COMPARATIVE ANALYSIS OF MEMBRANE STABILIZATION, ANTIOXIDANT, ANTI-SICKLING, AND ANTI-ANEMIC PROPERTIES OF VARIOUS PARTS FROM FIVE NIGERIAN MEDICINAL PLANTS

Hareg Zewdu ALEHEGN
PAU-UI-0753

MEDICINAL PLANTS RESEARCH AND DRUG DEVELOPMENT

Sickle cell disease (SCD) is a non-infectious and chronic congenital blood disorder caused by a mutation in the gene that instructs the body to make haemoglobin (Hb). Because of this mutation, the body produces an abnormal type of Hb known as haemoglobin S (HbS). At times, when oxygen levels are low or the blood cells are exposed to stress, HbS molecules can cause the RBCs to become stiff and eventually assume the characteristic sickle shape seen in SCD The research aims to evaluate and compare the antioxidant, membrane stabilizing, anti-sickling, and anti-anaemic activities and cytotoxicity effects of different parts of five medicinal plants used to treat SCD in Nigeria; *Rhaphiostylis beninessis*, *Telfairia occidentalis*, *Justicia secunda*, *Justicia carnea*, and *Chromolaena odorata*. Leaves, stems, and roots of five medicinal plants collected in Ibadan and authenticated at the Forest Herbarium Ibadan (FHI) were used. Their 70% ethanol crude extracts were subjected to anti-sickling activity using confirmed human sickled blood cells through inhibition, reversal, and membrane stabilization assays. Anti-haemolytic activities of the two most active plants were further assessed in 42 PHZ-induced anaemic rats, and their phytochemical composition was characterized using LC-MS. Further fractionation of *J. secunda* was done, and the total phenolic and flavonoid contents were analysed. All anti-sickling assays and the animal study were done with ethical approval and with appropriate informed consent from SCD patients. The quantitative phytochemical analysis indicated that the phenolic content was highest in JCL (3.750±0.024) among the extracts tested. At 60th minutes of reading the highest reversal activity was observed for JCL, 78.9% at 20 mg/mL, while TOL showed the strongest inhibition effect, 82.2% at 20 mg/mL. JSR was the most active in the stabilization of sickle cell erythrocyte membranes with IC50=0.28±2.49. For PHZ-induced anaemia, the values of RBC and PCV were significantly reduced (*$p < 0.05$), but JSL (100 & 200 mg/kg) and JCL (100 & 200 mg/kg) treatments significantly restored (# $p < 0.05$) these parameters. In conclusion, the current study represents therapeutic capability and safety for five medicinal plants against SCD through their anti-sickling, anti-inflammatory, antioxidant, and cytotoxic properties. The finding therefore hints that such plants could be a good complementary approach to SCD and suggests their further bioactivity elucidation and mechanisms.

Key Words: Sickle Cell Disease, Anti-sickling Activity, Anemia, Anti-anemic Activity

ANTI-OXIDANT ACTIVITY AND *IN VIVO* ANTIHYPERTENSIVE ASSAY OF MEDICINAL PLANTS USED IN THE MANAGEMENT OF HYPERTENSION IN NIGERIA

