

Investigation of Phytochemical and Trace Metal Elements in Medicinal Plants Obtained in Girei Local Government Area, Adamawa State, Nigeria

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Abstract

Phytochemical analyses, heavy metals composition of *Tetrapleura tetraptera*, *Euphorbia hirta* and *Sida acuta* were carried out with a view to investigate the levels of essential elements in the plants parts. Qualitative phytochemical analyses showed the presence of Alkaloids, Saponins, Tannins, Flavonoids, Glycosides and Terpenoids, however Resin and Steroids were observed to be absent in all the plant part and among the three plant species. The Mineral analyses indicate moderate concentration of Zn (0.44mg/kg) in *Euphorbia hirta* stem bark and high concentration of Mn (1.21mg/kg) in *Euphorbia hirta* leaves and concentration of Pb (0.38mg/kg) were found in *Sida acuta* bark, *sida acuta* root and *Tetrapleura tetraptera* root while Cu (0.27mg/kg) recorded the highest in concentration in *Euphorbia hirta* bark compared to all other plant extracts, in similar case Cd was observed to be absent in all the plant extract in all the three selected Plants species. The analysis of variance shows that the heavy metal elements have significant concentration on the plant samples (P-value=0.00) while the availability of many plant samples have a significant impact on the concentration of the heavy metal elements (P-value=0.03). The presence of the elements like Mn, Cu, Zn in the plants has tremendous health benefits to humans. In view of the importance of these medicinal plants, it is recommended that cultivation and monitoring of these plants be done regularly to ensure their availability and safety for food and medicine. This would serve as a source of income and prevent them from becoming extinct.

Keywords: Medicinal plants, heavy metals, phytochemical, Resin and Steroids.

Introduction

Medicinal plants are continually being utilized as therapeutic agents in formulation for treating diseases in traditional ethno-medical systems in Nigerian. However plants have been used over the years as curative agents against many infections and have been exploited in traditional medicine with their curative potentials well documented (Kasote et al., 2015), The plant kingdom is a treasure house of potential drugs and in the recent years there has been an increasing awareness about the importance of medicinal plants.(Narasimhan, et al; 2020, 2014, 2020), Drugs from the plants are easy available, less expensive, safe, and efficient and rarely have side effects. Plants are being used as valuable source of food and medicine for the prevention of illness and maintenance of human health (Narasimhan & Mohan, 2012). In northern Nigeria, many indigenous plants are widely consumed as food or home remedies especially in the treatment or management of

common diseases (Zumthurm, *et al* 2020). The importance of plants in medicine remains even of greater relevance with the current global shift to obtain drugs from plant sources, as a result of which attention has been given to the medicinal value of herbal remedies for safety, efficacy and economy. Most plants are capable to synthesize some chemical compounds that are useful to man and animals. These compounds are able to perform physiological action in the body. These chemical compounds are known as phytochemicals. These phytochemicals have important health benefits and can also be used to treat infections especially of microbial origin (Narasimhan, 2014). There are two basic classes of phytochemicals namely primary and secondary metabolites. The primary metabolites comprises of common sugars, amino acids, proteins and chlorophyll while the secondary metabolites consist of alkaloids, flavonoids, tannins and so on (Kubmarawa et al., 2007, 2008) (Edeoga et al., 2005).

Sicknesses and diseases have been of primary concern to mankind from time immemorial. Every generation has tried to respond to the variety of disabilities afflicting it is members according to its level of intellectual and technological development such response must be seen to be compatible with societal culture and beliefs (Ugbaja et al., 2017). The ancient Nigerian system of medicine is mainly plant based. It is now revealed that medicine blends with the socio-cultural life of the people (Sofowora et al., 2013). Despite all the advances made in modern medicine, the practice of herbal medicine as a bold self-reliant effort is still very much alive and plays important role in the health care of Nigerians. Even though most Nigerian urban dwellers due to changes imposed by modern life on social structures and attitudes reject the efficacies of traditional medicine (Ugbogu, 2014).

