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Trace Elements and Major Minerals Evaluation of *Spondias mombin*, *Vernonia amygdalina* and *Momordica charantia* Leaves

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Abstract: Samples of the plants were collected in Oyo state at Igbo-agbonin in the Ogbomoso North Local Government Area, Sabo road, Ogbomoso and were analyzed for the presence of trace elements such as; Fe, Zn, Mn, Cr, Cu, Cd, and Pb using Atomic Absorption Spectrophotometry. The results showed that trace element concentrations in *Spondias mombin* (Hog plum) were as follow: Fe, 574.00mg/kg, Zn, 59.60mg/kg, Mn, 23.00mg/kg, Cr, 66.00mg/kg Cu, 13.00mg/kg, Cd 50.00mg/kg. The mineral composition results showed that the leaves contained K 1.20%, Ca 1.05% and P, 0.32% Na 1.80%. Results of trace elements concentration in *Vernonia amygdalina* leaves were as follow: Fe, 277.30mg/kg, Zn, 74.50 mg/kg, Mn, 227.00mg/kg, Cr, 89.00mg/kg Cu, 11.00mg/kg and Cd, 4.30mg/kg. The mineral analysis revealed in the plant leaves, K 0.51%, Na 0.57%, Ca 0.45%, P 0.23%. Result of trace elements concentration in *Momordica charantia* were as follow: Fe, 8.125mg/kg, Zn, 354.8mg/kg, Mn, 37.00mg/kg, Cr, 162.00mg/kg, Cu, 21.00mg/kg, Cd, 51.40mg/kg and Pb 48.00mg/kg. the mineral analysis revealed in the plant, K 0.81%, Na 0.93%, Ca 0.90%, P 0.81%. The results obtained from the study show that the three plants are medicinal, *Spondias mombin* and *Vernonia amygdalina* are good antianaemic and antidiabetics agents, because of the high contents of Iron and chromium present in them.

Key words: *Spondias mombin, Vernonia amygdalina, Momordica charantia*, Therapeutic, Prophylactic

INTRODUCTION

The three plants have been traditionally noted for their medicinal and food values. Therefore they are referred to as medicinal plants, these are plants in which one or more of their parts contain substances that can be used for therapeutic purposes (Ogunrinola *et al*., 2004). Medicinal plants, because of their physiological effect on the structure and function of living organisms, are widely used for the prevention, diagnosis, treatment of disease and for the relief of symptoms. Thus they are referred to as therapeutic drugs (Abayomi Sofowora, 1986). Medicinal plants posses some important elements in small doses which have both therapeutics and prophylactic properties. The element are referred to as trace elements (Peter Bratter and Peter Schramel, 1980). Trace elements are required in plant mainly for the formation of pigments and enzymes in animals. They function mainly to facilitate certain vital metabolic processes. Many of these elements pair-up with vitamins in the metabolism of carbohydrates, fat, and protein. Metabolic disease will arise in the absence of trace elements.

Preliminary result of *Spondias mombin* analysis gave a wide range of antibacterial and antifungal properties (Okwu, 2001; Urugulaga and Laghton 2000). The chemistry of *Spondias mombin* has been reported by Shultes and Raffauf, 1990.

Kramer *et al*. (2006) recommended its use for pregnant woman but only after five months of pregnancy. Njoku and Akumefula, 2007 reported the mineral analysis results of the *Spondias mombin* as follow, 2.55% Potassium (K), 0.10% Sodium (Na), 0.304% Magnesium (Mg), 1.31% Calcium (Ca) and 0.20% phosphorous (P). He also reported that the *Spondias mombin* leaves contained alkaloids, flavonoids, tannins, saponins and phenolic compounds. The *Spondias mombin* leaves can be used in herbal medicine for the treatment of common cold and other diseases like prostrate cancer (Okwu and Okwu, 2004; Okwu and Ekeke, 2003).

