Comparative HPLC, Elemental,andAntioxidant Assay of *Ipomoea aquatica* and *Telfairia occidentalis*.

Abstract

Some medicinal plants are known to possess antioxidant and nutritional properties. People living in the developing countries rely on the use of medicinal plants for treatment of several diseases. *Ipomoea aquatica* and *Telfairia occidentalis* have been reported to have several medicinal potentials, such as antioxidant activity. The aim was to determine and compare the antioxidant properties of the two medicinal plants, and to carry out elemental assay of the crude plants and phytochemical profiling of70% methanol extracts. The experiment involved collection, extraction, chemicaland elemental profiling andantioxidant assessment. The present study revealed the presence ofminerals such as K, Fe, Zn, Se, Cu, Mg, Na, Mn, Ca, Cr, B and P in these medicinal plants. The HPLC analysis showed the presence of bioactive componentsincluding flavonoids, tannins and alkaloids.The extractshad an IC_{50}of190 µg/ml and 226.67µg/ml for *Ipomoea aquatica* and *Telfairia occidentalis* respectively in comparison to the standard drug ascorbic acid (616.67µg/ml). These medicinal plants could be use as a nutraceutical.

Keywords; *Telfaira occidentalis*, *Ipomea aquatic*, polyphenols antioxidant, elemental analysis.

1. INTRODUCTION

Telfairia occidentalis Cucurbitaceae(Fluted pumpkin) is a nutraceutical commonly use by Nigerians as vegetable in preparations of delicacies and cuisines. The leaves are medicinal because of the rich sources of mineral and secondary metabolites which are beneficial to human health [1, 2]. The aqueous extract of *T. occidentalis* had been reported to reduce blood glucose

level; to possess antimicrobial, anti-inflammatory, antioxidant, and analgesic properties. Other studies that have been carried out on the plant include; anti-convulsant, antidiabetic, renal protection and anticancer effect [2, 3, 4, 5].

*Ipomoea aquatic*Forsk(Convolvulaceae). It is a herbaceous perennial plant and is known commonly as Chinese water spinach, kangkong, swamp cabbage, morning glory, water convolvulus [6]. The plant is characterized by its fast growth, spreading along the ground or water surface, and is found in Asia, Africa and Australia[7]. *Ipomoea aquatica* are used for the treatment of diabetes, anticancer and genoprotective potential, antioxidant, anxiolytic effect and reported to contain alkaloids, tannins, and steroids[6, 8, 9, 10, 11]. *Telfairia. occidentalis* and *I. aquatica*, serve both culinary and medicinal purposes in various localities within Bayelsa State, Unlike *T. occidentalis* that is cultivated, *I. aquatica* (Figure 1) is naturally found growing in the wild while *T. occidentalis* is widely embraced and utilized, *I. aquatic* is less recognized and is specifically used inOgbiaLocal Government Area, as vegetable[12, 13]. Thus, the need to determine the chemical profiling, elemental analysisand which of the plant possesses better antioxidant property in comparison to the standard drug.

Figure 1: showing *I. aquatica* and*T. occidentalis*in its natural habitat.

2. MATERIALS AND METHOD

2.1 Chemicals and Reagents

Methanol (JHD),1,1-Diphenyl-2 Picrylhydrazyl,

2.2 Equipment and Instrument

Rotary evaporator (Rotavap-Buchi R-200), Water bath (HH-420), Analytical balance (Ohaus Adventure Pro AV213),FS240AA Atomic Absorption Spectrophometer(Agilent), UV-Vis Spectrophotometry (Jenway), BUCK M950 HPLC.

2.3Collection and extraction of Plant materials

The tender shoots of *Ipomoea aquatica* and the leaves of *Telfairia occidentalis* were collected from a farm at Niger Delta University campus and from a local market, Amassoma, Bayelsa State, Nigeria in November 2023 respectively. The plants were identified by a Taxonomist, Faculty of Pharmacy, Niger Delta University; the Herbarium voucher specimen was assigned

NDUP098 and NDUP034 to *Ipomoea aquatic and Telfairia occidentalis*. From the collected shoots, adulterated materials were removed and the leaves species were washed with a tap water.

2.4 Extraction

The dried materials were chopped and made into a coarse powder. About 337.02g of coarse powder of *T. occidentalis* and 287.09g *I. aquatica* were macerated in 70% Methanol in a glass container with consistent stirring for 72h, filtered and marc re-macerated for another 72h.The filtrates were concentrated *invacuo* at 50°C to obtain crude extracts.

