SELECTED METAL CONTENTS AND PHYTOCHEMICAL PROFILING OF *FICUS CAPREIFOLIA* AND *MANGIFERA INDICA* COMMONLY USED ANTIDIABETIC PLANTS FROM OIL PRODUCING REGION OF NIGERIA.

ABSTRACT

Aim: The study evaluated selected metal contents and phytochemicals present in *Ficus capreifolia* and *Mangifera indica* extracts commonly used antidiabetic plants from Aluu and Bodo communities in Rivers State, Nigeria.

Place and Duration of Study: University of Port-Harcourt, Choba, Rivers State, Nigeria and its environs was used between June to November, 2020.

Methodology: *Composite* soil samples and the leaves of *Ficus capreifolia* and *Mangifera indica* were collected from Bodo and Aluu communities respectively. Atomic absorption spectrophotometer was employed for the analysis of the metals (Zn, Pb, Ni, Mn, Fe, Cu, As and Cr). The plant extracts were screened for the presence of various phytochemicals using spectrophotometric methods.

Results:. Flavonoid, Saponins, Tannins, Alkaloids. Terpenoid, Glycoside and Carotenoid were detected in *Ficus carpreifolia* obtained from Bodo and Aluu communities while *Magnifera indica* obtained from both communities has Alkaloids, Phenols, Flavonoids, Saponins and Tannins detected. Metals such as Zn, Pb, Mn, Fe and As were detected at Bodo and Aluu soil samples. Cu, Ni and Cr were below the detectable limit. Zn, Pb and As were above the permissible limit in Bodo soil samples while only As was above the permissible limit in Aluu community. In the plant samples, only Mn was present and was within the permissible limit in plants samples obtained from Bodo and Aluu communities while Zn, Pb, Ni, Fe, Cu, As and Cr were below the detectable limit.

Conclusion:. The study shows that *Ficus capriefolia and Mangifera indica* do not bioaccumulate Fe, Zn, Ni, Pb, As and Cr and this may be attributed to the metal intolerance potential of the plants, hence no fear of metal toxicity when using these plants for medicinal purposes. The presence of saponins, tannins and flavonoid affirmed the hypoglycemic potentials of the plants.

Keywords: Metals, Phytochemicals, *Ficus Capreifolia and Mangifera Indica.*

1. INTRODUCTION

Metals are generally defined as substances characterized by relatively high densities, high electrical and thermal conductivity [4]. Some metals are either essential nutrients (typically iron, cobalt, and zinc), or relatively harmless (such as ruthenium, silver, and indium), but can be toxic in larger amounts or certain forms. Other metals, such as cadmium, mercury, and lead are highly poisonous [5]. Metals are therefore classified as essentials and non-essential metals. Essentials metals and their roles have been reported [10,11]. The essentials metals are beneficial to human and other living things; however essentials metals can be toxic to living things when the concentration exceeds the tolerable limit for the organism [6]. Non-essentials metals could be toxic to cells of the body even at low concentration [1]. Metals could build up in different body parts of humans which include blood, kidney, liver; heart among others, which can cause disease conditions [8]. Due to metal toxicity, their availability in medicinal plants is of immense concern

to public health due to their biotoxic effect [14]. This biotoxic effects of metals occur when the concentration exceeds bio-recommended levels. Some metals have the tendency of causing irreplaceable damage in humans, hence their concentration in medicinal plants due to bio-accumulation need to be monitored [9]. Several metals including mercury, lead, Zinc, cadmium, Iron, Manganese, Chromium, Antimony, Tin, Copper, Nickel and Arsenic among others have been reported in medicinal plants [11]. Among these metals, copper, zinc lead, cadmium, chromium, mercury and Arsenic among others are the main threats to human health [3]. Hence the need to evaluate the metal contents of these plants and their phytochemicals in order to take a position on their safety or others wise, as it is been used daily as therapy for the management of diabetes mellitus.

2. MATERIALS AND METHODS

2.1 Chemicals and Reagents

All chemicals/reagents and materials needed for the work were commercially made available and the manufacturers standard operating procedures was strictly followed.

2.2 Soil Collection

The soil samples were collected from Bodo City in Gokhana Local Government Area and Aluu in Ikwerre Local Government Area of Rivers State, Nigeria using an auger. The auger was driven down to about 20cm down the soil and the soil sample drawn out was placed in a sealed plastic tube and labeled.

2.3 Preparation of Soil Sample

The soil samples collected were kept in the laboratory and dried under room temperature. The soil samples were pretreated by homogenizing and sieve using 2mm sieve. 0.5g portion of each of the samples were weighed using a weighing balance in triplicate and digested with 20ml of aqua regia (HCl and HNO_3, in a ratio of 3:1) by heating the mixture in a fume cupboard for 2 hours. The resulting mixture was then filtered and the filtrate diluted to 50ml with distilled water.

2.4 Plant Material

Ficus capreifolia and *Mangifera indica* was obtained from Bodo City in Gokhana Local Government Area and Aluu in Ikwerre Local Government Area of Rivers State, Nigeria. The plants were identified and authenticated in the Herbarium of the Department of Plant Science and Biotechnology, Rivers State University, Port Harcourt as *Ficus capreifolia and Mangifera*

indica.

