

Comparative Studies of Chemical Composition of the Leaf Extracts of *Pterocarpus osun* from Different Geographical Regions of Nigeria

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ABSTRACT

Objectives: The leaf of *Pterocarpus osun* from different geographical region in Nigeria was studied to assess the phytochemical profile, antimicrobial activity and elemental composition.

Methodology: Ethanolic crude extracts were obtained by soxhlet extraction and then the extracts were tested against selected gram positive and gram negative bacterial strains. The crude extracts were equally subjected to phytochemical screening and elemental analysis.

Results: The antimicrobial studies showed that the ethanolic extracts of *Pterocarpus osun* leaf were active with inhibitory activity at (0.5, 1.0 and 2.0 mg/ml) against tested microorganisms. The crude ethanolic extracts showed the presence of phenol, saponins, tannins, cardiac glycosides, sterols and terpenes. The elemental analysis revealed the presence of Calcium (Ca), Chromium (Cr), Copper (Cu), Magnesium (Mg), Manganese (Mn), Nickel (Ni), Zinc (Zn), Sodium (Na) and Potassium (K) for all leaf extracts.

Conclusion: This report assessed the variation in the composition of *Pterocarpus osun* growing in different climatic region and that of the dried and fresh leaves. Moreover, the results justifies the use of *P. osun* in folkloric medicine for the management of some microbial infections.

Keywords- *Pterocarpus osun*, Phytochemical, Elemental analysis, Antimicrobial activity and Geographical regions.

INTRODUCTION

The genus *Pterocarpus osun* (Fabaceae) also referred to as camwood are found generally in many tropical areas of the globe particularly Africa and Asia where they are used for the management of a wide range of ailments¹. The powdered stem prevents infections of the freshly severed umbilical cord. It has been used to treat rheumatism, eczema, gonorrhoea, candidiasis and acne². The stem is an ingredient of traditional medicines against sickle-cell disorder and amenorrhoea^{3,4}. The dry leaf is also an ingredient of traditional black soap that is based on ash of burnt cocoa pods and palm oil while the heartwood, bark and roots are pounded into a paste and used as skin cosmetic⁴. The antioxidant activity and depigmenting effect have been reported⁴. Studies confirmed the wood contained red pigments of the santarubin and santalin that can be utilized as histological stains^{4,5}. The proximate and vitamin content have been previously been reported⁶. Study had also been carried to determine the hematological changes associated with accidental intake of the dye^{7,8}. The antimicrobial activities of pterocarpus species have been well documented⁹⁻¹¹. This species are also known to be of agricultural importance as they confer fertility on the soil via nitrogen fixing bacteria in their nodules¹². The inorganic mineral constituents which include phosphorus, calcium, magnesium, potassium, sodium, and nitrogen were previously reported¹³. The phytochemical screening of *Pterocarpus* species as previously reported revealed the presence of alkaloids, phenols tannins, saponins and flavonoids¹³. It is remarkable to state that *P. osun* stem extract form part of NICOSAN^R an herbal drug used to manage sickle-cell disease. This study re-evaluates the phytochemical, mineral composition and antimicrobial properties of the varieties of leaf extracts of *Pterocarpus osun* from the

tropical rain forest and Guinea savannah of Nigeria against some clinically isolated pathogens.

MATERIALS AND METHODS

General

All solvents and reagents used were of standard grade and the solvents were redistilled before use. The medium used in the antimicrobial screening was the Mueller Hinton agar, using the agar well disc method against the following organisms: *Escherichia coli*, *Proteus mirabilis*, *Klebsciella pneumonia* *Staphylococcus aureus* and *Pseudomonas aeriginosa*. All the clinical isolates were obtained from the microbiology laboratory of the Biotechnology Advanced laboratory (SHESTCO), Abuja, Nigeria.

Collection of plants

The plant namely *Pterocarpus osun* were collected at SHESTCO compound in Sheda Abuja and from Iyere- Owo, in Owo LGA of Ondo State Nigeria. The samples were labeled SH1 (Sheda fresh leaf), SH2 (Sheda fallen leaf) and SH3 (Owo fresh leaf). The samples were thereafter subjected to drying under shade for 14 days. The leaves were separated into three different types (SH1, SH2 and SH3.) This dried plant was blended into powder using a grinder.

Preparation of plant extracts

150 g of each powdered sample was extracted using Soxhlet apparatus. The powdered sample was uniformly packed into a thimble and extracted with ethanol, extraction continues for 7 hours, the resulting extracts solutions were concentrated with the aid of a Stuart rotary evaporator and extract obtained were dried and kept in a refrigerator.

Fresh leaf of *P.osun*Dry leaf of *P.osun*

Phytochemical screening

The crude extracts were screened for the presence of bioactive compounds using standard procedure^{14,15}.

Biological screening of extractives

The crude extracts were screened for microbial activity using a standard procedure¹⁶. The sensitivity was determined.

