https://dx.doi.org/10.4314/dujopas.v10i3c.5
ISSN (Print): 2476-8316
ISSN (Online): 2635-3490
Dutse Journal of Pure and Applied Sciences (DUJOPAS), *Vol. 10 No. 3c September 2024*

Comparative Phytochemical Profiling and Antioxidant Activity of Ethanol Extracts of three parts of *Dracaena arborea* (Willd.) Link

[1*]Uwemedimo Francis Umoh, [1]Nsima Akpan Andy, [2] Mathias N. Igwe, [3]Ekikere Ezekiel Ubengama, [1]Ogechi Innocentia Obasi, [1]Idaraobong Ekanem Usen,

[1]Department of Pharmacognosy and Natural Medicine,
Faculty of Pharmacy,
University of Uyo,
Uyo, Akwa Ibom State,
Nigeria.

[2]Department of Pharmacognosy,
Faculty of Pharmacy,
Madonna University,
Elele, Rivers State,
Nigeria.
[3]Department of Pharmacognosy,
Faculty of Pharmacy,
University of Calabar,
Calabar, Cross River State,
Nigeria.

Email: uwemedimoumoh@uniuyo.edu.ng

Abstract

Dracaena arborea is a known boundary plant which grows in arid semi-desert areas and used by the indigenous people of Akwa Ibom State, Nigeria, for the management of edematous diseases that come with pain. The ethanol extracts of D. arborea were analyzed to study their secondary metabolites. Antioxidant effect was studied using 2,2–diphenyl-1-picrylhydrazyl (DPPH) assay, ferric reducing antioxidant power (FRAP) assay and their total phenolic and flavonoid contents also determined. Result of phytochemical analysis revealed the presence of flavonoids, cardiac glycosides, saponins and tannins in the studied parts of D. arborea except that, stem was devoid of flavonoids. Also, the result of DPPH assay revealed the percentage inhibition of 58% for the leaf extract, 33% for the stem extract and 17% for the root extract at 100 µg/mL when compared with the blank and the result was comparable to ascorbic acid with a percentage inhibition of 62%. For the FRAP assay, the leaf extract (0.445 nm) showed a better activity than the stem extract (0.399 nm) and root extract (0.427nm) when compared to ascorbic acid (0.913nm), a standard antioxidant agent at 100 µg/mL. Extracts revealed total flavonoid contents of 52 mgRTE/g for leaf extract while the stem and root had 5 mgRTE/g and 50 mgRTE/g, respectively. This study supports the use of these parts of D. arborea for its folkloric applications in ethnomedicine.

Keywords: *Dracaena arborea*, Asparagaceae, Phytochemical profiling, Antioxidants

Author for Correspondence

INTRODUCTION

The importance of plants as medicines in health care management in most localities cannot be down played in that, vast proportion of them rely on their materials for numerous benefits and also, plants are known for their nutritional, medicinal and magical values (Abbink, 1995). The genus, *Dracaena* (Asparagaceae) contains about 120 species of trees and succulent shrubs in Nigeria (Illodibia *et al*., 2015).

In Nigeria, various parts of *D. arborea* are reported for treatment of infections of the skin, stomach and teeth. The plant leaves are also employed locally to manage hypertension, stroke and body pains. The leaves used with palm nut soap and with ferns, *Naphrolepsis biserrate* and *Dissotis multiflora* is used to energized pregnant women during child birth in Ghana (Fabricant and Farnsworth, 2001; Fang *et al*., 2002; Etukudo, 2003).

Ethnomedicinal and research data evidently reported *D. arborea* various parts to inhibit the growth of bacteria and fungi, stop nausea and vomiting, treat cutaneous and subcutaneous parasitic infections, reduce oedema and gout, treat oral complaints, expel worms, treat lung problems, reduce pain, improve diabetic condition, enhance fertility and sexual functions, and used as an arrow-poison (Sofowora, 1993, Halliwell *et al*., 1995; Nakatani, 2003; Watcho *et al*., 2007; Tambi and Imran, 2010; Hamid *et al*., 2010; Ekere *et al*., 2013; Okonkwo and Egeolu, 2014; Watcho *et al*., 2014; Ogunmodede *et al*., 2014; Umoh *et al*., 2020 Hikmawanti *et al*., 2021). In separate studies, the leaf and root have been reported to possess antioxidative property (Illodibia *et al*., 2015; Petnga *et al*., 2021).