Materials and Methods

The materials used includes pestle and mortar, standard laboratory sieve, analytical oven, analytical balance, soxhlet extractor, Atomic Absorption Spectrophotometer and Flame Emission Spectrophotometer all for were obtained from the department of chemistry, Modibbo Adama University of Technology Yola, Adamawa State

All reagents were analytical grade reagents these includes; NaOH, KOH, HNO₃, FeCl₃, Pb(NO₃)₂, CuSO₄·5H₂O, CdCl₂, KMnO₄, ZnSO₄, K₂Cr₂O₇, HCl, H₂SO₄, others were Fehling solutions A & B, petroleum, hexane, ether, acetone, methanol and ethanol, and distilled water,

Study Area

The Area of study was Girei Local Government Area. Girei LGA is located in the North Eastern part of Adamawa State - Nigeria. It lies between the co-ordinates 10° 13' 54" North and 12° 55' 49" East of the equator with a population of 169,183 by 21/3/2006 population census. Adamawa state occupies a total area of 36,917 square km of Nigeria land mass and a population of 3,178,950 by 21/3/2006 population census. The state spans two

vegetation zones namely Sudan and Sahel savannah. Effective rains start in late June and end in late October while the dry season start in October and end in June.

Sample Collection

Whole plant samples *Tetrapleura tetraptera*, *Tawa tawa* and *Sida acuta* was collected in September at Sangere area of Girei LGA of Adamawa State when the leaves were green and transported to Department of Chemistry, Modibbo Adama University Yola where it was authenticated by a taxonomist. Each of the samples was destalked, washed with deionized water before being air dried for a month. The roots were treated with boiling alcohol to prevent enzymatic oxidation and hydrolysis of the constituent bioactive agents and other pertinent deteriorating chemical reactions which might blur the presence of any bioactive agent under investigation (Narasimhan, *et al*, 2014),. The chopped roots were also air dried for thirty days. The dried leaves, barks and roots were then grounded mechanically using pestle and mortar. The homogenized samples were sieved, packed in polythene bags, labeled and stored pending further use. (Abolaji Bello, 2015)



Fig.1.1 *tetrapleura tetraptera*, *Euphorbia hirta*.and *Malvaceae (sida acuta)*

Sample Preparation

The plant samples were washed thoroughly with tap water and the deionized water to remove the soil particles from the leaves, barks and roots. The samples were cut into smaller pieces and air dried for thirty days, the dried samples were grounded into powder and stored in labeled polythene bags (Abolaji Bello, 2015), each powdered sample was digested as reported by (Moyo *et al.*, 2011) 2gm of each sample was weighed into separate beakers and treated with 20cm of HNO₃ acid. It was digested on an electric hot plate for 60 minutes. Blank was prepared similarly by digesting 20cm³ of HNO₃ acid in an empty beaker. It was cooled and the content filtered through Whatman filter paper into a volumetric flask and made up to 100cm³ with deionized water. The digests was Analyses for the trace metal contents using Buck scientific model 210VGP Atomic Absorption Spectrophotometer. Usually a calibration curve is constructed using standard stock solution for each element. The unknown sample absorbance is read off on the spectrophotometer and the

concentration in ppm is obtained by extrapolation on the curve. Concentration in milligrams is obtained in mg/kg.

Preparation of stock standard solution for AAS calibration

The salts to be used were weighed taking into consideration the water of hydration where present. The mass of 1g of each metal was calculated and weighed using analytical balance. This was dissolved in 1000 cm³ volumetric flask using distilled water. This gives 1000 ppm solution. This was served as the standard stock solution for each metal. The amount calculated is derived using simple proportion presented in the table below.

Table 1.1 Preparation of Standard stock solution mg/L:

Name of salts (mg/L) calculated	Chemical formula	Amount
lead (II) trioxonitrate (v)	Pb(NO ₃) ₂	1.59
Copper (II) tetraoxosulphate (VI) Pentahydrate	CuSO ₄ ·5H ₂ O	3.92
Potassium heptaoxochromate (VI)	K ₂ Cr ₂ O ₇	2.83
Zinc (II) tetratoxosulphate	ZnSO ₄	2.48
Potassium tetraoxomanganate (VII)	KMnO ₄	2.87
Iron (III) Chloride	FeCl ₃	2.90
Cadmium Chloride	CdCl ₂	1.63

Serial dilutions of the stock solution

Serial dilution was prepared as follows: 1 cm³, 2 cm³, 3 cm³, 4 cm³ and 5 cm³ of the stock solution was measured respectively, into a 50 ml standard volumetric flask and made up to their marks with distilled water. These were yield 2 ppm, 4 ppm, 6 ppm, 8 ppm, and 10 ppm concentrations of the different metals to be analyzed. The concentration of each volume to be prepared was derived by using the formula $C_1V_1 = C_2V_2$

Where C_1 = Concentration of stock solution in ppm

V_1 = Calculated volume solution of the desired concentration.