Vernonia amygdalina, which according to Hamowa (1994) could be used in traditional medicine to treat kidney disorder and hic cups, was also recommended as stomach purgatives, antihelmintics, antiasthmatics, carminatives and anti tumor agents.

The plant as reported contained carbohydrates and glucosides, flavonoid, glycosides, sterols, lactones and volatile substances. A bitter glycoside, vernomin, has been isolated from the root (Klein 1932).

A decoction of the leaves is taken as an antipyretic and laxative and for cough (expectorant). The bark of the root, and stems are astringent and find use as a febrifuge and in diarrhoea (David, 1983).

Locally the twigs are used as tooth cleaners and are chewed as a stomachic, tonic and appetizer. The root

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after removal of the bark by scorching is also taken as a tonic and appetizer and has been described as substitute for ipecacuanha. The leaves are used in soup and are applied in local medicine for itching and parasitic skin disease (Oliver, 1960).

Momordica charantia (family: Cucurbitaceae) with the common name "bitter Cucumber" is known as "Ejirin" in the Southwest of Nigeria (Gbile, 1984). In local medicine the juice of the leaves and fruit are given as an antihelmintic and the pulverized part is applied externally against malignant ulcers. (Oliver, 1960). The presence of two acidic resins and a bitter substance called momordicine in the leaves has been reported along with vitamin C. The presence of aminobutyric acid in the leaf has been indicated. The root has been estimated to contain about 12.84% ash. The fruit given about 7% ash the major elements present are silicon, Phosphorus, Iron Sodium, Zinc, Copper, Calcium and Strontium. The dry plant was reported to contain 0.038% of an unnamed alkaloid. The results of a screening on the entire plant of Congolese Origin showed the presence of trace amount of alkaloids and saponins but the absence of flavoids, tannins, quinines, steroids and terpenes.

Bitter Cucumber has a relatively high nutritional value compared with other Cucurbits, due mainly to the Iron and ascorbic acid content (Oliver, 1960).

Momordica charantia is used in the treatment of female problems such as in the darkened and scanty period, heat in the lower abdomen, gripping or pin-like pains, when it is not easy for a woman to conceive and also good during the period of pregnancy. It is also good for the treatment of diabetes, constipation, convulsion in children and as bacteriostatic (Elizabeth, 1994).

The objective of this study is to evaluate the trace elements and major minerals present in them so as to give recommendation on the amount to consume by an individual for medicinal purposes, since less information is available on the trace elements of these three plant leaves in South-West, Nigeria.

MATERIALS AND METHODS

Samples: Fresh leaf samples of study plants were collected From Igbo-agbonin along Sabo road, Ogbomoso, Oyo State, Nigeria.

Traffic: The roads adjoining the sample sites carry a lot of commuter traffic and are major feeder routes.

Instrumentation: The determinations of the trace elements were performed with the use of a buck 210 VGP model atomic absorption spectrophotometer. The instrument's setting and operational conditions were done in accordance with the manufacturer's specification. The instrument was calibrated with analytical grade standard metal solution ($1mgdm^{-3}$) in replicate. For the determination of minerals of the test samples (Na, Ca, K and P) flame photometer Jenway, U K model was used (Institute of Agricultural Research and Training, Obafemi Awolowo University, moor plantation,Ibadan, Nigeria).

The leaf samples were washed and oven dried at 15°C for three days. There after, the samples were ground into fine powder with a porcelain mortal and pestle and stored in air tight bottles prior to use for analysis.

Physico-chemical analysis: The trace and mineral elements were determined by wet acid digestion method as described by AOAC, 1980.

0.5g of each sample in 10ml Conc. HNO_3 in a covered flask placed in a fume cupboard for three days. Thereafter, the three covered flasks with the contents were heated on a hot plate for twenty-four hours, conc. HNO_3 was added intermittently as the content reduced until the sample solutions turned colorless.