Oral information from Traditional Medicine Practitioners of Ibibios of Akwa Ibom State, Nigeria has it that, even though *D. arborea* is a boundary plant for demarcation, the various parts are used for management of many diseases. No reported study comparing the antioxidant potentials of the parts of *D. arborea* thus, this study aimed at comparing the ability of the leaf, stem and root of *D. arborea* in eliciting antioxidant effect, establishing the most active parts and identifying the phytochemicals present to support its various uses in Akwa Ibom State ethnomedicine.

METHODOLOGY

Collection of Plant Materials

The plant, *D. arborea* was collected from the botanical garden managed by the Department of Pharmacognosy and Natural Medicine, University of Uyo and authentication done by Prof (Mrs.) M. Bassey, a taxanomist and a voucher specimen (UUPHB 30(I)) kept in departmental herbarium.

Preparation and Extraction of Materials

Various plant parts were separated, rinsed with water, garbled, dried and reduced to small sizes using hammer mill. These pulverized plant materials were cold macerated with aqueous ethanol (70%) for 3 days, agitated at intervals and filtered. The filtrate was concentrated by the aid of a rotary evaporator and the extracts stored in a refrigerator for the experiments.

Phytochemical Screening

The extracts were screened for the presence of phytochemicals according to standard procedures with slight modifications (Sofowora, 2003).

Antioxidant Evaluation of the Leaf, Stem and Root of *D. arborea*

DPPH Assay

The procedure adopted was similar to the one described by Shekhar and Anju (2014) and repeated three times. Dilutions of the extracts and ascorbic acid were prepared in methanol at concentrations range of 20 µg/mL-100 µg/mL. This was followed by the addition of 1 millilitre of 0.1mM of DPPH solution in methanol to the dilutions (3 mL), stirred for a minute and left in a dark compartment for 30 minutes. The absorbance (As) with a spectrophotometer at 517nm wavelength were recorded and data expressed as mean values ± standard error of mean. Lower absorption values were taken as good antioxidant property and lower absorbance of the reaction mixture showed higher free radical activity. Percentage DPPH scavenging ability was calculated by the equation below;

$$\% \text{ scavenging} = \frac{\text{Absorbance of Control} - \text{Absorbance of sample}}{\text{Absorbance of Control}} \times 100$$

FRAP Assay

In this study, the method of Oyaizu (1986) was used and repeated thrice. Here, the extracts of *D. arborea* and ascorbic acid were diluted to various concentrations (20 µg – 100 µg/mL). This was followed by addition of 1mL of 200 mM of Sodium phosphate buffer (PH 6.6) and 1mL of 1% potassium ferric cyanide to 1 mL volume of the various concentrations of the preparations and shaken before incubation at 50^{o}C for 20 minutes. After incubation, 1mL of 10% trichloroacetic acid (TCA) was added, mixed and centrifugation process activated at 650 rpm for 600 seconds. The resultant mixtures were further mixed with distilled water (4 mL) and 0.8 mL of 0.1% of ferric chloride (0.0%) and absorbance at 700 nm taken (Vijayalakshmi and Ruckmani, 2016). Data were expressed as mean values ± standard error of mean.

