

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

## ABSTRACT

**Aim:** This 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 capreifolia* obtained from Bodo and Aluu communities while *Mangifera indica* obtained from both communities, Alkaloids, Phenols, Flavonoids, Saponins and Tannins were detected. Metals such as Zn, Pb, Mn, Fe and As were detected at Bodo and Aluu soil samples while Cu, Ni and Cr fell below the detectable limit. Zn, Pb and As fell above the permissible limit in Bodo soil sample 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 plant samples from Bodo and Aluu communities while Zn, Pb, Ni, Fe, Cu, As and Cr fell below the detectable limit.

**Conclusion:** The study showed that *Ficus capreifolia* and *Mangifera indica* did not bioaccumulate Fe, Zn, Ni, Pb, As and Cr and this may be attributed to the metals intolerance potential of the plant, hence no fear of metal toxicity when used for medicinal purpose. The presence of saponins, tannins and flavonoid affirmed to its hypoglycemic potentials.

**Keywords:** Metals, Phytochemicals, *Ficus Capreifolia*, *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 heavy 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 beneficially to human health 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 the toxicity of metals, their availability in medicinal plants is of immense concern to public health due to its biotoxic effect [14]. This biotoxic effects of metals occur when the concentration exceeds bio-recommended levels. Due to the fact that some metals have the tendency to cause irreplaceable damage to the human being, 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 to take a position on its safety or otherwise, 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 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<sub>3</sub>, 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 plant 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 capreifolia* 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 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 plant 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 ( $P < 0.05$ ) 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 extract of *ficus capreifolia* and *mangifera 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 phytochemical absolutely 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 ( $33.34 \pm 0.34$ ) followed by alkaloids ( $8.84 \pm 0.02$ ), flavonoid ( $3.11 \pm 0.34$ ) and tannins ( $1.45 \pm 0.55$ ) in methanol extract of *ficus capreifolia* from bodo community while flavonoid was the highest in concentration ( $4.65 \pm 0.74$ ) followed by phenol ( $4.22 \pm 0.64$ ), alkaloids ( $3.97 \pm 0.05$ ) and tannins ( $2.34 \pm 0.34$ ) in *ficus capreifolia* from Aluu community. In the case of *mangifera indica* extract from bodo community, alkaloids has the highest concentration of ( $9.66 \pm 0.20$ ) in mg/ml followed by saponin ( $8.48 \pm 0.10$ ), flavonoids ( $6.86 \pm 0.22$ ), tannins ( $1.10 \pm 0.20$ ) and phenols ( $0.75 \pm 0.22$ ) while in *mangifera indica* obtained from Aluu community, flavonoids has the highest concentration ( $11.22 \pm 0.10$ ), followed by saponins ( $3.22 \pm 0.10$ ), alkaloids ( $0.84 \pm 0.11$ ), tannins ( $0.45 \pm 0.10$ ) and phenols ( $0.39 \pm 0.12$ ). 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 <sup>a</sup>	439.93±45.63 <sup>a</sup>	-	133.54±0.71 <sup>a</sup>	426.87±45.33 <sup>a</sup>	-	348.80±17.21 <sup>a</sup>	-
Bodo	416.93±24.42 <sup>b</sup>	444.20±16.16 <sup>a</sup>	-	169.67±4.15 <sup>b</sup>	5272.90±79.54 <sup>b</sup>	-	251.80±13.35 <sup>b</sup>	-
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 <sup>ab</sup>	-	-	-	-
Bodo	-	-	-	145.60±1.84 <sup>ab</sup>	-	-	-	-
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± <sup>ab</sup> ,7.23	-	-	-	-
Bodo	-	-	-	142.00± <sup>ab</sup> , 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 leafs 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 sample from Aluu and Bodo. Zn was within the permissible limited in Aluu community but above the permissible limit in Bodo. Pb was above the standard in both Aluu and Bodo, Ni was not found to be present in both 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 was highly polluted with Zn, Pb and As while Aluu soil sample was only polluted with As. However, the analysis of various metals in the plants samples (*Ficus capreifolia* and *Mangifera indica*) 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 heavy metals, hence they are expose to the cellular site of the plants for evaporation [2].

**Conclusion:** The study showed that *Ficus capreifolia* and *Mangifera indica* did not bioaccumulate Fe, Zn, Ni, Pb, As and Cr and this may be attributed to the metals intolerance potential of the plants, hence no fear of metal toxicity when used for medicinal purpose. The presence of saponins, tannins and flavonoid affirmed to its hypoglycemic potentials.

#### **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 products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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