C_2 = Concentration of the diluted solution in ppm

V_2 = Volume of the volumetric flask used for dilution in cm³

Phytochemical Screening: To trace the plant constituents Phytochemical screening was carried out. The root extract of the sample plants *Tetrapleura tetraptera*, *Tawa tawa* and *Sida acuta* were subjected to various phytochemical tests in an attempt to identify the constituent secondary metabolites as described by (Ahmad *et al.*, 2013), (Tijjani *et al.*; 2009) Phytochemical screening was conducted to determine the active components such as alkaloids, tannins, saponins, flavonoids, glycosides, phenolic compounds, resins and volatile oils. Primary metabolite like carbohydrates, proteins, fats and oils also were

determined processes of identification was done on accordance with procedure of (Tijjani *et al*; 2009).

Determination of alkaloids: 1ml of 1% HCl would be added to 3 ml of the extract in a test tube. The mixture was then heated for 20 minutes, cooled and filtered. About two drops of Mayer's was then added to 1 ml of the extract. A creamy precipitate was an indication of the presence of alkaloids.

Determination of tannins: One millimeter of freshly prepared 10% KOH was added to 1 ml of the extract. A dirty white precipitate shows the presence of tannins.

Determination of glycosides: 10ml of 50% H_2SO_4 was added to 1 ml of the extract and the mixture heated in boiling water for about 15 minutes. 10 ml of Fehling solution was then added and the mixture boiled, a brick red precipitate was confirmatory for the presence of glycosides.

Determination of saponins

- a) Frothing test: 2 ml of the extract was vigorously shaken in the test tube for 2 minutes. No frothing was observed.
- b) Emulsion test: 5 drops of olive oil was added to 3 ml of the extract in the test tube and vigorously shaken. Absence of stable emulsion formed showed absence of saponins.

Determination of flavonoids: One millimeter of 10% NaOH was added to 3 ml of the extract, there was no yellow colouration which is indication of the absence of flavonoids.

Determination of steroids: Salkowski test: 5 drops of concentrated H_2SO_4 acid was added to 1 ml of the extract in a test tube. Red coloration if observed is indication of the presence of steroids.

Determination of triterpenes: One millimeter of the extract was added to 5 drops of acetic anhydride and a drop of Conc. H_2SO_4 acid added. The mixture was then steamed for an hour and neutralized with NaOH followed by addition of chloroform. Absence of blue green color indicated the absence of triterpenes.

Determination of volatile oils: Extract was dissolved with 90% ethanol and drops of ferric chloride was added. Green coloration was taken as an indication for the presence of volatile oils.

Determination of phenols: Equal volume of extract plus equal volume of ferric chloride, a deep bluish green solution was taken as a positive test for the presence of phenols.

Determination of resins: Two millimeter of extract was added to equal volume of acetic anhydride and drops of concentrated H_2SO_4 acid. A violet coloration was taken as an indication for the presence of resins.

Determination of essential and heavy metals in the sample

The instrument was calibrated by allowing some warm up time for the AAS machine and the control knob adjusted until the meter reads 0% transmittance, three glass cuvettes were obtained and blotted with tissue paper. One of them was used for the solvent blank which is distilled water while the others were used for the analyte samples. The absorbance reading was measured for each metal serial dilution of the various samples. Calibration curves for each metal was prepared from which unknown concentrations in the samples were extrapolated. A plot of the absorbance (A) versus concentration gives a straight line graph. The analyte sample was introduced into the flame as a gas. The thermal energy dries the solvent, break the chemical bonds and excite the atoms which emit characteristic light of specific wavelength as it returns to the ground state. This is dispersed by a grating or prism and detected by the spectrometer.

The blank compensates for any absorption by the solvent containing the compound and serves to eliminate unwanted absorption due to the solvent.

Results and Discussion

Results

The three plant samples studied are presented in the text of methodology. The mineral elements distribution in mg/kg of the selected plant species is presented in tables 2.1 while Figure shows the graphical representation of the mineral element distribution in the plant species. The mineral content appeared to be dependent on the type and the part of the plant species. From the graph below in Figure 4.1 tawa tawa leaf has the highest concentration of Mn followed by tawa tawa stem, tawa tawa root and tetraptera leaf respectively. Zn has the highest concentration in tawa tawa bark followed by tawa tawa leaf and tawa tawa root respectively. The value for Pb is same concentration in acuda sida bark, acuta sida root, tawa tawa stem bark respectively. Cu has the least concentration in all the plant samples with tawa tawa leaf having the highest value followed by tawa tawa stem bark and leaf respectively.