2.5 Sample Preparations

Fresh leaves of *Ficus caprecfolia* were properly washed with deionized water to remove dirt. The leaves were dried under room temperature and pulverized using warring blender. Acid digestion was done as described in soil preparation for metals analysis while extraction was done for phytochemical screening using Soxhlet extractor in a continuous extraction Process (BDH Chemicals) for 72 hours using methanol, aqueous, ethyl acetate and n-hexane as extracting solvents. The extracts were concentrated using rotary evaporator set at 60°C.

2.6 Quantitative and Qualitative Phytochemical Screening Test

The quantitative and qualitative phytochemical screening was done using spectrophotometric methods (Spectro UV-Visible 2500, manufactured by LaboMed Inc., USA) at Nigeria Institute of Science Laboratory Technology, Ibadan, Oyo State, Nigeria.

2.7 Metal Analysis

Metal analysis of both the soil samples and plants extracts were done using Atomic Absorption Spectrophotometer (AAS) at various wave lengths.

2.8 Data Analysis

Data from this study was analyzed using SPSS version 23. ANOVA statistic followed by Tukey and Posthoc analysis was used to compare the means of the parameters. P-values less than 0.05 ($P \leq 0.05$) were considered statistically significant in this study.

3. RESULTS AND DISCUSSION

Table 1: Qualitative Phytochemical Screening of *Ficus capreifolia* Leaf Obtain from Aluu

S/N	Phytochemicals	Methanol Extract	Aqueous Extract	Ethyl acetate	Hexane
1.	Flavonoid	++	+	+	-
2.	Eugenol	-	-	-	+
3	Saponins	+	-	-	-
4.	Tannins	+	+	-	-
5.	Phenols	++	+	+	+
6.	Alkaloids	++	+	+	-
7.	Steroid	-	-	-	-
8.	Terpenoid	+	+	+	+
9.	Glycoside	+	+	-	-
10.	Carotenoid	+	+	-	-

Key: (++) = absolutely detected, (+) = moderately detected, (-) = below detectable limit.

Table 2: Qualitative phytochemical Screening of *Ficus capreifolia* Extract Obtained from Bodo

S/N	Phytochemicals	Methanol Extract	Aqueous Extract	Ethyl acetate	Hexane
1.	Flavonoid	++	+	+	-
2.	Eugenol	-	-	-	+
3	Saponins	+	-	-	-
4.	Tannins	+	-	-	-
5.	Phenols	++	+	+	+
6.	Alkaloids	++	+	+	-
7.	Steroid	-	-	-	-
8.	Terpenoid	+	+	+	+
9.	Glycoside	+	+	-	-
10.	Carotenoid	+	+	-	-

Key: (++) = absolutely detected, (+) = moderately detected, (-) = below detectable limit.

Table 3: Quantitative Screening of Phytochemical Components of *Ficus capreifolia* Obtained from Bodo.

S/N	Phytochemicals	Methanol Extract

1.	Flavonoid	3.11 ± 0.33
2.	Tannins	1.45 ± 0.55
3	Phenol	33.34 ± 0.34
4.	Alkaloids	8.42 ± 0.02

Table 4: Quantitative Screening of Phytochemical Components of *Ficus capreifolia* Obtained from Aluu.

S/N	Phytochemicals	Methanol Extract
1.	Flavonoid	4.65 ± 0.74
2.	Tannins	2.34 ± 0.34
3	Phenol	4.22 ± 0.64
4.	Alkaloids	3.97 ± 0.05

Table 5: Quantitative Screening of Phytochemical Components of *Mangifera indica* Obtained from Bodo

S/N	Phytochemicals	Methanol Extract
1.	Alkaloids	9.66 ± 0.20
2.	Phenol s	0.75 ± 0.22
3	Flavoinds	6.86 ± 0.20
4.	Saponins	8.48 ± 0.10
5.	Tannins	1.10 ± 0.20

Table 6: Quantitative Screening of Phytochemical Components of *Mangifera indica* Obtained from Aluu.

S/N	Phytochemicals	Methanol Extract
1.	Alkaloids	0.84 ± 0.11
2.	Phenol s	0.39 ± 0.12
3	Flavoinds	11.22 ± 0.10
4.	Saponins	3.22 ± 0.10
5.	Tannins	0.45 ± 0.10

