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SHORT COMMUNICATION

Comparative analysis of mineral elements of green and withered brown leaves of *Tectona grandis* Linn in Nigeria

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ABSTRACT

Plant mineral elements play a special role in the maintenance of good health. Nigeria is rich in natural wealth and there is an ample scope to explore mineral constituents from the plant kingdom. Teak is an exotic tree in Nigeria but easily grows on almost all soil types in the country. This research aimed at comparatively investigating the macro nutrient status of both withered brown leaf and green leaf of teak from Onigambari plantation. The result of the analysis shows that Green *T. grandis* leaves contains Sodium 0.488/48.8%,Calcium 0.162/16.2%, Magnesium 0.034/3.4%, Potassium 0.065/6.5% and phosphorus 0.0006/0.06% respectively while the withered brown leaves contains Sodium 0.488/48.8%, Calcium 0.174/17.4%, Magnesium 0.034/3.4%, Potassium 0.046/4.6% and phosphorus 0.005/0.5% respectively. Also the trace elements contents of Green *T. grandis* leaves contains Iron 0.41/41%, Copper 0.067/6.7%, Manganese 0.010/1%, Zinc 0.005/0.5%, Lead 0.004/0.4%, Chromium 0.002/0.2%, Cadmium 0.00002/0.002% respectively. While the Withered brown *T. grandis* contains Iron 0.53/53%, Copper 0.064/6.4%, Manganese 0.014/1.4%, Zinc 0.006/0.6%, Lead 0.003/0.3%, Chromium 0.003/0.3%, Cadmium 0.0001/0.01% respectively. The result of this analysis shows that withered *T. grandis* leaves is a good source of iron, however both Green and withered *T. grandis* leaves are good sources of Na, Ca, Fe and Cu. The result also shows that both samples are non toxic due to the low amount of lead.

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***Keywords*:** *Tectona grandis*, Mineral nutrients, Antinutritional Factors

1. INTRODUCTION

Tectona grandis Linn otherwise known as "teak" belongs to Lamiaceae family. The plant *Tectona grandis* is probably the most widely cultivated high value hardwood in the world. Research has shown that the plant is used in the treatment of bronchitis, cold and headache, urinary discharge, used as a laxative and sedative, as diuretic, antidiabetic, analgesic and anti-inflammatory [1].

Teak has small, white fragrant flowers and papery leaves that are mostly hairy on the lower surface. It is one of three species in the genus Tectona [14]. The remaining two species are *T. hamiltoniana* and *T. philippinensis*. It has been reported that the plant is medicinally important and that it cure many diseases [2]. *T. grandis* leaf extract are widely used in the folklore for the treatment of various kinds of wounds, especially burn wounds [3]. The leaves and other parts of the tree are used as diuretics, laxative, sedative, expectorant, anthelmintic, antiinflammatory, antibacterial, cytotoxic, antianemic, antiulcer, antiviral, menstrual disorders, heamorrhages, sorethroat, dyspepsia and burning of stomach caused by bile over flow, vermifuge, strengthening of sight, treatment of pile, dysentery, antidiabetic, antioxidant, antipyretic, as dye and incense [6]. Teak leaves contain anti-oxidizing properties thus it is effective for inhibiting deleterious effects of free radicals in the body. The phenolic compound of teak leaves, such as tectoquinone, querctine; ellagic acid and qallic acid are great antioxidising agents [7].

Classification

Kingdom: Plantae

Phylum: Tracheophyta

Class: Magnoliopsida

Order: Lamiales

Family: Lamiaceae

Genus: *Tectona* L.f.

Species: *Tectona grandis* L.f

In tropical forests, most of the nutrients can be found in the active tree tissues, such as leaves [4]. The concentration of nutrients declines as the age and the size of the teak tree increase [5]. The deficiencies or disturbances in the nutrition of an animal causes a variety of diseases and can arise in several ways [9]. Trace element deficiency results in characteristic syndrome which reflects the specific functions of the nutrient in the animal metabolism. Enzymatic systems require trace elements as an integral component, hence mineral elements deficiencies results in profound effects on tissue structure and metabolism. Several factors directly or indirectly affects the levels of minerals in plants and hence the amount available for humans and animals.

Antinutritional factors present in plants could affect the absorption and availability of some minerals by humans and animals.ANF which could reduce the bioavalabily of minerals is oxalates and phytates. Oxalic acid and phytic acid has the ability to bind divalent metals such as calcium and magnesium hence interfering with their metabolism [11]. The problem with phytic acid in foods is that it can bind some essential minerals nutrient in the digestive tract and can result in mineral deficiencies. High oxalate diet can increase the risk of renal calcium absorption and has been implicated as a source of kidney stones [10].

A few studies have been carried out on teak leaves, such as (*i*) A Comparative Study on the Phytochemicals and Antimicrobial Activities of the Hexane Extracts of the Leaves of *Tectona grandis* and Its Mistletoe by Uzama Danlami and Okolo Simon (2017); (*ii)* Quantification of nutrient content in the aboveground biomass of teak plantation in a tropical dry deciduous forest of Udaipur, India by Nirmar et al. **(**2009**)**; (*iii*) Analysis of chemical compounds from the withered brown leaves of *Tectona grandis* by B. Vinothini (2017); however, there is a lack of knowledge concerning the comparative nutrient content of green and withered brown leaves of Teak in Nigeria.

Therefore, the main objective of the present study is to compare the nutrient content of both withered and green leaves of teak.