Table 2.1: Heavy metals distribution in (mg/kg) in the selected plant species

Heavy metal	<i>Acuta sida</i>			<i>Tawa tawa</i>			<i>T. Tetraptera</i>		
	Leaf	Bark	Root	Leaf	Bark	Root	Leaf	Bark	Root
Zn	0.08	0.18	0.12	0.37	0.44	0.25	0.31	0.18	0.13
Mn	0.30	0.38	0.26	1.21	1.19	0.41	0.30	0.33	0.12
Pb	ND	0.38	0.38	ND	0.38	ND	ND	ND	ND

Cu	0.11	0.11	0.16	0.16	0.27	0.11	0.11	0.09	0.11
Cd	ND	ND	ND	ND	ND	ND	ND	ND	ND

Key: ND means not detected

Table 2.2: Zinc distribution in the plant parts in (mg/kg) among the selected plant species

Plants	Leaf	Stem Bark	Root
Acutasida	0.08	0.18	0.12
Tawatawa	0.37	0.44	0.25
Tetraptera	0.31	0.18	0.13

Table 2.3: Manganese distribution in the plant parts in (mg/kg) among the selected plant species

Plants	Leaf	Stem Bark	Root
Acutasida	0.30	0.38	0.26
Tawatawa	1.21	1.19	0.41
Tetraptera	0.30	0.33	0.12

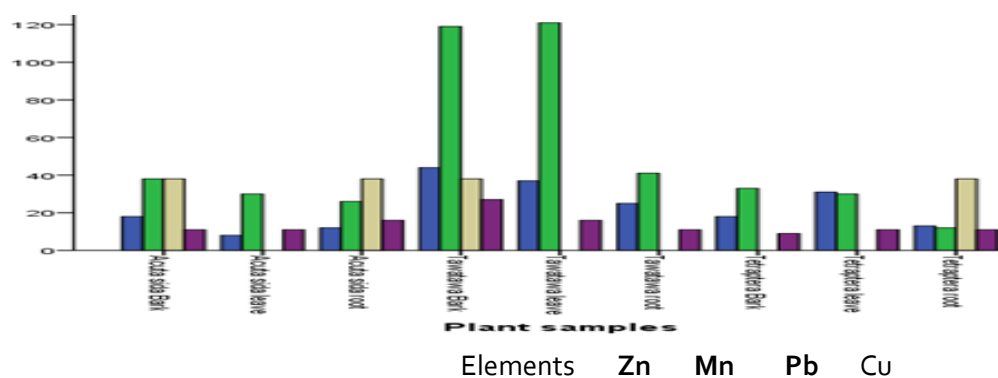
Table 2.4: Lead distribution in the plant parts in (mg/kg) among the selected plant species

Plants	Leaf	Stem Bark	Root
Acutasida	0	0.38	0.38
Tawatawa	0	0.38	0
Tetraptera	0	0	0.38

Table 2.5: Copper distribution in the plant parts in (mg/kg) among the selected plant species

Plants	Leaf	Stem Bark	Root
Acutasida	0.11	0.11	0.16
Tawatawa	0.16	0.27	0.11
Tetraptera	0.11	0.09	0.11

(Olaokiki & Adejumo, 2021)



(Olaokiki & Adejumo, 2021)

Discussion of Result

Here we compare results in the plants species by their level of concentration.

Concentration of Zn in the plant samples: Zinc is an essential mineral for human health. It is the second-most abundant metal in the body, after iron. The mineral is important for immune function, white blood cell formation, egg fertilization, cell division, and a host of other enzymatic reactions. Zinc deficiency may also be a causal factor in age-related vision deterioration. As depicted in the figure above it can be seen that zinc is mostly available in *tawa tawa* stem barks having a value 0.44% and *tawatawa* leaves as well as *tetraptera* leaves while also present in the remaining plants extracts. Zinc as a mineral element have numerous medicinal benefits as is vital for a healthy immune system, correctly synthesizing DNA, promoting healthy growth during childhood, and healing wounds. (Narasimhan, *et al*; 2020)