2.5 Elemental analysis

Elemental analysis of crude leaves conducted using Agilent FS240AA Atomic Absorption Spectrophometer according to the standard methods [14, 15, 16].

2.6 High Performance Liquid Chromatography

The analysis was performed on a BUCK M950 HPLC equipped wth a RESTEK 15 meter MXT-1 column (15m x 250um x 0.15um) was used. The concentration of the different bioactive compoundsexpress in ug/g[17, 18, 19, 20].

2.7 Antioxidant activity

1,1-Diphenyl-2- Picrylhydrazyl Radical Scavenging

The extracts were screened at 10, 40, 160, 360, 640 and 1000 ug/mL while Vitamin C was used as the standard drug andabsorbance was recorded at 516nm in UV-Visible spectrophotometer [21]. The percentages scavenging activity of samples were calculated using equation (1) and IC_{50} was determined from the plot.

% Scavenging activity = $\frac{\text{absorbance of control} - \text{absorbance of sample}}{\text{absorbance of control}} \times 100\%$.....(1)

3.0 RESULTS AND DISCUSSION

3.1 Elemental assessment of *Ipomoea aquatica* and*Telfairia occidentalis*

. The results (Table 1.0), showed that *I. aquatica* constitute high concentration of these elements K, Zn, Mn, Ca, and P compared to*T. occidentalis*. *Telfairia occidentalis*, high concentration of elements Fe, Na, Se, Cu, Mg, Cr, and B than*I. aquatic*. It is obvious that plants accumulate essentialelements for man and animals. The presence of Ca, Mg, Na, K, Cr, Cu, Fe, Mn, Zn, B, P, andSereflects their function as essential nutrients, often as co-factor activators in metal-ligand enzyme complexes [22]. Chromium, Cu and Zn are essential for hair growth and for increasing the rate of milk production by pregnant females [23, 24, 25, 26, 27].

The presence of high element concentrations in the plants under study gives a new insight into their potential use to compensate for element deficiencies in both man and animals. It is interesting to note that some of the medicinal plants used inforkloric medicine have high concentration of essential element. Mn, Fe, Cu, Zn etc. Zn is important in wound healing and also functions as an antioxidant. Mn essential for normal functioning of central nervous system and are a good anti-oxidant [26, 28].

Table 1: Elemental compositions of *I. aquatic* and *T. occidentalis*

SN	Element	*Ipomea aquatic* (ppm)	*Telfaira occidentalis* (ppm)
1	Potasium	6.075±0.006	6.066±0.002
2	Iron	0.893±0.002	0.978±0.002
3	Zinc	0.655±0.007	0.434±0.001
4	Selenium	0.013±0.001	0.019±0.001
5	Copper	0.003±0.001	0.018±0.001
6	Manganese	0.476±0.002	0.288±0.001

7	Sodium	8.501±0.017	9.279±0.003
8	Magnesium	6.013±0.002	9.018±0.001
9	Calcium	9.405±0.003	8.118±0.002
10	Chromium	0.003±0.001	0.017±0.000
11	Boron	0.003±0.001	0.004±0.001
12	Phosphorus	12.293±0.00	9.066±0.001

Mean±SD

3.2 Phytochemical Constituents of *Ipomoea aquatic* and *Telfairia occidentalis*

The plant extracts constitute high concentration of flavonoids and phenolic compounds. Flavonoids are potent antioxidants agents that play essential role for the protection against human diseases. The leaves extracts of *Ipomoea* aquatic (Table 2)and *Telfairia occidentalis* (Table 3)contained flavonoids, tannins, alkaloids, and other phenolic compounds [29]. Some of the flavonoids detected were flavon-3-ol, kaempferol, naringinin, rutin, catechin, anthocyanins, proanthocyanidins while resveratrol is a stilbene derivative. The results of this research corroborate with other scientific findings that these medicinal plants could be a major sources of polyphenolic compounds.

