International Journal of Engineering Science Invention
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org Volume 2 Issue 5 ǁ May. 2013 ǁ PP.51-54

Phytochemicals and Spectrophotometric Determination of Metals in Various Medicinal Plants in Nigeria

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ABSTRACT: *The use of plants part by various human traditions in the preparation of herbal remedies is as old as human history. The phytochemicals and mineral contents of dried leaves of Bambusa vulgaris, Euphorbia hirta, Lawsonia inarmic, Mimosa pudica, Bidens pilosa, Croton zambesicus and Persia americana used in the management and treatment of various human diseases were studied. Phytochemical analysis showed alkaloids to be very high in Euphorbia hirta (533 mg/100g), terpenoids showed highest level in Croton zambesicus (62.0 mg/100g), flavonoids in Bambusa vulgaris (260 mg/100g), saponins was found to be very high in Mimosa pudica (87.0 mg/100g), tannins very high in Mimosa pudica (180 mg/100g) and phytates had its highest value in Lawsonia inarmic (21.0 mg/100g). Mineral analysis showed calcium to be the highest metal determined in Lawsonia inarmic (193 mg/100g). Pearson correlation revealed significant correlation. These antioxidants property of plants can help prevent damage that is associated with cancer, heart disease and other related human diseases.*

Keywords: *Correlation, disease, minerals, phytochemicals, plants.*

I. INTRODUCTION

Plants are living organisms belonging to the kingdom plantae. They include familiar organisms such as trees. They are typically characterized by their green colour, which include common groups such as trees, herbs, flowers and fern and algae.

The active ingredients are the main effective compounds of medicinal plants, the presence and quality vary from one plant to the other. Some plants contain significant amount of minerals, the presence and quantity depend on plant family, history and phytochemical properties of the plant [1]. It has been found that many plants irrespective of their parts have medicinal usages [2]. So many medicinal plants have been used by traditional medicine practitioners in Nigeria for the treatment of different diseases. Among the various evidence revealing that medicinal and culinary herbs have some endemic species, a diet rich in fruits and vegetables and phytochemical which decrease the risk of cardiovascular diseases and some forms of cancer are of particular interest [3].

Many of these plants are underutilized. Phytochemicals are bioactive chemical compounds found naturally in plants that protect against diseases. They are non nutritive compounds (secondary metabolite) that contribute to flavor colour [4, 5].

Many phytochemicals have antioxidant activity and reduce the risk of different diseases known, for example carotenoids (from carrots) and flavonoids (present in fruits and vegetables). Minerals are required by living organisms and can help to prevent occurrence of some diseases. Some sources state that sixteen chemical elements are required to support human biochemical processes by serving, structural and functional role as well as electrolyte.

Some medicinal plants in Nigeria such as *Bambusa vulgaris (Poaceae), Euphorbia hirta (Euphorbiaceae), Lawsonia inarmic (Lyhracene), Mimosa pudica (Fabaceae), Bidens pilosa (Asteraceae), Croton zambesicus (Euphorbiaceae) and Persia americana (Lauraceae)* are underutilized for effective treatments of serious ailments. This work looks into the chemical properties of these plants which make them useful for curing some of these diseases by studying the phytochemical and mineral constituents.

II. MATERIALS AND METHODS

2.1Sampling

Samples of seven different medicinal plants such as *Bambusa vulgaris (Poaceae), Euphorbia hirta (Euphorbiaceae), Lawsonia inarmic (Lyhracene), Mimosa pudica (Fabaceae), Bidens pilosa (Asteraceae), Croton zambesicus (Euphorbiaceae) and Persia americana (Lauraceae)* were collected from an uncultivated farmland at Iddo-Osun in Osun State, Southwestern Nigeria. The samples were identified at the Forestry

Research Institute of Nigeria in Ibadan. Three plant samples were collected randomly for each species at three different spots and mixed to form composite samples, kept in a labeled polythene bag and taken to the laboratory. It was air dried, crushed into powdered form and kept for chemical analysis.

2.2 Phytochemical determinations

2.2.1 Determination of alkaloids

5g of each sample was weighed into a 250 mL beaker, and 200mL of 20% acetic acid in ethanol was added and covered to stand for 4h. This was filtered and the extract was concentrated using a water bath to evaporate one-quarter of the original volume. Concentrated ammonium solution was added drop-wise to the extract until precipitation was completed. The entire solution was allowed to settle and the precipitate was collected by filtration, after which it was weighed [6].

2.2.2 Determination of flavonoids

5g of each plant sample was weighed in a 250 mL titration flask, and 100mL of the 80% aqueous methanol was added at room temperature and shaken for 4h in an electric shaker. The entire solution was filtered through Whatman filter paper no. 42 and again, this process was repeated. The filtrate as a whole was later transferred into a crucible and evaporated to dryness over a water bath and weighed [7].