Caleb Oluwatosin OPONE
PAU-UI-0754

MEDICINAL PLANTS RESEARCH AND DRUG DEVELOPMENT

Hypertension or elevated blood pressure is a major cardiovascular disease characterised by a persistent increase in arterial blood pressure. It occurs when the diastolic and/ or systolic blood pressures exceed 90 mmHg and 140 mmHg, respectively. This study aims to carry out an ethno-medicinal survey on medicinal plants used in the management of hypertension in two herbal markets in Ibadan, southwest, Nigeria and carry out biological activities on the selected plants from this survey. The ethno-medicinal study was conducted using semi-structured interviews, at Bode and Oje herbal markets, located in Ibadan Southwest LGA and Ibadan Northeast LGA, respectively. Seven (7) medicinal plants were selected from the 60 plants generated from the ethno-medicinal survey on the basis of literature review and fidelity level. Phytochemical screening was conducted on all the selected plants to determine the secondary metabolites that may be present. The extracts were subjected to *in vitro* antioxidant activity assays. Among the seven selected plants, *Tetrapleura tetraptera* extract was subjected to an *in vivo* rat model of antihypertensive assay in which salt water was used induce hypertension. Furthermore, neurobehavioral studies, urine analysis, oxidative stress analyses, and haematological studies were also carried out. The data were analysed using ANOVA at P value α 0.05. Following the ethno-medicinal survey, the most prominent among the plant families mentioned were the Apocynaceae and Fabaceae, with nine and six species, respectively. Phytochemical screening of the selected plants revealed the presence of secondary metabolites such as alkaloids, phenols, saponins, tannins, and flavonoids. Extracts of *T. tetraptera* and *P. americana* demonstrated high TPC and TFC of 270 ±0.12 mg GAE/ g and 220.7 ± 0.14 mg GAE/ g, & 1501.7± 0.05 mg QUE/ g and 1629.8 ± 0.06 mg QUE/ g, respectively. The NO assay showed that *P. americana* had the lowest IC_{50} of 53.20 ± 0.3. The crude extract of *T. tetraptera* also had the highest DPPH inhibitory activity (IC_{50} of 42.69 ± 3.56 µg/ mL). *Tetrapleura tetraptera* plant extract reduced blood pressure, with 100 mg/ kg and 200 mg/ kg having mean arterial pressure of 115.3 mmHg and 109.3 mmHg, respectively while, the untreated group had a high mean arterial pressure of 173.9 mmHg. Urinalysis assay revealed the presence of nitrites while ketones, glucose, ascorbic acid, bilirubin and urobilirubin were generally absent in the urine of all the rats. Neurobehavioural tests indicated that the plant extract enhances spatial learning, memory and motor functions at doses of 100 mg/ kg and 200 mg/ kg. *Tetrapleura tetraptera* extract exerted antioxidant activity and showed antihypertensive effects against salt-induced hypertensive rats, thus justifying its use ethnomedicinally in treating hypertension.

Key Words: Hypertension, Medicinal plants, Ethno-medicinal survey, Antioxidants, Antihypertensive

ANTIBACTERIAL, BIOFILM INHIBITORY, AND ANTIOXIDANT ACTIVITIES OF BIOACTIVE COMPOUNDS FROM BACTERIAL ENDOPHYTES AND FERMENTATION-BASED BIOTRANSFORMATION OF MEDICINAL PLANT EXTRACTS

Hissein Hassan MOUSSA
PAU-UI-0755

MEDICINAL PLANTS RESEARCH AND DRUG DEVELOPMENT (MPRDD)

The global research effort for new antibiotic substances and antioxidant agents has become vital. Endophytic bacteria are a solution source, producing secondary metabolites through their symbiotic relationship with plants. Medicinal plants such as *Aloe vera, Azadirachta indica, Zingiber officinale, Euphorbia hirta,* and *Carica papaya* are known to harbour endophytes with potential bioactivities. This study aimed to determine the antimicrobial, biofilm inhibitory, and antioxidant activities of bioactive compound(s) from bacterial endophytes isolated from these plants in southwest Nigeria. A total of 35 bacterial endophytes were isolated and identified via 16S rRNA sequencing. Five strains were selected for further study, and their secondary metabolites were produced and evaluated. Antibacterial activity and biofilm inhibition were assessed using broth-dilution and crystal violet methods, while antioxidant potential was determined using DPPH and ABTS assays. HR-MS/MS and LC-MS were used for metabolite profiling. All endophytic extracts showed antibacterial activity. *Serratia marcescens*-NB was the most active, with 79.82% and 75.41% inhibition against *Bacillus subtilis* and *Salmonella typhi* at 5 mg/mL, respectively. HR-MS/MS identified prodigiosin, serratamolid, and serranticin. In biofilm inhibition assays, *Bacillus thuringiensis*-S1-NB extract was most effective (89.41% and 87.53% inhibition against *Bacillus subtilis* and *Salmonella typhi* at 5 mg/mL). *Serratia marcescens*-NB2 showed the strongest antioxidant activity with DPPH IC50 of 741 µg/mL and ABTS IC50 of 492.4 µg/mL. Another aspect of this study was the biotransformation of plant extracts with *Lactobacillus plantarum* (L.P), since L.P was isolated from all five plants. Several fermented samples exhibited enhanced antibacterial and anti-biofilm activities. Fermented samples such as *Z. officinale* and *Euphorbia hirta* showed important chemical changes in their extracts under LC-MS analysis, underlining the formation of new active molecules. These findings highlight the potential of bacterial endophytes and fermentation-based biotransformation in drug discovery. Further studies are needed to isolate and characterise active compounds from the remaining strains and biotransformed products.