Concentration of Cu in the plant samples: copper content distribution as shown in Figure 4.1 are lower with *tetraptera* stem bark having value at 0.09mg/kg equivalent to gm/g/kg value in percentage and highest with *Tawatawa* stem bark. While also presents in all the three plants in some trace concentrations. Copper is an essential trace mineral necessary for survival. It is found in all body tissues and plays a role in making red blood cells and maintaining nerve cells and the immune system. It also helps the body form collagen and absorbs iron, and plays a role in energy production. Because of its role in facilitating iron uptake, copper deficiency can produce anemia-like symptoms, neutropenia, bone abnormalities, hypopigmentation, impaired growth, increased incidence of infections, osteoporosis, hyperthyroidism, and abnormalities in glucose and cholesterol metabolism. Conversely, Wilson's disease causes an accumulation of copper in body tissues. Severe deficiency can be found by testing for low plasma or serum copper levels, low ceruloplasmin, and low red blood cell superoxide dismutase levels; these are not sensitive to marginal copper status. The "cytochrome c oxidase activity of leucocytes and platelets" has been stated as another factor in deficiency, but the results have not been confirmed by replication (Iroha & Maduelosi, 2020)

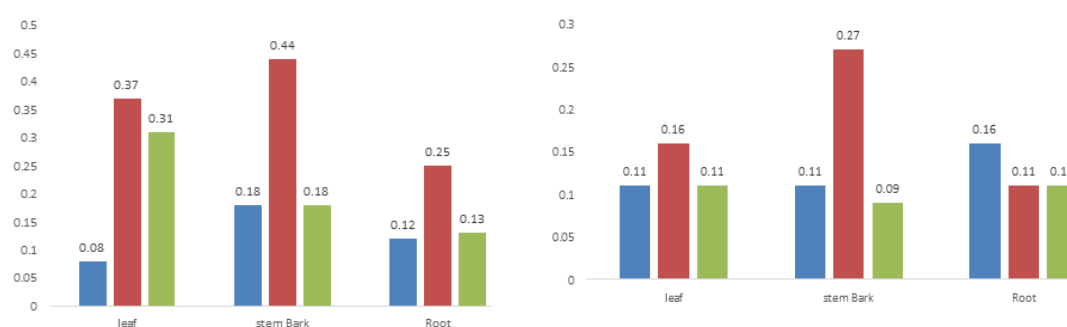


Fig.3.1: Distribution of Zn/Cu in the plant parts

Concentration of Pb in the plant samples: Pb was detected in all four of plant parts (*Acuta sida* bark, *tawa tawa* bark, *acuta sida* root and *tetraptera* root) of the plant samples as shown in Table 4. It is a non-essential element in foods and natural waters. The tolerable concentration limit of Pb is 0.001 mg/kg body weight. There is a strong link between micronutrient nutrition of plants, animals and humans and the uptake and impact of contaminants in these organisms (MaFragasso et al., 2015). Common sources of lead include automobile exhaust, ashes, batteries, bone meals, cigarettes, petrol and lead accumulator batteries, Lead is toxic and linked with failures in reproduction; it affects the brain causing hyperactivity and deficiency in the fine motor functions thereby resulting in damage to the brain. The nervous system of children is especially sensitive to lead leading to retardation. It is also cardio toxic and contributes to cardiomyopathy.

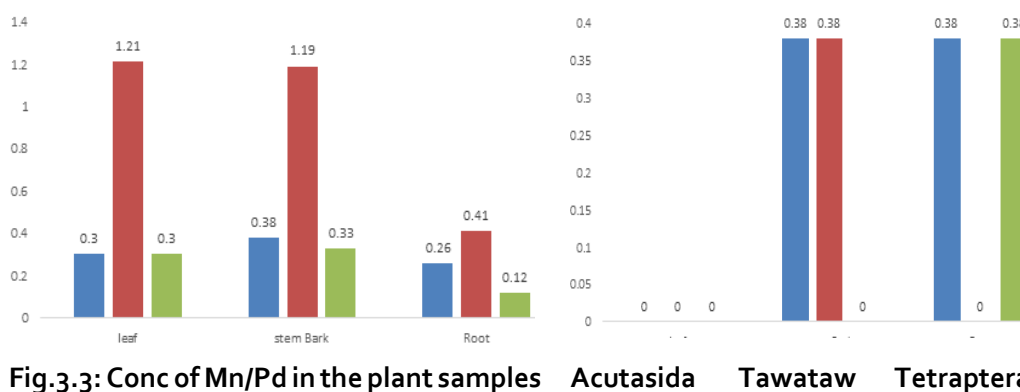


Fig.3.3: Conc of Mn/Pd in the plant samples Acutasida Tawataw Tetraptera
(Olaokiki & Adejumo, 2021)

Concentration of Mn in the plant samples: Manganese content distributions as shown in Figure 4.1 are lower with *tetraptera* root having its lowest value at 0.12mg/kg Mn concentration which is the least. The range of values of 0.11 mg/kg to 0.29mg/kg is below the recommended daily allowance for Mn of 2.5mg to 5.0mg (Hamasalim, 2015). However climatic factors especially rainfall and temperature, genetics, soil characteristics and the kind of plants might influence their mineral composition. Manganese plays a structural role in the chloroplast membrane system and as a cofactor for fatty acids, DNA and RNA synthesis (Schlenker et al., 2010). Though the concentration of Mn in these plants is low, they will still supplement other sources of Mn and regular consumption may help in preventing adverse effects of this dietary deficiency on the central nervous system and skeletal anomalies among children (Barminas et al, 1998).