Determination of Total Phenolic Contents

The study employed Folin-ciocalteu reagent. Extracts (0.5 mL) were mixed with 10% Folin-ciocalteu reagent (2.5 mL), 2 mL of 7% of sodium bicarbonate (2 mL), vortexed for 15 seconds and incubated at 40^{o}C for 30 minutes. The absorbance of the mixtures were taken at 765 nm using UV-spectrophotometer. For accuracy, the experiments were done in triplicates. The same procedure was carried out for gallic acid at different concentrations for plotting of calibration curve and data expressed in microgram of gallic acid equivalent (mg GAE/g extract (Gey *et al*., 1991; Cheeseman, 1993)

Determination of Total Flavonoid Contents

In this study, 1mL of the plant extracts and distilled water (200 µL) were shaken lightly. Five percent (5%) of sodium nitrate solution (150 µL) was added, incubated for another 5 minutes and 150 µL of aluminium chloride (1%) solution added and further incubated for 6 minutes. 2mL of sodium hydroxide (4%) solution again added and scaled up to 5 mL with distilled water, shaken properly and given 15 minutes for equilibration with room temperature. Absorbance was taken at a wavelength of 510 nm and experiment repeated in triplicates. The procedure was repeated using different concentrations of rutin (20 µg – 100 µg) and the calibration curve plotted. Total flavonoid contents were calculated and recorded in microgram of rutin equivalent (mg RE/g) extract on a dry weight from the standard curve (Esmaelli *et al*., 2015).

RESULTS AND DISCUSSION

Results

The phytochemical screening result of the ethanol extracts represented in Table 1, revealed that the extracts of *D. arborea* contained tannins, saponins, flavonoids and cardiac glycosides in three parts of the plant and devoid of alkaloid and anthraquinone.

Table I: Phytochemical constituents of extracts

Metabolites	Test	Leaf	Stem	Root
Alkaloid	Dragendorff (Brick red precipitate)	-	-	-
Tannin	Ferric Chloride (Dark black colouration)	++	++	+
Saponins	Frothing (Froths10 mins)	+	++	+++
Flavonoid	Magnesium metal (Reddish colour)	+++	-	++
Cardiac glycoside	Salkowski (Reddish brown colour)	+	+	+
	Lieberman	-	+	+
	Keller Killiani (bluish colour)	+	+	-
Anthraquinone	Combined anthraquinone (Reddish colour) -	-	-	

Keys: - = absence, += present in trace amount, ++= moderately present and +++= abundantly present

Result of DPPH radical scavenging assay (Figure 1) revealed that at 100 µg/mL, the leaf extract had a percentage inhibition of 58% followed by the stem with a percentage inhibition of 34% and finally the root with a percentage inhibition of 17%.

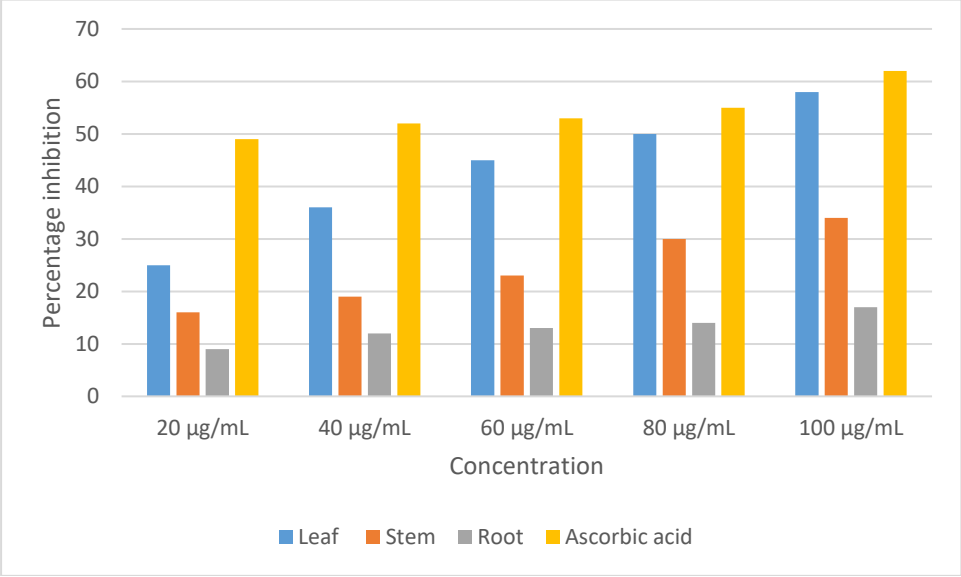

Figure 1: Result of DPPH assay of ethanol leaf, stem and root extracts of *D. arborea*

For the FRAP assay, the result as presented in Figure 2 showed that, the leaf had a better antioxidant activity when compared with the root and stem but not as much as the standard drug (ascorbic acid).