Ipomea aquatica may have similarity with *T. occidentalis* (Figure 2.0) *in terms of* chemical constituents; resveratrol, kaempferol, ribalinidine and lunamarin are found in *Ipomea aquatica* and *T. occidentalis* while epihedrine, naringin, spartein, ellagic acid, quinine, naringenin and rutin are present in *T. occidentalis*, while catechin, flavonone, Flavan-3-ol, flavones, digitoxigenin, gallocatechin, isoflavonoid are found in *I. aquatic* (Figure 1.0 an) However, anthocyanidine constituents include; Proanthocyanidine, delphinidine, pyranoanthocyanin, anthocyanidine and malvidine which are found in both *T. occidentalis* and *I. aquatica* as revealed by the HPLC profiling(Table 4). These Tannins and anthocyanin are polyphenols which are water soluble pigments and can be found in many plants. They also possess some biological

activities which include anti-inflammatory, vasorelaxant, cardioprotective and antioxidant properties [30].

Flavonoids are associated with activities such as anti-inflammatory, anti-pyretic, hypoglycemic, antifungal, antibacterial and antitumor [31, 32]. The protective activities of flavonoids (Rutin and kaempferol, Flavanones, epicatechin) are attributed to their ability to transfer electrons to free radicals. Antioxidant properties of these compounds have made them useful in the prevention of many degenerative diseases [33]. Other activities exhibited by these phytochemicals include; anticancer, cardio-protective, wound healing, antimicrobial, anti-inflammatory, anti-viral, hypoglycemic, anti-lipidemia anti-depressant and anti-allergic [13, 34, 35]. Naringenin; is abundantly found in citrus fruits and pigmented vegetables and have been beneficial in the management of cancer, liver injury, cardiovascular diseases, oxidative stress and osteoporosis [36]. Proanthocyanidins and anthocyanidins occur naturally in plants. Proanthocyanidins are considered condensed tannins. They are known for several biological activities such as anti-inflammatory, prevention of neurodegenerative diseases, diabetes and cancer which endeared proanthocyanidins to enter the natural product market as dietary supplement [37]. Alkaloids are another group of phytochemicals that enormously occur in plants. Their analgesic uses with the discovery of morphine and its derivatives are known. However, the presence of quinine, sparteine and ribalinidine in the leaves of *Ipomoea aquatic* and *Telfairia occidentalis*, must have been responsible for some outstanding activities in their ethnobotanical uses. These alkaloids have been documented to be effective in the management of cancer, malaria, microbes and protozoans. Ribalinidine, which is a strong antioxidant, has been reported for its strong radical scavenging property [38].

Table 2: Phytochemicals Constituents identified in the leaves extract of *I. aquatic*

Constituents	Retention time (mins)	Concentration (µg/g)
Resveratol	0.426	6.744±0.001
Catechin	2.423	10.119±0.00
Ribalinidine	5.506	12.397±0.001
Flavonones	16.900	9.149±0.004
Flavan-3-ol	18.013	10.388±0.001
Flavone	23.483	17.276±0.002
Digitoxigenin	24.916	7.746±0.006
Lunamarine	32.563	33.627±0.001
Gallocatechin	38.806	13.426±0.004
Isoflavonoids	38.563	5.025±0.001
Kaempferol	39.776	10.986±1.062

Mean±SD

Table 3: Phytochemical components identified in the extract of *T. occidentalis*

Constituents	Retention time (mins)	Concentration (µg/g)
Resveratrol	40.080	10.924±0.000
Epihedrine	1.006	17.492±0.001
Ribalinidine	4.100	13.208±0.002
Ellagic acid	9.146	72.953±0.001
Spartein	12.016	8.2461±0.001
Naringin	14.310	39.155±0.001
Quinine	25.570	144.355±0.002
Lunamarin	20.116	1.153±0.002
Naringenin	32.263	40.999±0.001
Rutin	35.140	12.214±0.002
Quinine	45.233	69.534±0.001
Kaempferol	29.456	4.307±0.001

Mean±SD

Table 4: Phytochemical Constituentsidentified in methanol extracts of *Ipomea. aquatic* and *Telfairia occidentalis*.

Constituents	Retention time (mins)	Ipomea aquatica (Conc ug/g)	Telfairia aquatic (Conc ug/g)
Proanthocyanides	6.376	46.347±0.133	46.355±0.002
Delphinidin	16.823	61.497±0.001	56.476 ±0.002
Pyranoanthocyanidines	22.353	6.809±0.003	7.355±0.002
Anthocynidines	34.036	119.19±0.003	110.299±0.001
Malvidine	42.620	20.913±0.002	16.388±0.003