Key Words: Endophytic bacteria, Secondary metabolites, Bioactive compounds, HR-MS/MS, LC-MS, Fermentation, Biotransformation

ANTIMICROBIAL ACTIVITIES OF SELECTED BURUNDIAN AND NIGERIAN PLANTS AND ECO-FRIENDLY SYNTHESIS OF SILVER NANOPARTICLES

PHILBERT NZEYIMANA
PAU-UI-0756

MEDICINAL PLANTS RESEARCH AND DRUG DEVELOPMENT

Plants are widely used for healthcare. Africa, including Nigeria and Burundi have a large diversity of medicinal plants, not scientifically evaluated. *Thunbergia petersiana* Lindau, *Clerodendrum schweinfurthii* Gürke, *Acalypha psilostachya* Hochst. ex A. Rich., and *Berkheya spekeana* Oliv. are used for the management of various microbial infections in Burundi; and *Acalypha indica* L. and *Justicia secunda* Vahl are known in Nigeria for medicinal uses including antimicrobial applications. This study aimed to evaluate the antimicrobial properties of these plants against microorganisms implicated in skin infections, *Pseudomonas aeruginosa, Staphylococcus aureus*, *Candida albicans*, and *Trichophyton rubrum*; and synthesise silver nanoparticles (AgNPs) using their extracts. Agar well diffusion method was conducted to screen the plants, and the green synthesis of AgNPs was carried out with *C. schweinfurthii* and *T. petersiana* extracts owing to their higher antimicrobial potential. Antimicrobial activities of the AgNPs and crude extracts were assessed using broth dilution methods to determine the minimum inhibitory concentrations (MIC). The AgNPs were characterised by Ultraviolet-visible (UV–Vis) spectroscopy, Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy-energy dispersive X–ray spectroscopy (SEM/EDS), and zeta potential. The findings demonstrated the presence of various secondary metabolites, and all phytochemicals screened were present in *T. petersiana* extract. At 100 mg/mL, 50 mg/mL, and 25 mg/mL, *C. schweinfurthii* extract inhibited *S. aureus* with zones of inhibition of 19.66 ± 0.57 mm, 16.66 ± 0.57 mm, and 14.00 ± 0.47 mm, respectively; 18.66 ± 1.57 mm, 17.00 ± 1.00 mm, and 14.00 ± 1.00 mm against *C. albicans*; 16.66 ± 1.15 mm, 14.00 ± 1.00 mm, and 11.66 ± 0.57 mm against *T. rubrum*. *Thunbergia petersiana* extract displayed 17.00 ± 1.00 mm, 13.66 ± 1.52 mm, and 10.66 ± 0.57 mm against *S. aureus*; 19.66 ± 1.53 mm, 17.00 ± 1.73 mm, and 15.00 ± 1.73 mm against *C. albicans*, and 19.33 ± 0.57 mm, 17.33 ± 0.57 mm, and 15.00 ± 1.00 mm against *T. rubrum*. The zones of inhibition for *A. psilostachya* were lower compared to those two that were selected. *Berkheya spekeana* and *A. indica* inhibited fungal growth only. *Justicia secunda* did not inhibit any microbial growth. *Clerodendrum schweinfurthii* leaf extract exhibited MIC of 7.81 µg/mL against *S. aureus* and 250 µg/mL against *P. aeruginosa*, *C. albicans*, and *T. rubrum*; and the MIC for *C. schweinfurthii* leaf extract-mediated AgNPs (CS-L AgNPs) were 0.78 µg/mL against *S. aureus*, 3.12 µg/mL against *P. aeruginosa*, and 12.50 µg/mL against tested fungi. *Thunbergia petersiana* aerial parts extract displayed MIC of 250 µg/mL against tested organisms while, *T. petersiana* aerial parts extract-based AgNPs (TP-AP AgNPs) exhibited 12.5 µg/mL against bacteria, 25 µg/mL against *C. albicans*, and 0.78 µg/mL against *T. rubrum*. The average particle size of nanoparticles was 20.08 nm for CS-L AgNPs and 21.75 nm for TP-AP AgNPs. This study evidenced the uses of these plants to manage skin infections except *J. secunda*. It also gave insights into phytochemicals which could be responsible for these properties. The formation of AgNPs with the crude extracts and their antimicrobial assessment revealed their higher antimicrobial potential.