Cadmim was not detected in all the three plant samples studied namely, *Acuta sida*, *tawa tawa* and *tetraptera* as presented in Table 4.1 This might be due to the location of these plants which is far to sources of automobile exhaust waste or the soil contents from where they grow (Doherty et al., 2012) The tolerance limit of Cd is 0.1-2.4mg/kg (Hamasalim, 2015). Cd is a non-essential element in food and natural water and accumulates principally in the kidney and live (Sobukola et al., 2010). It is linked with low sperm count and reduced birth weight and causes cardiovascular diseases and hypertension. Their absences indicate

that the plants contribute nothing to the toxic effects of this non-essential element. It is a non-essential element in foods and natural water and accumulates essentially in the kidney and liver (Sobukola *et al.*, 2010). The maximum level set by (Hamasolim, 2015) is 2 mg/kg body weight. Its absence indicates that the plant contributes nothing to the toxic effect of this non-essential element. Its toxicity is linked with low sperm count and reduced birth weight; it is also carcinogenic and seems to be a causal factor in cardiovascular diseases and hypertension. Knowing the toxicity effect and the essentialities of some of the trace metals in the environment on human health is of paramount importance for food hygienist and health authorities to be familiar with available information on some of the hazardous metal content of our food like the leafy vegetables (*S S Asaolao and m. F Asaolao 2010*) This information may serve as a guide to the nutritional value and toxicity potential of some leafy vegetables due to their mineral content. Normal range in plants is 0.1m 2.4mg. (Samson Ishola *et al.*, 2017)

Phytochemical screening

The extracts were analyzed for the presence of alkaloids, flavonoids, steroids, terpenoids, tannins, saponins, glycosides and phenols (Sofowora *et al.*, 2013). Qualitative analysis carried out on each plant showed the presence of phytochemical constituents as summarized in Table 4.3 shows that saponin, alkaloids, glycosides, flavonoids and terpenoids were present in all the plants studied. The extracts of *tawa tawa*, *acuta sida* and the leaf extract of *tetraptera* were rich in Phenol. Steroids were found to be absent in all the plant samples, Tannin were absent in the root and bark extracts of *acuta sida* and *tetraptera*. (Hosseinzadeh *et al.*, 2015), Compounds such as phenols, flavonoids, steroids, terpenes and alkaloids present in the extracts were of medicinal value. Okigbo and Tgwe, (2008) reported that such bioactive compounds in *ocinium grallisinium* and *piper guineense* exert bacteriostatic and bactericidal effects on some bacteria thus the use of the extract in traditional herbal medicine is scientifically justified. The flavonoids present in the extracts example were reported to exhibit antioxidant activity.

Sida acuta: Effect of terpenoids, saponins, glycosides and alkaloids

From the phytochemical screening carried out it shows that *sida acuta*, record the presence of terpenoids, saponins, glycosides and alkaloids in the samples. Studies have shown that *sida acuta* species extracts possess potent antimicrobial, antiulcer and anti-inflammatory properties. (Hosseinzadeh *et al.*, 2015). Many pharmacological applications including anti-plasmodia, antibacterial, antifungal, antioxidant, cytotoxic activities and many other properties. *Nwuzo et al.*, (2009) reported the antibacterial potential of aqueous and ethanol leaves extracts of *sida acuta* against 45 clinical isolates of *S. aureus* isolated from nasal cavity of Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) affected patients. Antibacterial activity of chloroform and ethanol leaf extract of *sida acuta* was reported against *S. aureus*, *B. subtilis*, *E. coli*, and *P. aeruginosa* (*Nwuzo et al.*, 2009) .A

similar antibacterial property of *sida acuta* was also reported by (Aliyu et al., 2011). (Karou et al., 2006) The antibacterial assays were performed by the agar well diffusion and the both micro dilution for the evaluation of inhibition zone diameters, minimal inhibitory concentration (MIC) and minimal bactericidal concentration (MBC) values. The highest inhibition zone diameters were recorded with gram positive bacteria (Akilandeswari S et al., 2010). The two major alkaloids in the extract, recognized as cryptolepine and quindoline, exhibited good antimicrobial activity against several test microorganisms (Karou et al., 2006)