2.2.3 Determination of saponins

For the determination of saponins, 5g of each plant samplewas weighed, and was dispersed in 100mL of 20 % ethanol. The suspension was heated over a hot water bath for 4h with continuous stirring at about 55^{o}C. The filtrate and residue were re-extracted with another 100mL of 20 % ethanol. The combined extracts were reduced to 40mL over water bath at about 90^{o}C. The concentrate was transferred into a 250 mL separating funnel and 20 mL of diethyl ether was added and shaken vigorously. The aqueous layer was recovered while the ether layer was discarded. The purification process was repeated and about 30 mL on n-butanol was added. The combined n-butanol extracts were washed twice with 10 mL of 5% aqueous sodium chloride. The remaining solution was heated in a water bath. After evaporation, the sample were dried in the oven to a constant weight. The saponin content was calculated [6].

2.2.4 Determination of tannins

The level of tannin in the plants was determined using the method of [8]. 500mg of the sample was weighed into a 50mL plastic bottle. 50mL of distilled water was added and shaken for 1 h in a mechanical shaker. This was filtered into a 50mL volumetric flask and made up to the mark. Then 5mL of the filtered was pipette out into a test tube and then mixed with 2 mL of 0.1 M $FeCl_3$ in 0.1 N HCl and 0.008 M potassium ferrocyanide. The absorbance was measured at 120 nm within 10 min using Genway model 6000 electronic spectrophotometer.

2.2.5 Determination of terpenoids

100g of plant powder were taken separately and soaked in alcohol for 24 hours. Then filtered, the filtrate was extracted with petroleum ether; the ether extract was treated as total terpenoids [9]

2.2.6 Determination of oxalate and phytate

The method of [10] was used to determine oxalate and phytate.

2.3 Determination of mineral composition:

The plant samples were dry ashed at 550°C. The ash was boiled with 10mL of 20% hydrochloric acid in a beaker and then filtered into a 100ml standard flask . It was made up to the mark with deionised water. The minerals were determined from the resulting solution using Atomic Absorption Spectroscopy.

III. RESULTS AND DISCUSSION

The results obtained are as shown in Tables 1 and 2.

Table 1. Phytochemicals in selected medicinal plants (mg/100g)

Plant type	Alkaloid	Terpenoid	Flavonoid	Saponin	Tannin	Phytates	Oxalate
B. vulgaris	**123±6**	**10.0**	**260**	**63.3±2.89**	**55.0**	**15.7±0.58**	**45.0**
E. hirta	**533±29**	**483±2.89**	**120**	**75.0**	**125**	**12.0**	**30.0**
L. inarmic	**80.0**	**30.0**	**145**	**30.0**	**96.7±2.89**	**20.7±1.16**	**37.3±1.16**
M. pudica	**350**	**25.0**	**255**	**86.7±2.89**	**180**	**15.70.58**	**40.7±1.16**
B. pilosa	**150**	**15.0**	**140**	**50.0±2.89**	**108±3**	**14.0**	**24.7±0.58**
C. zambesicus	**440±17**	**61.7±2.89**	**135**	**40.0**	**150**	**18.0**	**21.7**
P. americana	**250**	**45.0**	**173±3**	**45.0**	**80.0**	**10.0**	**15.0**

Table 2. Mineral contents of selected medicinal plants (mg/100g)

Plant type	Ca	Fe	Co
B. vulgaris	**178±3**	**327±0.22**	**ND**
E. hirta	**76.7±3.00**	**0.53±0.05**	**ND**
L. inarmic	**193±3**	**5.63±0.15**	**0.02**
M. pudica	**160**	**3.17±0.12**	**0.01**
B. pilosa	**81.7±3.00**	**2.17±0.06**	**ND**
C. zambesicus	**90.0**	**2.70**	**ND**
P. americana	**125**	**6.33±0.15**	**0.02**

Table 1 discusses the amount of phytochemicals present in these medicinal plants. *M. pudica* having the highest saponin (86.7 mg/100g) and tannin (180 mg/100g), *L. inarmic* with highest phytate (20.7 mg/ 100g) and *B. vulgaris* with highest oxalate (45.0 mg/100g). Table 2 shows metal levels in these plants with L. *inarmic* having highest Ca, and *P. americana* with highest Fe and *L. inarmic* and *P. americana* with highest Co level (0.02 mg/100g).