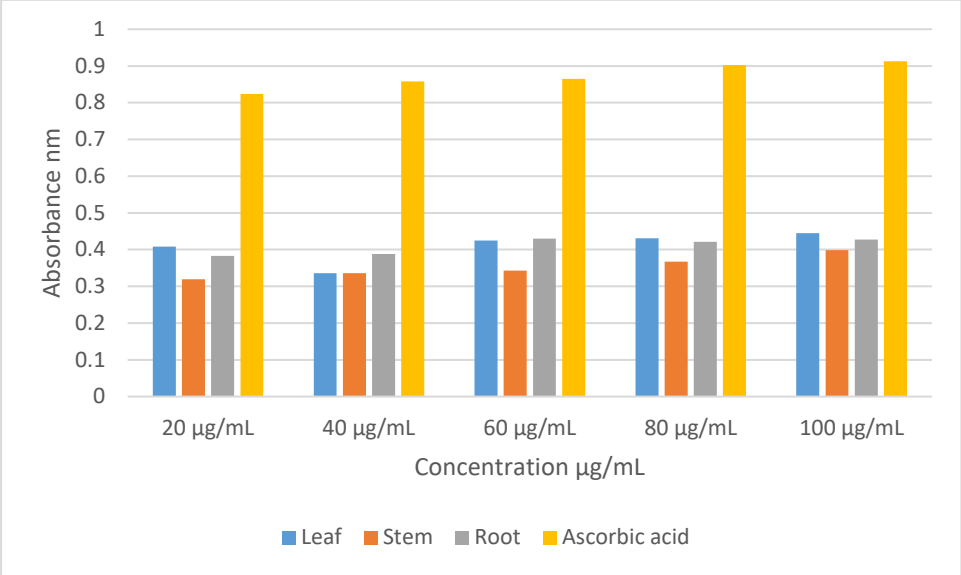

Figure 2: Result of FRAP activity of leaf, stem and root of *D. arborea*

The total phenolic content quantification of *D. arborea* extracts (Figure 4), garlic acid calibration curve for standardization (Figure 3), total flavonoid content (Figure 6) and rutin calibration curve (Figure 5) are represented below.