Acutasida			Tawatawa			Tetraptera		
Bark	Root	Leaf	Bark	Root	Leaf	Bark	Root	Leaf
4.02±0.02	9.01±0.01	6.00±0.02	4.01±0.01	4.89±0.02	16.00±0.01	19.02±0.02	7.01±0.01	3.01±0.01
7.01±0.02	9.00±0.01	1.85±0.01	6.00±0.01	7.03±0.01	3.20±0.12	2.01±0.01	2.32±0.01	11.02±0.01
0.98±0.01	0.24±0.01	0.26±0.01	0.25±0.01	0.44±0.01	0.43±0.01	0.64±0.01	0.51±0.01	0.46±0.01
0.97±0.01	0.64±0.01	0.64±0.01	0.78±0.02	-	1.26±0.01	0.09±0.00	0.44±0.01	1.01±0.01
38.89±0.01	48.89±0.02	24.86±0.01	8.06±0.01	-	34.24±0.01	30.69±0.01	25.83±0.01	37.36±0.01

Table 3.1: Summary of the qualitative analysis of the selected medicinal plants

Bioactive compound	<i>Acuta sida</i>			<i>Tawa tawa</i>			<i>Tetraptera</i>		
	Leaf	Bark	Root	Leaf	Bark	Root	Leaf	Bark	Root
Alkaloids	++	++	++	++	++	+++	+	+++	+++
Glycosides	++	++	++	++	++	+++	+	+	+++
Flavonoids	+	++	++	+	++	++	+	+	+
Phenol	+	-	-	+	-	-	+	-	-
Saponin	-	++	+++	-	+	++	+	++	+++
Steroids	-	-	-	-	-	-	-	-	-
Tannin	+	++	+	++	+	+	+	-	-
Terpenoid	+	+	++	+	-	++	+	+	++

Presence of phytochemical: +++ (high amount); ++ (moderately high amount) ;+(low amount).

Tawa tawa: Effect of saponins, flavonoids, tannins and terpenoids

From the phytochemical screening of *tawa tawa* it shows the presence of saponins, flavonoids, tannin and terpenoids in an appreciable quantity. *Euphorbia hirta* (Tawa-tawa) is also called Gatas-gatas because of the healing properties of its milky juice. It contains triterpenes, phytosterols, tannins, saponins, polyphenols, and flavonoids. This herb has gained widespread attention because of its ability to help patients recover from dengue. Folk wisdom regards it as a hemostatic, which may help explain why blood platelets increase after ingestion of a boiled decoction of the plant. The presence of saponins as shown in Table 8 is the reason why the leaves of *tawa tawa* is used traditionally to cleanse and purify blood since one of saponins medicinal uses is as a gentle blood cleanser (Hosseinzadeh et al., 2015),

Tetraptera: Effect of flavonoids, glycosides, saponins

From the phytochemical screening shows the presence of flavonoids, glycosides, saponins in the Tetraptera plants in appreciable quantity. *Tetraptera* also known as Aidan in Nigeria are widely used for its medicinal values. In agreement with its local names, T. tetraptera is reported to have various medicinal and nutritional properties (Adesina et al., 2016) The species medicinal attributes are due to presence of bio-active compounds (alkaloids, flavonoids, saponins, tannins, phenols and glycosides) which are essential for health (Okwu 2003).

Availability of heavy metals in *Tetrapleura tetraptera*, *Tawa tawa* and *Sida acuta*

The plants extracts consisting of the bark, leaves and roots of *Tetrapleura tetraptera*, *Tawa tawa* and *Sida acuta* were tested for the presence of heavy metals i.e metallic elements (Cadmium, Zinc, Manganese, lead and Copper) using the Atomic Absorption spectrophotometer-VGP210 taken under the Air-acetylene flame integrated mode. It can be seen that all the heavy metal has significant presence in the plant samples except cadmium which have been not detected in the plant samples. Zinc is significant and has significant interaction with all the other elements, Manganese is also significant in the plant sample with significant interactions with Pb, Cu, Zn and Pb, also has significant concentration in the plants with significant interactions with Mn, Cu and Zn. Copper Cu have been found to be significant in the plant samples and also having possible significant interaction with only Mn and Pb.