Key Words: Medicinal plants, Antimicrobial activity, Antimicrobial resistance, Eco-friendly synthesis, Extract-mediated silver nanoparticles

IN SILICO AND *IN VITRO* ANALYSIS OF CRUDE BIOACTIVE METABOLITES FROM ENDOPHYTIC FUNGI ISOLATED FROM *CATHARANTHUS ROSEUS* FOR ANTICANCER APPLICATIONS

Everlyne Osir OWIRO
PAU-UI-0758

MEDICINAL PLANTS RESEARCH AND DRUG DEVELOPMENT

Although there is great progress in the treatment of cancer, the demand for new anticancer agents still exists. Endophytic fungi are important sources of bioactive metabolites in drug discovery. However, limited research has been done to evaluate the molecular basis of their anticancer potential. The objective of this study was to evaluate the anticancer activity of crude bioactive metabolites of fungal endophytes isolated from *Catharanthus roseus* (L.) G. Don, obtained from KEMRI, Kirinyaga site, Kenya. A total of eight fungal isolates (CR1–CR8) were successfully cultured and were subjected to molecular characterization using ITS rDNA sequencing which characterized as belonging to the genus *Alternaria*. They demonstrated promising anticancer activity in vitro using human cancer cell lines, including 4T1 (breast), DU145 (prostate), and HeLa (cervical) cell lines, which showed selective cytotoxic effects of fungal ethyl acetate and methanol extracts. The EtOAc extract of CR 5 isolate was the most cytotoxic towards the 4T1 cell line (IC50 = 21.757 µg/mL, Selectivity Index = 29.431).
Fungal crude extracts were analysed using gas chromatography-mass spectrometry (GC-MS) and were screened according to oral bioavailability (OB) and drug-likeness (DL). A total of 86 compounds of *C. roseus*-fungal extracts were identified and 72 active components were screened. Network pharmacology analysis on the active components identified 1140, 1139 and 1141 potential targets associated with prostate, breast and cervical cancers respectively. After protein-protein interaction (PPI) network topology analysis, 10 key protein targets, including TP53, AKT1, STAT3, EGFR, ESR1, IL6, IL1β, TNF, SRC, and GAPDH, were screened. The molecular docking results showed that the active components of fungal crude extracts had good binding activity with key targets. GO and KEGG analysis of candidate targets found that the main enrichment was in PI3K/Akt-mediated intrinsic apoptotic pathways. Finally, according to the results of network pharmacology, the potential molecular mechanism of fungal crude extracts intervention in the three cancers was validated experimentally in vitro. The experimental validation results demonstrated that the antitumor activity of fungal crude extracts may be related to inhibiting the PI3K-Akt signalling pathway and activating the mitochondrial-mediated apoptosis pathway.
In conclusion, the results highlight the promise of endophytic fungi as a sustainable source of anticancer agents. However, subsequent studies should concentrate on purification and structural elucidation of bioactive metabolites, optimization of fungal culture settings to maximize metabolite yield, and in vivo studies to reconfirm their therapeutic efficacy.

Key Words: Fungal endophytes, cancer, cytotoxicity, *In Silico, network pharmacology*

COMPARATIVE METABOLOMICS AND THE BIOACTIVE POTENTIAL OF *Euphorbia hirta* L. and *Euphorbia tirucalli* L. FROM NIGERIA AND COMOROS ISLANDS USING NETWORK PHARMACOLOGY