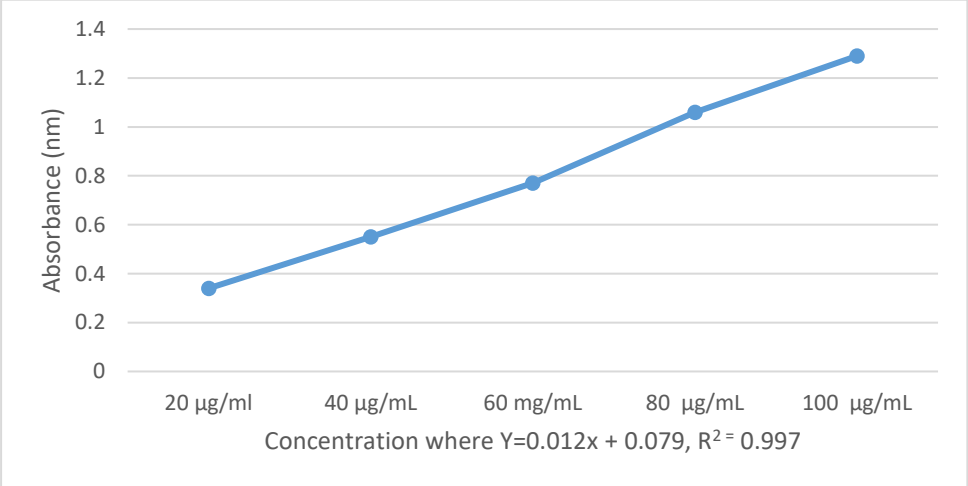

Figure 3: Garlic acid calibration curve for total phenolic content

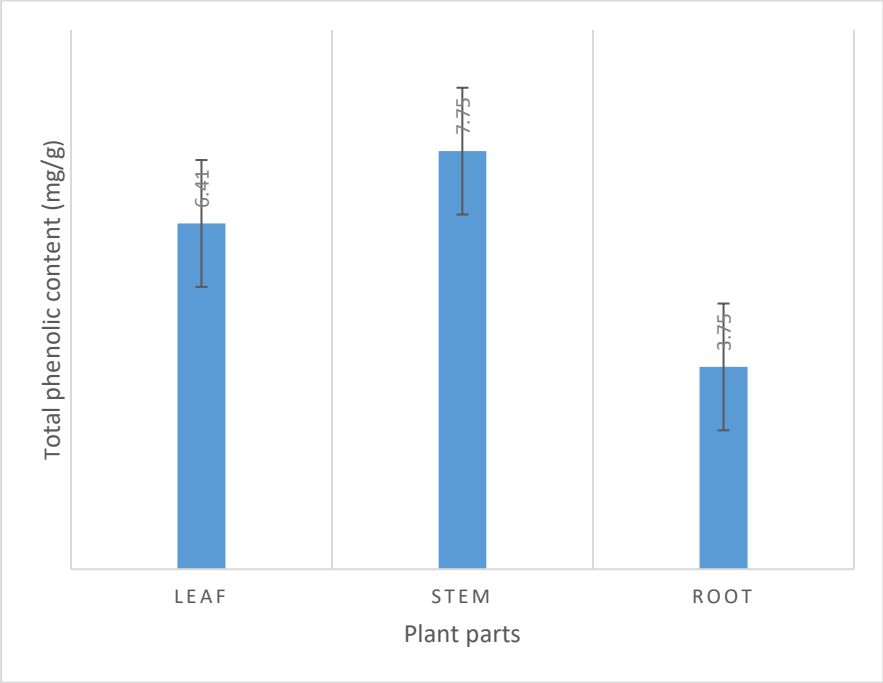

Figure 4: Total phenolic content with reference to garlic acid

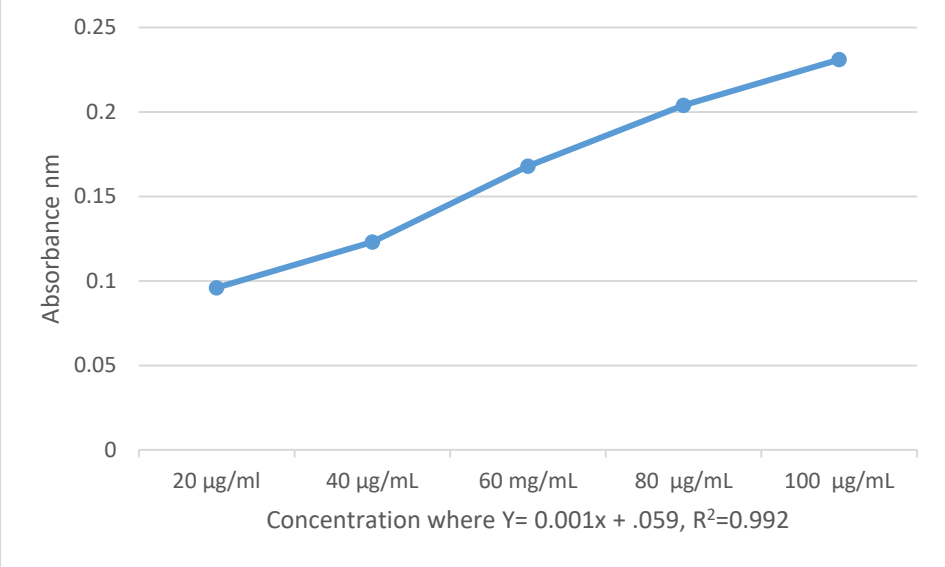

Figure 5: Rutin calibration curve for total flavonoid contents

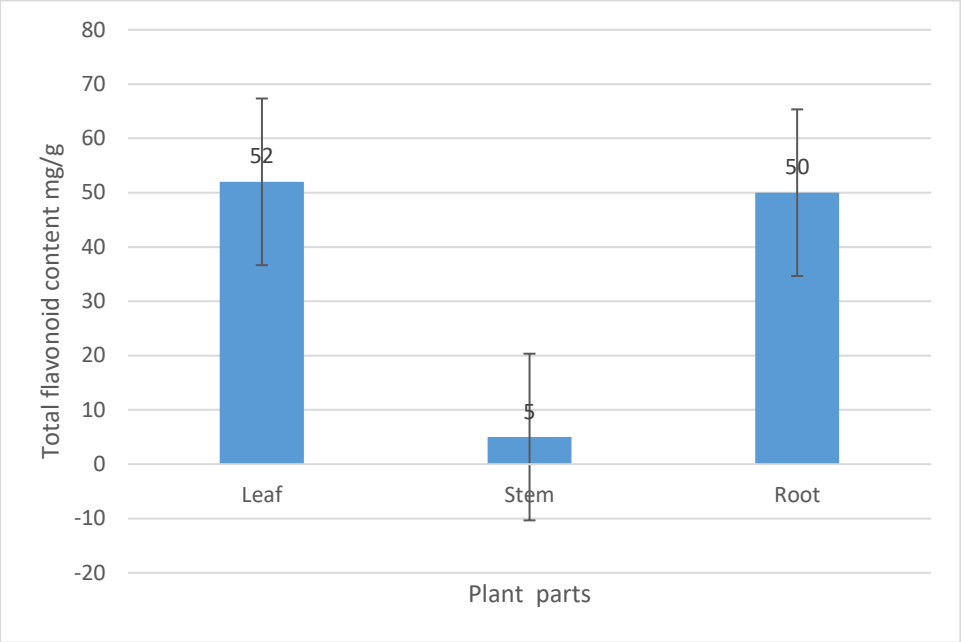

Figure 6: Total flavonoid contents with reference to rutin

DISCUSSION

Phytochemical screening result had it that the root and leaf gave positive results for tannins, saponins and flavonoids while stem gave a negative result for flavonoids and showed positive result for the presence of cardiac glycosides. Phytochemicals in plants are known to be the reason why plants are used as medicines and the ability of *D. arborea* involvement in folkloric practices for pain-related complaints by indigenous people of Akwa Ibom State, may be related to the presence of these classes of compounds (Zhang *et al*., 2022).

The result of DPPH assay showed that although the inhibition by leaf extract of *D. arborea* was close to that of a prototype antioxidant, ascorbic acid (62%) was more potent. The result also revealed that the leaf exhibited more free radical (DPPH) scavenging potential than the stem and root while the root was the least. DPPH, a stable oxidant absorbs at 517 nm and also loses this absorption when it accepts an electron leading to the formation of yellow colour from purple (Laughton *et al*., 1991).

The result of FRAP assay revealed that the leaf of *D. arborea* exhibited better antioxidant activity comparable to the other parts (stem and root) (Figure 2) but not as much as the standard drug and this collaborates with the DPPH model. The principle of FRAP assay is based on electron transfer where Fe^{3+} is reduced to Fe^{2+} thus forming a complex which resulted in the observed colour change (Laughton *et al*., 1991).

In the total phenolic content determination at 100 µg/mL, the result (Figure 4) showed that the stem had the highest value of 7.75 mgGAE/g, followed by the leaf (6.41 mgGAE/g) and then the root (3.75 mgGAE/g). For the total flavonoid content determination, the result (Figure 6) revealed the leaf with the highest value (52 mgRTE/g) which is in line with the DPPH and FRAP assay models. This confirms the phytochemical screening results that the root and leaf contained flavonoids but the stem was devoid of flavonoids. The phytochemical screening results also revealed that tannins were present all the three parts of *D. arborea* although it was more in the leaf and stem. The involvement of phenolics as stabilizers of lipids against peroxidation (Halliwell, 2007; Rahman *et al*., 2022), and the inhibition of various

types of oxidizing enzymes attest to the intrinsic ability of these extracts in demonstrating marked antioxidants effects.