They were cooled and transfered into 50ml volumetric flask and made up to mark with distilled water. The solutions were filtered and transferred into an analytical bottle, corked, and labeled, kept for AAS and flame photometric analysis.

RESULTS AND DISCUSSION

Table 1 shows the trace elements composition of the three medicinal plants. From the table it can be seen that *Spondias mombin* contained the highest concentration of iron. Iron is important for the building up of red corpuscles, essential for formation of haemoglobin, the oxygen - carrying pigment in red blood cells. Iron is used against anaemia, tuberculosis and disorder of growth (Claude and Paule, 1979). Iron is an energizer but excess can cause fatigue but we hardly have excess if taken from natural Source (Gbolahan, 2001).

The Zinc content was found to be 59.60mg/kg in *Spondia mombin*, 74.50mg/kg in *Vernonia amygdalina* and 364.8mg/kg in *Momordica charantia* indicating that *Momordica charantia* contained large quantity of zinc. Zinc is very important for nerve function and male fertility. It is important for normal sexual development especially for the development of testes and ovaries, it is also essential for reproduction. Zinc stimulates the activity of vitamins, formation of red and white corpuscles (Claude and Paule, 1979), healthy functioning of the heart and normal growth (Elizabeth, 1994).

The manganese content was found to be 23.00mg/kg in *Spondias mombin*, 27.00mg/kg in *Vernonia amygdalina* and 37.00mg/kg in *Mormodica charantia*, since these plants contain this element in different concentration, the quantity to be taken will depend on the therapeutic need of the individual. The activity of this element is noticed in the metabolism of food which is incorporated into the bone. According to Claude and Paule (1979), manganese is necessary for the functioning of the

Table 1: Trace elements composition of *Spondias mombin* leaves on dry weight basis expressed in mg/kg

Elements	Concentration (mg/Kg)
Fe	574.00
Zn	59.00
Mn	23.00
Cr	66.00
Cu	13.00
Cd	50.00
Pb	Nd

Results are mean of five determinations

Table 2: Mineral Composition of the leaves of *Spondias mombin* on dry weight basis expressed in %

Mineral	%
K	1.20
Na	1.80
Ca	1.05
P	0.32

Results are mean of five determinations

Table 3: Trace elements composition of the leaves of *Vernonia Amygdalina* on dry weight basis expressed in mg/kg

Elements	Concentration (mg/kg)
Fe	277.30
Zn	74.50
Mn	27.00
Cr	89.00
Cu	11.00
Cd	4.30
Pb	Nd

Results are mean of five determinations

Table 4: Mineral composition of the leaves of *Vernonia amygdalina* on dry weight basis expressed in %

Mineral	%
K	0.51
Na	0.57
Ca	0.45
P	0.23

Results are mean of five determinations

Table 5: Trace elements composition of *Momordica charantia* on dry weight expressed in mg/kg

Elements	Concentration (mg/kg)
Fe	8.125
Zn	354.8
Mn	37.00
Cr	162.00
Cu	21.00
Cd	51.40
Pb	48.00

Results are mean of five determinations

Table 6: Mineral composition of *Momordica charantia* dry weight basis expressed in %

Mineral	%
K	0.81
Na	0.93
Ca	0.90
P	0.81

Results are mean of five determinations.
Nd: Not detected

pituitary gland, the pineal gland and the brain, it promotes hepatorenal function, combat anemia and also essential for growth.

The chromium content was found to be 66.00mg/kg in *Spondias mombin*, 89.00mg/kg in *Vernomia amygdalina* and 162.00mg/kg in *Mormodica charantia*. The presence of chromium even at low concentration is an indication that the plants are useful, therefore, with high concentration of chromium in *Mormodica charantia* shows that this will be more effective in the management of diabetes. It is a co-factor with insulin in carbohydrate metabolism, therefore, if chromium is deficient, insulin will not be effective (Gbolahan, 2001).