The qualitative and quantitative phytochemical screening of the leaves extracts of *ficus capreifolia* and *magnifera indica* using different extracting solvents revealed the presence of flavonoids, saponins, tannins, phenols, alkaloids, terpenoids, glycoside and carotenoid as

contained in table 1, 2, 3, 4, 5 and 6. Methanol extract has most of the phytochemicals detected when compared with aqueous, ethyl acetate and n-hexane extracts. This can be attributed to the polarity of methanol as compared with other extracting solvents. Phenol has the highest concentration in mg/ml (33.34±0.34) followed by alkaloids (8.84±0.02), flavonoid (3.11±0.34) and tannins (1.45±0.55) in methanol extract of *ficus capreifolia* from bodo community while flavonoid was the highest in concentration (4.65±0.74) followed by phenol (4.22±0.64), alkaloids (3.97±0.05) and tannins (2.34±0.34) in *ficus capreifolia* extract obtained from Aluu community. In the case of *mangifera indica* extract from bodo community, alkaloids has the highest concentration of (9.66±0.20) in mg/ml followed by saponin (8.48±0.10), flavonoids (6.86 ±0.22). tannins (1.10±0.20) and phenols (0.75±0.22) while in *mangifera indica* extract obtained from Aluu community, flavonoids has the highest concentration of (11.22±0.10), followed by saponins (3.22±0.10), alkaloids (0.84±0.11), tannins (0.45±0.10) and phenols (0.39±0.12). Hence, flavonoids, Saponins and Tannins are families of compounds with established hypoglycemic activity [10,11]. Thus, anyone or a combination of some or all of the above mentioned components of the leaves could be responsible for the hypoglycemic potentials of the plants.

Table 7: Metals Concentration in mg/kg of Composite Soil Samples obtained from Aluu and Bodo Communities

Location/Metals	Zn	Pb	Ni	Mn	Fe	Cu	As	Cr
Aluu	10.20±4.04[a]	439.93±45.63[a]		133.54±0.71[a]	426.87±45.33[a]	-	348.80±17.21[a]	-
Bodo	416.93±24.42[b]	444.20±16.16[a]	-	169.67±4.15[b]	5272.90±79.54[b]	-	251.80±13.35[b]	-
Standards	10 – 300	2– 200	500	20 – 3000	70000-550,000	2 – 100	1 – 50	1 - 1000

Table 8: Metals Concentration in (PPM) of *Ficus capreifolia* obtained from Aluu and Bodo Communities

Location/Metals	Zn	Pb	Ni	Mn	Fe	Cu	As	Cr
Aluu	-	-	-	161.23±9.73[ab]	-	-	-	-
Bodo	-	-	-	145.60±1.84[ab]	-	-	-	-
Standards	10 – 300	2– 200	500	20 – 3000	70000-550,000	2 – 100	1 – 50	1 - 1000

Table 9: Metals Concentration in (PPM) of *mangifera indica* obtained from Aluu and Bodo Communities

Location/Metals	Zn	Pb	Ni	Mn	Fe	Cu	As	Cr
Aluu	-	-	-	157.30±[ab,]7.23	-	-	-	-
Bodo	-	-	-	142.00±[ab,] 0.80	-	-	-	-

Values are triplicate of mean ± SEM . Values with the same superscript letters are significantly different at $P \leq 0.05$ while the one with different superscript are significantly different at $P \leq 0.05$. (-) = Below detectable limit.

Toxicity induced by metals is associated with bioaccumulation and biomagnification [7]. Plants are good source for bioaccumulation of metals if they are bioavailable [12]. This is the property responsible for the usage of plant for phytoremediation, but on the other hand, there is great concern about heavy metal toxicity when using medicinal plants for therapeutic purpose when the heavy metals load are not been verified due to environmental pollution [13]. A total of 8 elements (Zn, Pb, Ni, Mn, Fe, Cu, As and Cr) were determined both in the composite soil samples obtained from Aluu and Bodo communities as well as in the leaves of *Ficus capreifolia* and *Mangifera indica*, as continued in table 7, 8 and 9. Table 7 shows the concentrations of various metals in the soils samples obtained from Aluu and Bodo. Zn was within the permissible limited in the soil samples obtained from Aluu community but above the permissible limit in Bodo soil sample. Pb was above the standard in both Aluu and Bodo soil samples. Ni was not found to be present in both Bodo and Aluu soil samples but Mn and Fe, was found to be within the permissible limit in both soil samples. Cu was not found and As was above in both cases while Cr was not detected. This clearly shows that Bodo soil samples is highly polluted with Zn, Pb and As while Aluu soil samples is only polluted with As. However, the analysis of various metals in the plants samples (*Ficus capreifolia and Mangifera indica*) obtained from both communities has only Mn to be presents while others were not detected. The above generic specificity of accumulation of metals is associated with peculiarities of plant metabolism and the type of adaptive strategy [15]. Thus, it could be said that *Ficus capreifolia* and *Mangifera indica* has high intolerance to metals, hence they are expose to the cellular site of the plants for evaporation [2].

Conclusion: The study shows that *Ficus capriefolia and Mangifera indica* do not bio-accumulate Fe, Zn, Ni, Pb, As and Cr and this may be attributed to the metals intolerance potentials of the plants, hence no fear of metal toxicity when using the plants for medicinal purposes. The presence of saponins, tannins and flavonoid affirmed to the hypoglycemic potentials of the plants.

ETHICAL APPROVAL

All authors hereby declare that principles of laboratory animal care were followed as well as specific national laws where applicable. All experiments have been examined and approved by the appropriate ethics committee.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The plants used for this research are commonly and predominantly use plants in our area of research and country. There is absolutely no conflict of interest between the authors because we do not intend to use these Plants extracts for any litigation but for the advancement of knowledge. Also, the research was funded by personal efforts of the authors.

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