CONCLUSION

The result obtained from this study revealed that *D. arborea* has potent antioxidant property with the leaf leading and followed by the stem. These findings correlate with an earlier study (Nwaeujor *et al*., 2013). This data validates the ethnomedicinal use of *D. arborea* in treatment of various ailments in Akwa Ibom State ethno medicine and also suggest that its curative effects could be related to the presence of phenolic components in them.

REFERENCES

Abbink, J. (1995). Medicinal and ritual plants of the Ethiopian South West: An account of recent research. *Indigenous Knowledge and Development Monitor*; 3(2): 6-8.

Boxin. O. U., Dejiantt, M. A. F., Elizabeth, K. D. (2002). Analysis of antioxidant activities of common vegetables employing oxygen radicals absorbance capacity (ORAC) and ferric reducing antioxidant power (FRAP) assays: a comparative study. *Journal of Agricultural Food Chemistry*; 5: 223–228.

Cheeseman, K. H., Sater, T. F. (1993). An Introduction to free radicals chemistry. *Brochure of Medical Bulletin*; 49: 481–493.

Ekere, S. O., Okoye, C. N., Udoumoh, A. F. (2013.) Fertility enhancing effects of methanolic leaf extract of Dracaena arborea in albino rats (*Rattus norvegicus*). *Czech Journal of Animal Science*; 11: 520–524.

Esmaelli, A., K, Taha, R. M., Mohajer, S., Taha, R.M. (2015) Antioxidant activity of total phenolic and flavonoid contents of various solvent extracts from *in vivo* and *in vitro* from *Trifolium pratense* L. (Red Clover). *Biomedical Research International*; 6(3285): 1 – 11.

Etukudo, I. (2003). Ethnobotany, Conventional and traditional use of plants, 1st Edition, The Verdict Press: Uyo, Nigeria. 191.

Fabricant, D.S., Farnsworth, N.R. (2001). The value of plants used in traditional medicine for drug discovery. *Environmental Health Perspective*; 109(1): 69-175.

Fang, Z., Yang, S., Wu, G. (2002). Free radicals, antioxidants and nutritives. *Journal of Nutrition*; 18(10): 872 -879.

Gey K. F., Puska, P., Jordon, P., Moser, U. K. (1991). Total antioxidant capacity of plant foods. Inverse correlation between plasma vitamin E and mortality from ischemic heart disease in cross-cultural epidemiology. *American Journal of Clinical Nutrition*; 1991; 53: 326–334.

Halliwell, B., Murcia, M. A., Chirico, S., Aruoma, O. I. (1995). Free radicals and antioxidants in food and what they do and how they work. *Critical Review of Food Science and Nutrition*; 35: 7–20.

Halliwell, B. (2007). Biochemistry of oxidative stress. *Journal of Biochemical Society Transactions*; 35(5): 1147-1150.

Hamid, A. A., Aiyelaagbe, O. O, Usman, L. A., Ameen, O. M., Lawal, A. (2010). Antioxidant: Its medicinal and pharmacological applications. *African Journal of Pure and Applied Chemistry*; 4(8): 142 – 151.

Illodibia, C, Ugwu R, Okeke C, Akachukwu, E., Aziagba, B., Okeke, N. (2015). Anatomical studies on two species of *Dracaena* in South Eastern Nigeria. *International Journal of Biological Research*; 3(1): 9-15.

Laughton, M. J., Evans, P. J., Moroney, M. A., Hoult, R. S., Halliwell, B. (1991). Inhibition of mammalian s-lipoxygenase and cyclo-oxygenase by flavonoids and phenolic dietary

additives. Relationship to antioxidant activity and to iron ion-reducing ability. *Biomedical Pharmacology*; 42(9): 1673 – 1681

Nakatani, N. (2003). Biologically functional Constituents of Spices and herbs. *Journal of Japan Society Nutrition Food Science*; 56: 389-395.