IV. DISCUSSION

The phytochemical estimation of the medicinal plants showed that they are rich in alkaloids, flavonoids, saponins. Most of these plants show medicinal activity as well as exhibiting physiological activity [12]. The biological function of alkaloids is very important and is used in analgesic, antispasmodic and bactericidal activities. Alkaloid was found to be very high in *E. hirta* and *C. zambesicus* as compared to all other plants. Alkaloid was observed to be lowest in *L. inarmic*. The level of alkaloid determined in these plants were higher compared to what was obtained by [11] in their study of selected medicinal plants. These plants should not be taken excessively and that is why the local people have problems of taking too much of the extract of this plant. Morphine, quinine, ephedrine, nicotine and strychnine are the major types of alkaloids some of these are nacrotic analgesics as well as are anti-tissue agent [13]. The presence of terpenoids in medicinal plants has been reported by [14, 15]. These plants contain high terpenoid levels. The presence of high terpenoid in *E. hirta* and *C. zambesicus* makes them applicable as a purgative. The Euphorbia species including *E. hirta* are used in treatment of cough, asthma and hay fever [16, 17]. Flavoniods in these plants was found to be very high especially *B.vulgaris*. Flavonoids are water soluble phytochemicals and an important plant phenolic. They have anti cancer, anti inflammatory activities and a large effect in lower intestinal tract and heart disease. Flavonoids from these plants provide anti-inflamatory action [17]. The flavonoid in this study was high compared to [2]. The presence of high saponin level in *M. pudica* gave a justification why the extracts from this plant are used in wound healing and bleeding treatment. Saponins have properties of precipitating and coagulating red blood cells and they also have cholesterol binding properties, formation of foams in aqueous solutions and hemolytic activity [19]. Tannins draw the tissue closer together and improve their resistance to infection. The highest level of tannin was obtained in *M. pudica*. All the plants showed high tannin content which explains their antimicrobial usefulness. Tannins are capable of lowering available protein by antagonistic competition and can therefore elicit protein deficiency syndrome 'kwashiorkor'.

The highest level of phytate was obtained in *L. inarmic* and lowest in *P.americana*. phytic acid binds metal ions such as calcium, zinc, iron and other minerals, thereby reducing their availability in the study [19]. The level of oxalate obtained was highest in *B. vulgaris*, but generally high in these plants for them to reduce human ailments. Oxalate can complex with most essential trace elements therefore making them unavailable.
Mineral composition of the plants reveals *L. inarmic* to contain the highest calcium and P. americana the highest iron content. Cobalt was not detected in some of the plants except *L. inarmic, M. pudica* and *P. americana*.

These antioxidant properties of plants help prevent damage that is associated with cancer, heart disease and other related human diseases.

The presence of these photochemical have been attributed to the bioactive principles responsible for ethnopharmalological activities of most medicinal plant. This dictates why efforts have been expanded in studies aimed at elucidating their levels in medicinal plant. The medicinal values of plants and vegetables are dictated by their phytochemicals and other chemical constituents.

V. STATISTICAL ANALYSIS

Pearson correlation analysis using STATISTICA 7.0 revealed the association between the pairs as shown in Table 3.

Table 3: Pearson correlation between pairs for the plant samples

Correlation for phytochemicals (r)	Correlation for minerals (r)
E. hirta $_{\text{terpenoid}}$***/P. americana*** $_{\text{flavonoids}}$ **(+ 1.00)**	***B. vulgaris*** $_{Ca}$***/ L.inarmic*** $_{Ca}$ **(+0.50)**
B. vulgaris $_{\text{phytates}}$***/ E. hirta*** $_{\text{terpenoid}}$ **(+1.00)**	***B. pilosa*** $_{Ca}$***/ P. americana*** $_{Fe}$ **(+0.95)**
L. inarmic $_{\text{phytates}}$***/ E. hirta*** $_{\text{terpenoids}}$ **(+1.00)**	***B. pilosa*** $_{Ca}$***/ L. inarmic*** $_{Fe}$ **(+0.95)**
B. vulgaris $_{\text{saponin}}$ **/*B. pilosa*** $_{\text{tannin}}$ **(+1.00)**	***B. vulgaris*** $_{Fe}$**/*B. pilosa*** $_{Ca}$ **(+ 0.97)**
B. vulgaris $_{\text{saponin}}$**/*B. pilosa*** $_{\text{oxalate}}$ **(+1.00)**	***B. vulgaris*** $_{Fe}$***/ P. americana*** $_{Fe}$ **(+0.99)**
B. pilosa $_{\text{saponin}}$***/ M. pudica*** $_{\text{oxalate}}$ **(+1.00)**	***E. hirta*** $_{Fe}$**/*E. hirta*** $_{Ca}$ **(+1.00)**
L. inarmic $_{\text{tannin}}$***/ M. pudica*** $_{\text{saponin}}$ **(+1.00)**	
B.pilosa $_{\text{oxalate}}$***/ B. pilosa*** $_{\text{tannin}}$ **(+ 1.00)**	