2. MATERIALS AND METHODS

2. 1. Collection of pods sample

The biological materials used for this study are Fresh green *T. grandis* and withered Brown *T. grandis*. Leaf samples were collected from Onigambari research station of the Forestry Research Institute of Nigeria, Oyo State (Fig. 1). They were immediately transported to the Laboratory of Soil department Forestry Research Institute of Nigeria and stored under prevailing tropical ambient conditions before the preparation of powder from raw materials.

2. 2. Sample Preparation.

The selected leafs were washed with clean water to eliminate adhering dirt and extraneous materials, and then they were dried in an oven at 65 °C for 48 hours. Then dried leafs were ground into powder, sieved with 25µm mesh sieve and stored in bottles in an oven at 55 °C for different analysis.

2. 3. Analytical Procedure

Apparatus: Block-digester, Vortex tube stirrer, Atomic Absorption Spectrophotometer, Flame photometer.

Procedure:

Weigh 1g oven dried and ground plant material, then transfer quantitatively into a 100 ml Pyrex digestion tube. Add 1 ml (2:1) nitric acid and Perchloric acid mixture and allow to stand overnight or until vigorous reaction phase is over. Place small and short – stemmed funnels in the mouth of the tubes to reflux acid, after the preliminary digestion, place the tubes in a cold block-digester and then raise the temperature to 15 ºC for 1hour. Place the U-shaped glass rods

under each funnel to permit exit of volatile vapors'. The temperature was increased slowly until all traces of HNO_3 disappear, the U-shaped glass rods was then removed.

Raise temperature to 235 ºC when the dense white fumes of $HClO_4$ appear in the tubes, continue digestion for 30 minutes more. The tubes rack was lifted out of the Block digester and a few drops of distilled water were carefully added through the funnel. After vapors condense, distilled water was added in small increments to wash down walls of the tubes and funnels. Bring to volume, the solution of each tube was mixed and then leave undisturbed for a few hour. The mineral elements was then determined using Atomic absorption spectrophotometer.

Fig. 1. Teak Leaves - *Tectona grandis* L.f [15-17].

3. RESULTS AND DISCUSSION

Different nutrient concentrations in different tree species can be due to environmental conditions or genetic characteristics of the species [8]. Table 1. Reflect the result of the present study. The sodium and Magnesium content of both green and withered brown leaves of *Tectona grandis* are the same (0.488 and 0.034) respectively. Sodium is the principal cat ion in extracellular fluids.

It regulates plasma volume and acid –base balance involved in the maintenance of osmotic pressure of body fluids. Oxidative phosphorylation is greatly reduced in the absence of magnesium. The level of Calcium in the green teak is 0.162/16.2% which is lower when compared to the withered brown teak leaves 0.174/17.4%. Calcium plays a vital role in enzyme activation .A reduced extracellular blood calcium increases the irritability of nerve tissue. This results shows that withered brown teak leaves is a better enzyme activator when compared to

the green *T. grandis* leaves. The result of the analysis shows that the green *T. grandis* leaves has a high level of potassium 0.065/6.5% when compared with withered brown *T. grandis* leaves 0.046/4.6%.potassium helps in the transfer of phosphate from ATP to pyruvic acid, its functions in muscular contraction particularly the cardiac muscles. Potassium deficiency affects the collecting tubules of the kidney, resulting in the inability to concentrate urine, and also causes alterations of gastric secretions and intestinal motility [12]. Phosphorus content of the green teak leave yielded 0.0006/0.06% while the withered brown teak leaves yielded 0.005/0.5% .Phosphorus is needed in every cell of the body; it is concerned with metabolic processes. It is a constituent of bones, teeth and adenosine triphosphate. It also serves buffering functions in phosphate buffers.

The result also shows that withered brown teak leaves is a good source of iron 0.53/53% when compared with the green leave with 0.41/41% iron. Iron functions as hemoglobin in the transport of oxygen and it's an essential component of enzymes involved in biological oxidation such as cytochrome [13].

The level of copper in green teak leaves was observed to be 0.067/6.7% a result which is slightly higher than that of the withered brown teak leaves 0.064/6.4%. Copper is necessary for the growth and formation of bones, formation of myelin sheaths in the nervous system, helps in the incorporation of iron in haemoglobin [14].

The amount of trace elements Manganese, Zinc, Lead, Chromium and Cadmium in Green teak leaves are 0.010/1%, 0.005/0.5%, 0.006/0.6%, 0.002/0.2% and 0.00002/0.002% respectively while the withered brown teak leaves contains 0.014/1.4%, 0.006/0.6%, 0.004/0.4%, 0.003/0.3 and 0.0001/0.01% of the trace metals respectively. The insignificant amount of lead in both samples shows that its save for human use.

Tab1e 1. Percentage Concentration of Mineral Elements in Green and Withered brown leaves of *Tectona grandis* L.f

	Na %	Ca %	Mg %	K %	P %	Fe %	Cu %	Mn %	Zn %	Pb %	Cr %	Cd %
Green Teak	0.488	0.162	0.034	0.065	0.0006	0.41	0.067	0.010	0.005	0.004	0.002	0.00002
Withered Brown Teak	0.488	0.174	0.034	0.046	0.005	0.53	0.064	0.014	0.006	0.003	0.003	0.0001

4. CONCLUSIONS

In conclusion, the result of this research work showed that both Green and withered brown leaves of *T. grandis* are good sources of sodium and calcium but more importantly the withered brown teak leaves is very rich in iron. Also green teak leaf is rich in copper a nutrient that is

very important in iron absorption. The amount of lead and other heavy metals in both samples are insignificant which further confirms that both are safe for human consumption.

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