Table 3.2: Anova analysis of the concentration of heavy metals in the plant samples

		Sum of Squares	Df	Mean Sq	F	Sig.
Plant samples	Between Groups	147.530	18	8.196	1.831	.037
	Within Groups	331.240	74	4.476		
	Total	478.770	92			
Heavy metals	Between Groups	77.400	18	4.300	87.418	.000
	Within Groups	3.640	74	.049		

Total	81.040	92
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The preliminary phytochemical screening of methanol extracts for stem bark, leaves and rhizome of *Tetrapleura tetraptera*, *Tawa tawa* and *Sida acuta* (Hosseinzadeh et al., 2015), revealed the presence of saponins, flavonoids, steroids, cardiac, glycosides, terpenoids, phenols and tannins. The heavy metals have significant concentration on the plant samples (P-value=0.00) while also the availability of many plant samples have a significant impact on the concentration of the heavy metal (P-value=0.03). The presence of the elements (like manganese, copper, zinc) in the plants has tremendous health benefits to humans. Zinc as a mineral element have numerous medicinal benefits as is vital for a healthy immune system, correctly synthesizing DNA, promoting healthy growth during childhood, and healing wounds. Though the concentration of Mn in these plants is low, they will still supplement other sources of Mn and regular consumption may help in preventing adverse effects of this dietary deficiency on the central nervous system and skeletal anomalies among children (Barminas et al, 1998). The absence of such toxic elements as Cd and few presences of Pb (only in *acuta sida* bark and leaves, *tawa tawa* bark and *tetraptera* roots) but not detected in the remaining samples make the plants suitable and safe for use as dietary supplements and medicinal plants. It may however be possible that these plant species may possess these elements of interest that were not detected; they may be present in amounts far below the instrument detection limit.

Conclusion and Recommendation

Conclusion

The investigation and phytochemical analyses of heavy metals composition of *Tetrapleura tetraptera*, *Euphorbia hirta* and *Sida acuta* were successfully carried out. The mineral composition of these plants showed that they could be rich sources of minerals. Improved health and nutrition can be achieved not only from the consumption of fruits and vegetables with high antioxidant capacities but also from medicinal herbs and plants. High concentration of Mn and Zn may be attributed to both geological and anthropological activities.

The extract of the plant species *sida acuta*, *tawa tawa* and *tetraptera* were observed to be rich in secondary metabolites. Most of these constituents are potent bioactive compounds found in medicinal plant samples (*sida acuta*, *tawa tawa* and *tetraptera*) used for therapeutic purposes or which are precursors for the synthesis of useful drugs (**Chinyere G. Chinyere 2009**) It is apparent that there is a plant for every health disorder. Local people notice medicinal plants growing in their farms and utilize them to solve a lot of health problems (**Sofowora et al., 2013**). The active constituents differ from plant to plant due to their biodiversity and they produce a definite physiological action on human body. They act as antiviral, antimicrobial, antibacterial, anti-inflammatory, anti-parasites, expectorant immune against diseases that contribute to ill-health in the body system. The

phytochemicals (alkaloids, flavonoids, saponins, terpenoids, tannins and steroids) were present commonly in all the studied plants. The plants have been screened for phytochemical constituents and seemed to have the potential to act as a source of useful drugs and also to improve the health status of the consumers as a result of the presence of various compounds that are vital for good health. This study opens up the possibility for the search of new antimicrobials as an alternative to the antibiotics.

Recommendations

Based on the findings of this research work, the following recommendations are worthy of consideration.

- Phytotherapy should be introduced and recognized as a course of study in the university for herbal practitioners. Prospective students should be versed in science subjects like physiology, anatomy, pharmacology and chemistry among others. This would help to overcome the problem of diagnosis encountered with traditional healers. They can therefore treat sicknesses which hitherto had been a challenge toward the acceptability of herbs for disease management.
- In view of the importance of these medicinal plants, it is recommended that cultivation and monitoring of these plants be done regularly to ensure their availability and safety for food and medicine. This would serve as a source of income and prevent them from becoming extinct.
- To protect the non-toxicity level of these plants, efforts should be made to prevent these plants from being cultivated near the roads or industrial areas where they may be contaminated through the dissipation of heavy metals.
- This work could be expanded so as to carry out chromatographic separation to isolate the active components and characterize their structures using IR, UV, M/S or NMR methods.
- The toxicity assay may be carried out on the extracts to determine the safety level of these medicinal plants for human consumption.

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