Aminati BACAR
PAU-UI-0759

MEDICINAL PLANTS RESEARCH AND DRUG DEVELOPMENT

Medicinal plants are significant sources of lead identification due to the extensive diversity of their bioactive metabolites. Comparative metabolomics and biological activities of Nigeria and Comoros *Euphorbia hirta* and *Euphorbia tirucalli*, traditionally employed in African medicine, were investigated in the present study. Metabolite profiling to identify their potential against diabetes, obesity, and COVID-19 was carried out using *in vitro* enzyme assays and network pharmacology. Ultra-high-performance liquid chromatography-tandem mass spectrometry (UHPLC-MS/MS) profiled plant metabolites. Compounds were identified using spectral libraries (GNPS, MoNA, MassBank Europe). *In vitro* inhibitory tests on alpha-glucosidase, alpha-amylase, and lipase were conducted. Network pharmacology predicted molecular targets, constructed PPI networks, and analyzed biological pathways. Results showed significant phytochemical variation among samples. Terpenoids, phenolics, and flavonoids were the major classes found. Comoros *E. hirta* showed stronger alpha-glucosidase (IC_{50}= 20.93 µg/mL) and lipase inhibition, while Nigerian *E. hirta* showed stronger alpha-amylase inhibition (IC_{50}= 95.73 µg/mL). Similarly, Nigerian *E. tirucalli* showed stronger lipase activity than the Comoros counterpart. Antioxidant activity, measured through DPPH assay, was greater in Comoros *E. hirta* (IC_{50}= 116.0 µg/mL). Total phenolic content (TPC) was more in Comoros samples, while total flavonoid content (TFC) was greater in Nigerian samples. Network pharmacology revealed IL-6, IL-1β, and AKT1 as major targets participating in metabolic and inflammatory pathways. These results scientifically prove the long-standing utilization of Euphorbia species and highlight their pharmacological potential. The combination of metabolomics and network pharmacology offers a strong platform for bioactive molecule discovery and mechanism of action elucidation in the treatment of metabolic and infectious diseases

Key Words: Diabetes, Obesity, COVID-19, Metabolomics, Network pharmacology, Cytokine storm, Geographical variations, *Euphorbia hirta* L., Euphorbia *tirucalli* L.

CHEMICAL PROFILING, ANTIMICROBIAL AND ANTIOXIDANT ACTIVITIES OF *Vernonia conferta* Sch.Bip. ex Baker AND *Vernonia nestor* S. Moore (ASTERACEAE)

ALHAGIE DRAMMEH
PAU-UI-0760

MEDICINAL PLANTS RESEARCH AND DRUG DEVELOPMENT

Medicinal plants have long been recognized for their therapeutic potential, offering a rich source of bioactive compounds with antioxidant and antimicrobial properties. *Vernonia conferta* and *Vernonia nestor* are two species with promising medicinal applications, yet their chemical composition and biological activities remain largely unexplored. This study explores the phytochemical composition, antioxidant properties, and antimicrobial activities of *Vernonia conferta* and *Vernonia nestor* extracts. Plant extracts were obtained using cold maceration with solvents including *n*-hexane (HEX), dichloromethane (DCM), ethyl acetate (EA), and methanol (ME) over a 72 h. Phytochemical screening was performed through color reactions (qualitative) and spectrophotometry (quantitative) to determine the presence of bioactive compounds. Antimicrobial activity was assessed using susceptibility tests, while antioxidant potential was evaluated through DPPH, TAC, and H_2O_2 radical scavenging assays. Additionally, chemical profiling was conducted using GC-MS and LC-MS to identify key bioactive compounds. Phytochemical screening confirmed the presence of flavonoids, tannins, and saponins in both species. Quantitative analysis revealed that *V. conferta* ME extract exhibited the highest levels of total phenolics (824.23 mg/g), flavonoids (899.08 mg/g), and tannins (676.09 mg/g). *Vernonia nestor* EA extract contained significant amounts of phenolics (593.00 mg/g), flavonoids (362.59 mg/g), and tannins (491.05 mg/g). Antimicrobial susceptibility tests showed that *V. conferta* ethyl acetate extract had a strong inhibitory effect on MRSA (26.0 mm, MIC = 1.25 µg/mL*),* while *V. nestor* ethyl acetate extract exhibited potent activity against *Streptococcus pyogenes (*27.5 mm, MIC = 1.25 µg/mL*).* Antioxidant assays confirmed the strong radical scavenging ability of *V. conferta* ME extract, with the lowest IC50 (16.53 µg/mL) on DPPH, correlating with its high phytochemical content. Chemical profiling using GC-MS identified ethylbenzene (0.65%) and limonene (0.79%) in *V. conferta* EA, while *n*-hexadecanoic acid (1.63%) and 9,12-octadecadienoic acid (1.73%) were present in *V. nestor* EA extract. LC-MS analysis revealed rutin, scopoletin, and apigenin-7-O-glucoside in *V. conferta* methanol extract, and 2-nitrofuran, corticosterone, quercetin-3-galactoside, and quercitrin in V. nestor methanol extract, compounds known for their antioxidant and antimicrobial properties. The findings highlight V. conferta and *V. nestor* as rich sources of bioactive compounds with significant antimicrobial and antioxidant activities. These results support the potential pharmaceutical applications of these species. Further research is recommended to isolate and characterize the bioactive compounds to fully explore their therapeutic potential.