The copper content were low with 13.00mg/kg in *Spondias mombin*, 11.00mg/kg in *Vernonia amygdalina* and 21.00mg/kg in *Momordica charantia*. Copper helps in the absorption of Iron, it is therefore often seen with Iron naturally. Copper is important for cellular defense and protection of the mucous membranes, anti anemic and essential for the formation of Iron and haemoglobin (Claude and Paule, 1979).

The result of the mineral composition clearly shows that *Spondias mombin* leaves contains rich source of mineral elements (Table 1). This result become so important when the usefulness of such minerals like Ca, K, Na and P in the body are considered. Calcium is necessary for the coagulation of blood, the proper functioning of the heart and nervous system and the normal contraction of muscles. Its most important function is to aid in the formation of bones and teeth. Most of these plants containing some percentage of calcium exhibit these properties.

Sodium and Potassium are closely related in the body fluids, they regulate the acid-base balance. Sodium remains one of the major electrolytes in the blood. Without sodium the body can not be hydrated, it would dry off. At the point where some vital processes are taking place sodium is not needed, too much will cause the cell to breakdown (Gbolahan, 2001).

This explains the lower percentage or content of the element in most medicinal plants. According to Njoku and Akumefula (2007) the lower Na content (0.100g of *Spondias mombin* is an added advantage because of the direct relationship of sodium intake with hypertension in human. Another mineral useful to the bone is phosphorus. It is mineral pair of calcium, the two of them go hand in hand, they are bound together in the bone, teeth and ligament of the body. It is very important for nerves, it will produce the same bone diseases like calcium will produce (Gbolahan, 2001). It is required in small quantity. All these explain why the minerals are present in different quantity in most medicinal plants.

Table 3 shows the result of trace elements composition of *Vernonia amygdalina* (bitterleaf) and the concentration of each of the element is indicated. Iron content was shown to be 277.30mg/kg, followed in high

content by chromium with 89.00mg/kg and zinc with 74.50mg/kg with these values obtained the plant would be antidiabetic, antianaemic and antihelmintics.

The presence of manganese, 27.00mg/kg, Cu, 11.00mg/kg are useful in the areas of treatment and prevention of diseases.

Table 4 shows the percentage composition of some of the minerals obtained, this indicates that potassium (K), 0.51%, sodium (Na), 0.57, Calcium (Ca) 0.45%, Phosphorus (P) 0.23%. their functions are in line with Table 2.

The results showed the concentration of trace elements in *Momordica charantia*, element with the highest value is zinc with 354.8mg/kg this is an indication that the plant would be good for anything concerning reproductive organs, fertility and healthy functioning of the heart (Table 5). The second element is chromium with value of 162.00mg/kg which also indicates that the plant *(Momordica charantia)* would be good in the management of diabetes.

The presence of other elements also shows that *Momordica charantia* is embodiment of medicinal properties.

Table 6 show the mineral composition of *Momordica charantia*. The result of the minerals composition clearly shows that the plant contains potassium (K) 0.81%, sodium (Na) 0.93%, Calcium (Ca) 0.90% phosphorus (P) 0.81%. The importance of all the minerals had earlier been explained under Table 1.

The presence of Cd and Pb in *Vernonia amygdalina* and *Momordica, charantia* call for concern because they are not required, even in small amounts, by living organisms (Adeniyi, 1996).

Conclusion: This present study shows the trace elements and major minerals composition of three different medicinal plants, these are, *Spondias mombin*, *Vernonia amygdalina* and *Momordica charantia*. This partly shows the uses of these plants in herbal medicine. As a rich source of minerals and beneficial trace elements, these plants can be seen as potential source of useful food and drugs.

Spondias mombin and *Vernonia amygdalina* are good antianaemic agents and antidiabetics agents because of the high contents of Iron and chromium present in them.

Further studies have to be carried out to isolate, characterize and elucidate the structure of the bioactive compounds from the plants for industrial drug formulation.

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