



Essential and Trace Elements of *Tacazzea apiculata* Oliv. (Periplocaceae)

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Abstract: *Tacazzea apiculata* is used in Hausa folkloric medicine to treat hemorrhoids, inflammations and as food. Elemental analysis of the powdered drug was carried out using energy-dispersive X-ray fluorescence (EDXRF) machine. The results revealed the presence and concentration of some micronutrients, essential elements including Mn (1110±28.4ppm) in leaves, Cu (28.2±6.47ppm) in twigs, Fe (1310±26.6ppm) and Zn (177±6.69ppm) in root. The non essential elements such as As, Pb, Rb, Sr, Zr, were only found to be within Food and Agriculture Organization (FAO) recommended threshold in the leaves but higher in twigs and roots plants.

Keywords: *Tacazzea apiculata*, elemental analysis, micronutrient, EDXRF.

INTRODUCTION

Plants accumulate minerals essential for their growth from the environment and can accumulate metals such as cadmium, cobalt, and silver, which have no known direct benefit to the plants^{1, 2}. Some of these elements such as arsenic, boron, cadmium, copper, mercury, molybdenum, nickel, lead, selenium, and zinc even have adverse effect on the plant, animals and humans that consume it. Many of the elements are amplified in the food chain. In recent years, there has been a growing interest in monitoring trace elements and heavy metal contents in spices and herbs. Medicinal plants are important because they serve as a reliable source of drugs for rural populations; the activities of these medicinal plants depend on bioactive metabolites which they contain. It has been found that even trace elements play an important role in the activity of medicinal plants³.

Tacazzea apiculata Oliv (Fam: Periplocaceae) is a woody climber widely distributed in tropical and South Africa. The plant is known by the Hausas of northern Nigeria as “Yadiyar kada. The flowers are edible⁴. In South Africa, the twig is powdered and taken in milk or water as “tonic” to improve the general health condition of the body. The leaves are used for skin diseases⁵. In northern Nigeria the powdered root mixed with milk or honey is taken orally to relief pains in pile. The plant is also reported to be used in

traditional medicine for the treatment of some forms of cancers and inflammations⁶. Acute toxicity (LD₅₀ 118.3mgkg⁻¹) of the ethanol extract and analgesic activity has been reported⁷. Isolation and characterization of active compounds from the plant is currently going on in our laboratory. This paper reports the concentration of micronutrients components of *T. apiculata*.

MATERIALS AND METHODS

Collection, Identification and Preparation of Plant Materials

Plant material was collected during its flowering stage in July 2006 from Sakaru village, Zaria. The plant was identified by U. S. Gallah of the Department of Biological Sciences, Ahmadu Bello University Zaria, (Herbarium No. 6975). The leaves, twig and root of *T. apiculata* were separated, air dried under room temperature, and ground to powder using pestle and mortar. The plant materials were stored in plastic containers, properly labeled as Tacazzea leaves powder (TLP), Tacazzea Twig powder (TTP) and Tacazzea root powder (TRP).

Elemental Analysis

The analysis was carried out using Energy Dispersion X-Ray Fluorescence (EDXRF) transmission–emission technique at the Center for Energy Research and Training (CERT), Ahmadu Bello University, Zaria. Standard methods^{8,9} were adopted. Samples of the fine powdered drug were prepared and introduced into the system. The EDXRF system consists of a 925 MBq ¹⁰⁹Cd annular isotopic source

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with a Combera Si (Li) detector having a resolution of 170 eV at 59 KeV. The X-ray spectra were acquired with a computer based MCA and (Trump 8K). The set up provides for dead-time correction and pile up rejection. Sensitivity calibration of the system was performed using thick foils of pure metals (Ti, Fe, Co, Ni, Cu, Zn, Zr, Nb, Mo, Sn, Ta, Pb) and of stable chemical compounds (K_2CO_3 , $CaCO_3$, Ce_2O_3 , WO_3 , ThO_2 , U_3O_8).

