expressed as mean ± SEM from three determinations

CONCLUSION

The presence of micronutrients in *A. cordifolia* leaf though at minimal concentrations has added value to the wealth of existing knowledge about this important medicinal plant and further consolidates findings already established on it especially as it regards its therapeutic potentials. Similarly, *T. daniellii* has been proven through this research to be one of the very few medicinal plants with multiple potentials to function both as therapies for numerous human diseases as well as sources of micronutrients for active cellular metabolic functions and hence may be suitable as livestock feed.

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