Mean±SD

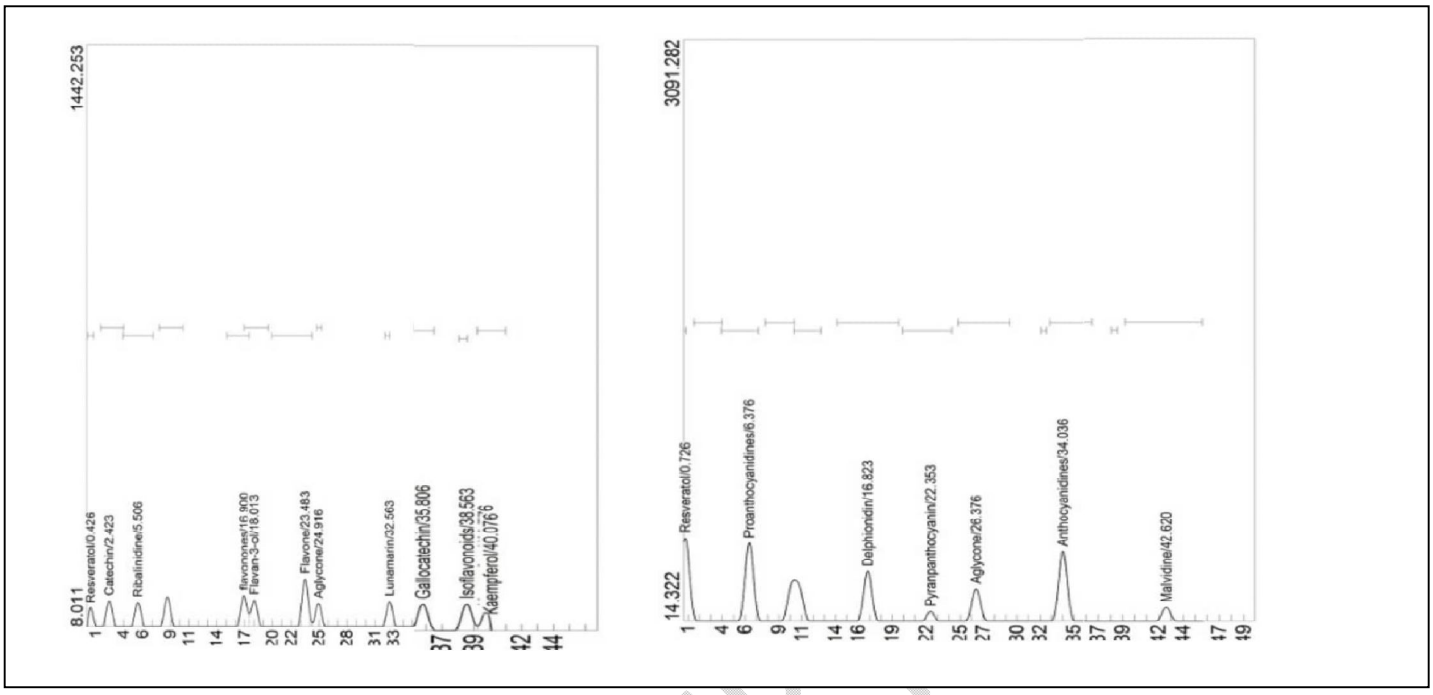

Figure 2: Chromatogram of the leaves of *I. aquatica* extract.