Pearson correlation as shown in Table 3 revealed significant correlations for the phytochemicals. Very high correlation was observed for most of the phytochemicals revealing a high therapeutic usage of these plants for curing of various human diseases. Very high correlation was obtained for mineral contents between pairs of the medicinal plants in *B. vulgaris* $_{Fe}$*/ P. americana* $_{Fe}$ (r = +0.99) and *E. hirta* $_{Fe}$ */E. hirta* $_{Ca}$ (r = +1.00). This reveals the ability of the medicinal plants as source of minerals if well consumed.

VI. CONCLUSION

This study showed that the studied medicinal plants contained appreciable amount of various phytochemical, good antioxidant properties and reasonable mineral content. Low value of their toxicity property showed that the plants cannot produce any adverse health effect. This work has shown that all the plants have medicinal values for the management of certain health conditions.

However, the anti-nutrient factors can further be reduced by proper simple processing techniques such as soaking and cooking.

REFERENCES

[1]. P. Houghton, Use of medicinal plants in CNS disorders in Yanniv Z. and U. Bachrach (Eds.) Handbook of medicinal plants, India, (Harworth press, 2007) 234.

[2]. A. Sofoworola, Medicinal plants and traditional medicine in Africa. (Spectrum Books Ltd., Ibadan, Nigeria, 1993) 289.

[3]. J. Javanmerdi, C. Stushnoff, E. Lockie, M. Vivanco, Antioxidant activity and total phenolic content of Iranian Ocimum accession, Journal of Food Chemistry, 83, 2003, 547 -550.

[4]. T. John, Phytochemicals as evolutionary mediators of human nutritional physiology, International Journal of Pharmcology. 34 (95), 1996, 327-334.

[5]. W. Craig, Health-promoting properties of common herbs, American Journal of Clinical Nutrition, 70 (3), 1999, 491-499.

[6]. B. Obadomi, P. Ochuko, Phytochemical studies comparative efficacy of the crude extracts of some homeostatic plants in Edo and Delta States of Nigeria, Global J. Pure Appl. Sci., 8, 2001, 203-208.

[7]. A. Boham, A. Kocipai, Flavonoid and condensed tannins from leaves of Hawaiin vaccininum vaticulum and vicalycinium, Pacific Sci., 48, 1994, 458-463.

[8]. T. Van-Burden, W. Robinson, Formation of complexes between protein and tannin acid, J. Agric. Food Chem. 1, 1981, 77.

[9]. N. Ferguson, A textbook of pharmacognosy, (Mac Millan Company, 1956) 191.

[10]. S. Asieber, (1987). Biochemical analysis of varieties of food in Nigeria. Handbook 1, 32.

[11]. H. Iqbal, U. Riaz, U. Rooh, K. Muhammad, U. Naseem, B. Abdul, A. Farhat, R. Muneeb, Z. Mohammed, K. Jehangerir, K. Naeem, Phytochemical analysis of selected medicinal plants, African Journal of Biotechnology. 10 (38), 2001, 7487 – 7492.

[12]. F. Stary, The natural guide to medicinal herbs and plants, (Tiger Books International, London, 1993) 12 -16.

[13]. T. Hayashi, K. Okanmuka, M. Kawasaki, N. Morita, Production of diterpenoids by cultured cells from two scorparia dulas, Phytocochemistry 35(2), 1993, 353-356.

[14]. T. Rahila, N. Rukhsandra, A. Zaidi, Phytochemical screening of medicinal plants belonging to Euphorbiaceae, Pak. Vet. J. 14, 1994, 160-162.

[15]. H. Burkill, The useful plants of West Tropical Africa families. A. D. Royal Botanical, 1994, 411-415.

[16]. L. Gill, Ethnomedical uses of plants in Nigeria. (Univeristy of Benin press, Nigeria, 1992) 276.

[17]. J. Farquar, Plant sterols, their biological effects in humans, Handbook of lipids in human nutrition, (BOCA Rotan HL CRC Press, 1996) 101-105.

[18]. A. Sodipo, J. Akiniyi, J. Ogunbamosu, Studies on certain characteristics of extracts of bark of pansinystalia macruceras (Kschemp) pierre Exbeille, Global J. Pure Appl. Sci. (6) 2000, 83-87.

[19]. FAO, Root, tuber, plantains and bananas in human nutrition. FAO corporate document repository, 1. Rome http//www.fao.org/docrep/T0207e/T0207E08.htm#7, 1990.