RESULTS AND DISCUSSION

The concentration of macronutrients such as calcium, potassium and bromine (Table 1) are relatively high in the three part studied while they have been found to contain higher concentration of Mn, Fe, Cu and Zn than the FAO

threshold of 0.2,5.0,0.2,2.0 ppm respectively (Table 2). The concentrations of toxic trace elements which may be considered non-essential are presented in Table 3.

DISCUSSION

The significance of macro elements and trace elements for human health is well documented¹⁰. The uses of EDXRF techniques offer a good multielemental approach for the rapid quality control of bulk raw plant materials¹¹. Manganese, iron, copper and zinc are considered essential trace elements and they are among the beneficial trace elements in herbal drugs¹². Some of these elements including Mn, Cu, Zn, Se and Fe act as cofactors for endogenous antioxidants such as glutathione peroxidase (GSHPx), catalase (CAT) and superoxide dismutase (SOD)

Table 1. Some Macronutrients of *T. apiculata* as determined by EDXRF

Element	Concentration (ppm)			
	TLP	TTP	TRP	FAO threshold
K	3420 ± 249	8260 ± 393	4360 ± 345	-
Ca	<253	9640 ± 339	1180 ± 347	-
Br	<0.712	42.8 ± 3.31	<5.15	-

Tacazzea leaves powder (TLP), Tacazzea Twig powder (TTP) and Tacazzea root powder (TRP)

Table 2. Some Essential Elements of *T. apiculata* as determined by EDXRF

Element	Concentration (ppm)			
	TLP	TTP	TRP	FAO threshold
Mn	1110 ± 28.4	433 ± 23.1	45.7 ± 217	0.2
Fe	36.3 ± 8.54	227 ± 16.3	1310 ± 26.6	5.0
Cu	<1.42	28.2 ± 6.47	<16.7	0.2
Zn	<1.53	<55.2	177 ± 6.69	2.0
Se	<0.889	<7.26	<6.47	-
Ni	<2.89	<17.4	<16.9	0.2

Tacazzea leaves powder (TLP), Tacazzea Twig powder (TTP) and Tacazzea root powder (TRP).

Table 3. Some Toxic Trace Elements of *T. apiculata* as determined by EDXRF

Element	Concentration (ppm)			
	TLP	TTP	TRP	FAO threshold
As	<1.52	<14.0	<10.9	0.1
Pb	<2.60	20.8 ± 3.39	<15.7	5.0
Rb	<0.643	19.9 ± 2.87	10.6 ± 2.22	-
Sr	36.3 ± 8.54	227 ± 16.3	1310 ± 26.6	-
Ti	6710 ± 131	<159	707 ± 60.8	-
V	<1.42	28.2 ± 6.47	<16.7	-
Zr	<1.53	<55.2	177 ± 6.69	-
Cd	ND	ND	ND	0.01

Tacazzea leaves powder (TLP), Tacazzea Twig powder (TTP), Tacazzea root powder (TRP) and Not detected (ND)

for optimum catalytic activity and effective antioxidant defense mechanism against oxidative stress¹³. Concentrations of Mn, Cu, Zn, Se, Ni and Fe (Table 2) are higher than the FAO recommended threshold for plants¹⁴. Recently, plant species have been identified that contain nutrients displaying new, beneficial medicinal or therapeutic properties¹⁵. Although any element can have adverse health effects if the concentrations are high enough. Cadmium, Copper, Nickel and Zinc are four trace elements that commonly pose hazard to plants, animals and humans. Cadmium was not detectable in any of the samples analyzed. Cadmium has caused adverse health effects in humans who have eaten food grown on Cd rich soils.

CONCLUSION

The energy-dispersive X-ray fluorescence (EDXRF) spectroscopy has been used for the determination of essential and trace elements contents of *T. apiculata*. The results of the present study revealed that the beneficial micronutrients are not below FAO recommended threshold in the entire sample analyzed while the toxic trace metal contents of *T. apiculata* were within the limit range in leaves and higher in twigs and root. The overall suggestion is that the plant especially the twig and root should be used with caution as it may pose risk to humans as a result of its use as drug in the crude form.

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