Nwaehujor, O. 1, Ode, J. O, Nwinyi, F. C, Madubuike, S. A. (2013). Anticoagulant and Antioxidant activities of *Dracaena arborea* Leaves (Wild.) Link. *American Journal of Biochemical Research*; 2013; 1(4): 86-92.

Ogunmodede, O. S., Oseni, S. O., Adenmosun, O. O., Tella, J. O. (2015). *Dracaena arborea* leaf extract: a phytothrapuetic option for ameliorating oxidative stress-mediated endocrine and testicular disorders in alloxan-induced diabetic rats. Journal of Coastal Life Medicine; 3(10): 809–814

Okonkwo C. O., Egeolu, V. C. (2014). Antihaemolytic potentials of the ethanolic leaf extract of *Dracaena arborea* on zidovudine–induced haemolysis in wistar albino rats. *International Journal of Science and Technolodge*; 2(6), 142-145

Oyiazu, M. (1986). Studies on products of browning reaction: antioxidative activity of products of browning reaction prepared from glucosamine. *Journal of Nutrition*; 44: 307-315

Petnga, Y. B. T. Momo, A. C. T., Wankeu-Nya, M., Alumeti, D. M., Fozin, G. R. B., Defo, P. B. D., Ngadjui, E., Watcho, P. (2021). Dracaena arborea (Dracaenaceae) increases sexual hormones and sperm parameters, lowers oxidative stress and ameliorates testicular architecture inrats with 3 weeks of experimental varicocele. *Evidence-Based Complimentary and Alternative Medicine*; 1378112: 1-12.

Rahman MM, Rahaman MS, Islam MR, Rahman, M.M., Mithi, F.M., Algahtani, T., Almikhlafi, M. A., Alghamdi, S. Q., Alruwaili, A. S., Hossain, M. S., Ahmed, M. S., Das, R., Emran, T. B., Uddin, M. S. (2022). Role of Phenolic Compounds in Human Disease: *Current Knowledge and Future Prospects. Molecules*; 27(1): 233.

Shekhar, C. T., Anju, G. (2014). Antioxidant activity of DPPH, radical scavenging method of *Ageratum conyzoides* Linn. leaves. American Journal of Ethnomedicine; 1(4): 244-249.

Sofowora, A. (1993). Medicinal plants and traditional medicine plant in Africa, 2nd Edition, Spectrum Books Ltd, Sunshine House: Ibadan, Nigeria; 199-203

Tambi, M. .I, Imran, M. K. (2010). *Eurycoma longifolia* (Jack) in managing Idiopatic male infertility. *Asian Journal of Androgenology*; 2(3): 376–380.

Umoh, U. F, Thomas, P. S, Okokon, J. E., Ajibesin, K. K. (2020) Comparative study on anti-inflammatory and analgesic effects of the leaf, stem and root of *Dracaena arborea* (Wild) Linn. (Asparagaceae). *Nigerian Journal of Pharmaceutical and Applied Science Research*; 9(2): 40-46.

Vijayalakshmi, M., Ruckmani, K. (2016). Ferric reducing antioxidant power assay in plant extract. *Bangladesh Journal of Pharmacology*; 11: 570-572.

Watcho P, Wankeu-Nya M, Nguelefack, T. B., Tapondjou, L., Taponno, R. B., Kamanyi. (2007). Pro-sexual effect of *Dracaena arborea* (Wild) Link (Dracaenaceae) in sexually experienced male rats. *Pharmacologyonline*; 1:1400 – 419.

Watcho, P., Modeste, W. N., Albert, K., Juarex, M. C. (2014). *Dracaena arborea* extracts delay the pro-ejaculatory effect of dopamine and oxytocin in spinal male rats. *International Journal of Impotence Research*; 6: 213–217.

Zhang, Y., Cai, P., Cheng, G., Zhang, Y. A brief review of phenolic compounds identified from plants: the extraction, analysis and biological activity. *Natural Product Communication*; 2022; 17(1); 1-14