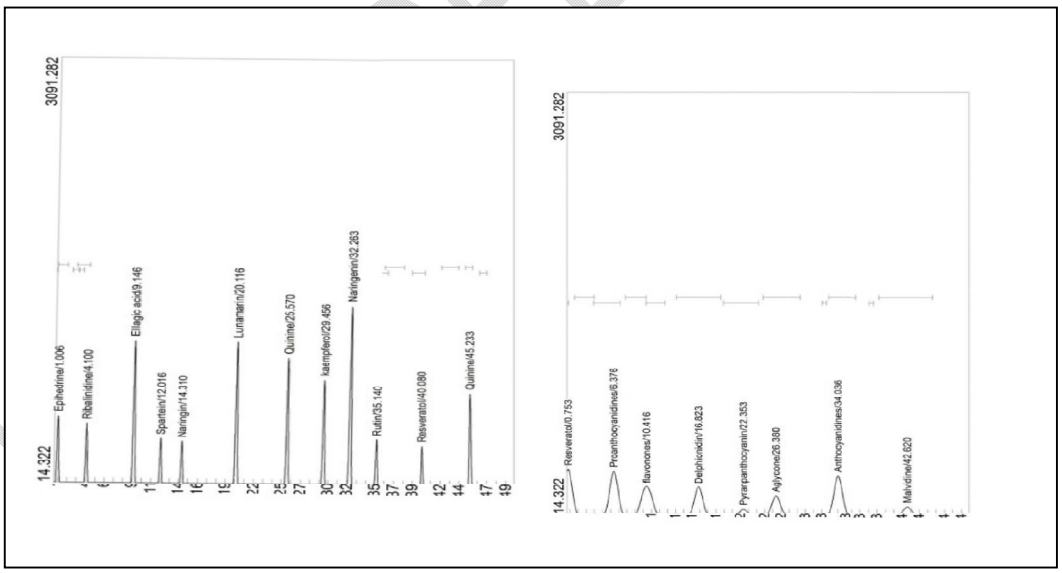

Figure 3: Chromatogram of the leaves extract of *T. occidentalis*

3.3 *In* vitro antioxidant activity of *Ipomoea aquatica* and *Telfairia occidentalis*

In the present study, it was observed that*I. aquatica* extract exhibited better scavenging activity when compared to*T. occidentalis* (IC_{50} 190 µg/ml and 226.67 µg/ml), respectively as shown in Figure 4. The result of the antioxidant activity of *T. occidentalis* indicates that is less potent compared to findings reported by Nkereuwem et al., 2011, which showed that the methanol extract had an IC_{50} of 31.25 ug/ml for *T. occidentalis* compared to 226.67 ug/ml from the investigation [39]. The effect could be due to geographical location, seasonal and chemical constituents [40]. The high scavenging activity of*I. aquatica* could be due to high phenolic content compared to*T. occidentalis*. Ogu et al., (2009) reported a strong relationship between phenolic content and antioxidant activity in selected fruits and vegetables [41]. *Ipomeaaquatica* had an IC_{50} (190 ug/ml), compared to the study conducted by Saika et al., 2023 that *I.aquatic* had an IC_{50} of 112 ug/ml which showed that is more potent compared to our findings [6]. James et al., (2009) reported the antioxidant effect(IC_{50}) of the methanol extracts of leaves and stem of *I. aquatic*a had 672.376 ug/ml and 33.188 ug/ml respectively [8]. The variation could be due to chemical constituents, seasonal and geographical location [42, 43].

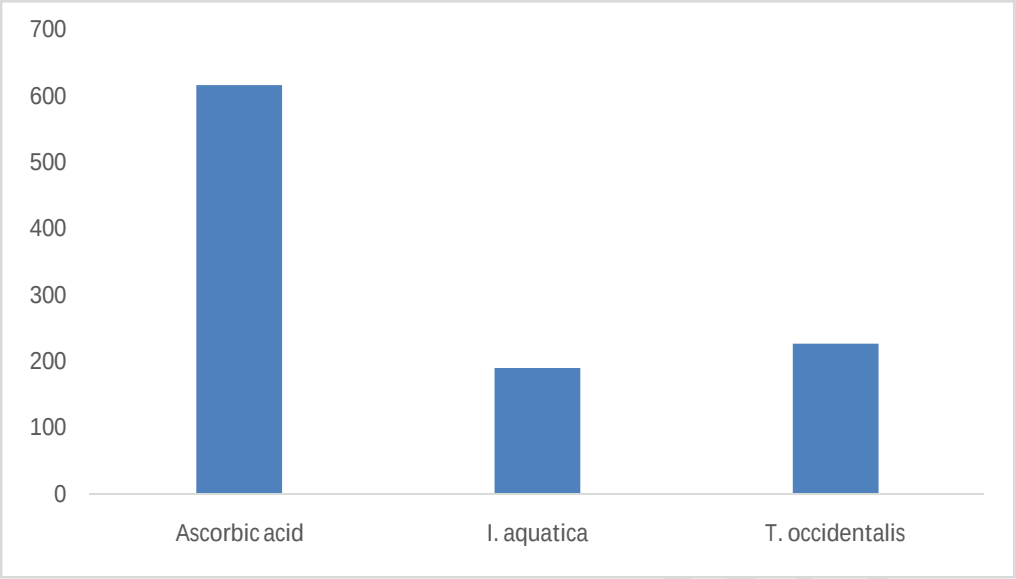

Figure 4: IC_{50} value for ascorbic acid, extracts of *I. aquatica*, and *T. occidentalis*

CONCLUSION

Free radical scavenging activity of the plant extract through the antioxidation of the DPPH radical showed that *I. aquatica* is a potent source of antioxidant with low $IC_{50}$when compared with *T. occidentalis*.

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