Key Word: Phytochemicals, Antioxidants, Antimicrobial, Bioactive compounds, *Vernonia conferta*, *Vernonia nestor.*

IN-VITRO ANTI-INFLAMMATORY AND ANTIOXIDANT ACTIVITIES OF *Delonix regia* (Bojer Ex Hook.) Raf. AND *Chasmanthera dependens* Hochst. LEAVES AND STEMS.

Precious Aderiyike ADEKANYE
PAU-UI-0761

MEDICINAL PLANTS RESEARCH AND DRUG DEVELOPMENT

Inflammation and oxidative stress are closely connected and play crucial roles in the development of several diseases, such as cardiovascular diseases, cancer, diabetes, and neurodegenerative disorders. *Chasmanthera dependens* Hochst. (Menispermaceae) and *Delonix regia* (Bojer ex Hook.) Raf. (Fabaceae) have been used traditionally in the treatment of inflammation and other health problems. This study evaluated the *in- vitro* anti-inflammatory and antioxidant potentials of extracts and fractions of *C. dependens* and *D. regia*. The dried and pulverized leaf and stem samples of the plants were extracted via maceration with methanol at room temperature. Fractionation of the crude extracts with *n*-hexane, ethyl acetate and methanol was carried out via vacuum liquid chromatography (VLC). The plant extracts were screened for the presence of secondary metabolites using standard methods. The anti-inflammatory activity was determined via a membrane stabilizing assay. The antioxidant activity was determined via DPPH, total phenolic content (TPC), ferric ion reducing antioxidant power (FRAP) and total antioxidant capacity (TAC) assays. FT-IR was used to identify the functional groups in the crude extracts. GC–MS was used to analyse the compounds in the active fractions. Phytochemical screening of the crude extracts and fractions revealed the presence of saponins, tannins, flavonoids, cardiac glycosides, terpenoids, steroids, alkaloids and phenols. The methanol extract of *C. dependens* stem exhibited a significantly higher membrane stabilizing activity (51.00%) than its leaf extract (40.83%) and the standard drug, Indomethacin (41.46%) at the highest concentration. *Delonix regia* leaf extract also had greater membrane stabilizing activity (47.77%) than did the stem extract (40.46%) and the standard drug, Indomethacin (41. 46%). The ethyl acetate fractions of *C. dependens* leaf and *D. regia* stem extracts had greater membrane stabilizing activity compared to the *n*-hexane and methanol fractions, the. The DPPH, TPC, and TAC contents and reducing power ability were concentration dependent. Like the *D. regia* methanolic stem extract, the *C. dependens* methanolic leaf extract presented a relatively high antioxidant capacity. In the FT-IR analysis, functional groups such as alcohols, amines, alkanes, aromatic compounds, nitro compounds, and alkyl and aryl halides were identified and found to be common across all the extracts. GC–MS analysis of the *n*-hexane fractions of *C. dependens* leaf and *D. regia* stem extracts yielded 16 compounds. The study revealed that *Chasmanthera dependens* Hochst. and *Delonix regia* (Bojer ex Hook.) Raf. leaves and stems possess appreciable anti-inflammatory and antioxidant properties, which may be due to the wide range of phytochemicals present in them. Further research can be carried out on the toxicological aspects, as well as the isolation, identification and characterization of the pure bioactive compounds.

Key Words: *Chasmanthera dependens, Delonix regia,* Anti-inflammatory, Antioxidant, Membrane stabilization.