AAS analysis of extract

The metal analysis was determined using standard method¹⁷. The samples were analyzed using iCE 3000 AA02134104v1.30 atomic absorption spectrometer using the lamps for Fe, Ca, Zn, Ni, Pb, Cr, Cd and Mn.

RESULTS AND DISCUSSION

The yields of the three extracts with starting materials of 150g for each sample were as follow SH1 (27.42g), SH2 (24.33g) and SH3 (30.57g). These yields translate to 18.3%, 16.2%, and 20.4% respectively.

Phytochemical screening of the crude ethanolic extracts of the leaf *pterocarpus.osun* revealed the presence of phenol, saponnins, tannins, cardiac glycosides, sterols and terpenes. Phytochemical screening of the crude ethanolic extracts of the leaf *pterocarpus osun* revealed the presence of phenol, saponnins, tannins, cardiac glycosides, sterols and terpenes.

The results of antimicrobial screening of the three extracts (Table 1) revealed that the plant has reasonable activity against the tested organisms. SH1, SH2 and SH3 indicated inhibitory effects against *E.coli*, *P.mirabilis*, SH1 showed activity against *P.aeriginosa* and *K.pneumonia* at higher concentration. SH2 and SH3 were less potent at lower concentration. Previous screening on the crude ethanol extract on *Pterocarpus osun leaf* revealed it possessed antimicrobial activities¹⁸. The elemental analysis (Table2) revealed presence of magnesium,(Mg) chromium, (Cr) nickel,(Ni) zinc,(Zn) sodium, (Na)potassium, (K) were present in all the plant samples at different concentration

however there are significant variation between SH1 (Sheda fresh leaf), SH2 (Sheda fallen leaf) and SH3 (Owo fresh leaf); Ca 7.077/2.612 mg/ml, Zn 0.030/0.050 mg/ml while there minimal variation in (Na, K, Cr, Mg, Mn, Ni and Zn). The lower concentration of zinc and copper in SH1 and SH3 is an indication of little or non-toxic in the plant as heavy metals known to cause cancer, liver and kidney problems¹⁹. The elements Mg, Ca, Cu and Mn are used extensively in chemotherapy and are essential in human and animal health. Magnesium and calcium are known to help in bone and teeth development²⁰ Co and Pb were not detected in all the three types but Cd was only detected in trace amount in SH3.

CONCLUSION

This study has investigated the bioactivities of *P. osun* extracts towards drug resistant and clinically significant micro-organisms and the results showed significant activities against some of the tested organisms and the fallen leaf extracts was more active than the fresh. Phytochemical screening, and elemental analysis have revealed the presence of elements and compounds that are well known to possess beneficial bioactivities. Thus, the leaf of *P. osun* can be harnessed for medicinal and agricultural purposes.

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Table 1: The susceptibility screening of different types of ethanol extract of *Pterocarpus osun* against tested micro-organisms

Organisms	SH1			SH2		
	2.00	1 .00	0.5	2.00	1 .00	0.5
<i>E.coli</i>	12.00±0.25	10.05 ±0.50	-	14.01±0.10	11.00 ±0.50	-
<i>S.aureus</i>	9.00±0.64	11.00 ±0.10	-	8.00±0.10	-	-
<i>P.aeriginosa</i>	11.00±0.11	9.00 ±0.50	-	9.05±0.00	-	-
<i>P.mirabilis</i>	12.00±0.33	11.05±0.00	8.00±0.10	14.00±0.50	12.00±0.22	-
<i>k.pneumonia</i>	9.00±0.02	7.00±0.10	-	7.00±0.25	-	-
Organisms	SH3			CHP		
	2.00	1 .00	0.5			
<i>E.coli</i>	12.05 ±0.02	10.05 ±0.50	-	22.00		
<i>S.aureus</i>	-	-	-	21.05		
<i>P.aeriginosa</i>	11.00±0.02	9.00 ±0.50	-	22.00		
<i>P.mirabilis</i>	12.00±0.50	11.05±0.10	8.00±0.02	23.00		
<i>k.pneumonia</i>	9.00± 0.10	7.00±0.10	-	22.00		

SH1 (Sheda air-dried leaf), **SH2** (Sheda sun-dried leaf) and **SH3** (Owo air -dried leaf) **CHP**, **Chloraphenicol**

Table 2: Elemental analysis of the plant samples

Metals	SH1(ppm)	SH2 (ppm)	SH3 (ppm)
Ca	7.077	7.094	2.612
Cd	BDL	BDL	0.002
Co	BDL	BDL	BDL
Cr	0.023	0.012	0.024
Cu	0.001	0.830	0.030
Mg	1.440	1.434	1.384
Mn	0.180	0.241	0.074
Ni	0.025	0.211	0.030
Pb	BDL	BDL	BDL
Zn	0.030	0.028	0.050
Na	0.022	0.0037	0.0075
K	0.0015	0.0019	0.0044