https://chemclassjournal.com/
ChemClass Journal Vol. 9 Issue 2 (2025); 269-278
e-ISSN:3092-8214 p-ISSN:3092-8206
DOI: https://doi.org/10.33003/chemclas-2025-0901/157

Anti-nutritional Factors, Vitamin C and Mineral Compositions of the Root, Stem and Leaf of *Ficus exasperata Vahl*

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Abstract

The demand for organic-based foods, the quest for plant-based growth promoters and antioxidant agents by health-conscious individuals is on the increase. *Ficus exasperata Vahl* is a plant based herb, used for several ailments in Nigeria. It is important to know the anti-nutrients and mineral compositions of the root (FEVR), stem (FEVS) and leaves (FEVL) of *Ficus exasperata Vahl* so as to ensure their safety for human consumption and maximal derived health nutrients. Standard methods of analyses were used to determine the mineral contents of (FEVR, FEVS) and anti-nutritional factors of *Ficus exasperata Vahl* root (FEVR), Stem (FEVS) and the leaves (FEVL). The anti-nutrients in the aqueous extract of *Ficus exasperata Vahl* show that the stem (FEVS) has the highest value for phytate and Vitamin C (18.95, 21.31) mg/100 g, compared to (16.57, 6.08) mg/100 g Phytate and (6.53, 5.16) mg/100 g Vitamin C for FEVR and FEVL respectively. Tanin, and Flavonoid were found in trace amount in the root, stem and leaves. The results of mineral analysis show the presence of some heavy metals like Zinc, Copper and Manganese in the roots and stem. This may be from the environment where the tree was planted.

Keywords: Anti-nutrients, Herbs, *Ficus exasperata Vahl*, Sand-paper leaf tree

Introduction

Many food consumers now prefer organically produced substances rather than inorganic substances that are used in production due to residues of the inorganic substances with their attendant health implications [1]. Plants are a good source of a wide range of phyto-chemicals such as polyphenols, carotenoids, alkaloids, sulphur-containing groups, terpenes and terpenoids, which contains enormous anti- microbial and antioxidant properties [1]. Anti-nutritional factors are chemical compounds synthesized in natural food and or feedstuffs by the normal metabolism of species and by different mechanisms (for example inactivation of some nutrients, diminution of the digestive process or metabolic utilization of food/feed) which exerts effect contrary to optimum nutrition [2].

These anti-nutritional factors are also known as 'secondary metabolites' in plants and they have been shown to be highly biologically active. One

major factor limiting the wider food utilization of many tropical plants is the ubiquitous occurrence in them of a diverse range of natural compounds capable of precipitating anti-nutrient, which actually deleterious effects in man, and animals compound which act to reduce nutrient utilization and/or food intake are often referred to as anti-nutritional factors [3].

Cells have developed various metallo-regulatory mechanisms for maintaining a necessary homeostasis of metal-ions for diverse cellular processes, most importantly in the central nervous system [4]. Transition metals are integral parts of the active centers of numerous enzymes (e. g. Cu,Zn-SOD, Mn-SOD, Catalase) which catalyze chemical reactions at physiologically compatible rates [4]. Either a deficiency, or an excess of essential metals may result in various disease states arising in an organism [4]. Some typical ailments that are characterized by a disturbed homeostasis of redox active metals include neurological disorders (Alzheimer's, Parkinson's and Huntington's disorders), mental health problems, cardiovascular diseases, cancer, and diabetes [4]. To comprehend more deeply the mechanisms by which essential metals, acting either alone or in combination, and/or through their interaction with non-essential metals (e.g. chromium) function in biological systems will require the application of a broader, more interdisciplinary approach than has mainly been used so far [4].

Ficus exasperata Vahl. (Moraceae), popularly referred to as "Sandpaper leaf tree" owing to the rough surface of the leaves, is increasingly being used for a number of ailments and hence, studies validating the traditional claims are on the increase [5]. In Nigeria, *Ficus exasperata Vahl* is called Ewe epin, in Yoruba language. *Ficus exasperata Vahl,* also called the sandpaper tree, forest sandpaper fig, white fig, or sandpaper leaf tree are plants belonging to Ficus species, they are well known all over the world as "Fig plants" [6]. *Ficus exasperata* is a specie commonly used in the pharmacopoeia for the treatment of many diseases, including hypertension [7]. *Ficus exasperata* aqueous leaf extract was found to be high in phenols [8].

In Nigeria, the young leaves are prescribed as a common anti-ulcer remedy. Few leaves that are chewed and swallowed three times for 4-8 weeks are believed to produce a complete cure of ulcer [9]. The leaves are also used in the stabilization of palm oil to potentially enhance keeping qualities through the elimination of saponins and the foaming tendency and enhancement of carotenoid levels in the oils, thereby resulting in reduced free fatty acids, acid value and peroxide value [10].

There were several reports of research work on the leaf of *Ficus exasperata,* but there is however, little or no report on the anti-nutritional composition and mineral compositions of the root and stem of *Ficus exasperata*. This research therefore aims at determining the mineral composition of (FEVR,

FEVS) and anti-nutritional compositions of the roots, stem and leaves of *Ficus exasperata*.

Materials and Methods

Materials

Apparatus/Equipment Used: Muffle Furnace (Model: TT-EF, Rated Temperature:1000℃, Techmel and Techmel USA), Crucible with Lid, Crystallising Dish, Drying Oven, Weighing Balance (Adam Equipment PW 124-PW Analytical Balance, 120g), Desiccator, Miscellin Cloth, Soxhlet Extractor, Volumetric Flask, Reagent Bottle, Petri Dish, Filter Paper, Measuring Cylinder, Kjeldal Flask

Reagent Used: *Distilled Water, N-Hexane, Hydrochloric acid (HCl), Sodium Hydroxide (NaOH).*

Collection and Processing of *Ficus Exasperata Vahl* root, stem and leaf samples

Fresh samples of *Ficus Exasperata Vah*l roots, stem and leaves were harvested from a *Ficus exasperata Vah*l tree in Egbe forest, Oye town, Ekiti State, Nigeria in November/December, 2022. The roots were taken to the Department of Chemistry, Federal University, Oye Ekiti, Nigeria (FUOYE) laboratory, washed with distilled water, in order to remove sandy particles and all other impurities. They were air dried in the laboratory, cut into tiny pieces with knife and hands, and then blended into fine powders with an electric blender. Each was then stored in separate polythene bags and labelled appropriately.

Aqueous extract of each part of the samples was made by macerating the samples in distilled water. Each of the parts was filtered and vacuum evaporator was used to have the dry samples used for anti-nutritional composition of the samples.

Fig. 1: *Ficus exasperata Vah*l leaves and the pulverised FEVLS

Fig 2: *Ficus exasperata Vahl* stem (FEVS)

Fig 3: *Ficus exasperata Vahl root* samples (FEVR)

Determination of mineral compositions

The mineral content (Na, K, P, Mg, Mn, Ni, Pb, Cd, Fe, Zn and Cr) ppm of the Root and Stem were determined as described by [11, 12].

Determination of Anti Nutrients in the samples

Anti-nutritional compositions of the FEVR, FEVS and FEVL were determined, using the aqueous extracts of the samples.

Tannin Content

Tannin was determined as described by Makkar and Goodchild [13].

Phytate Content

Phytate was determined according to the method of Wheeler and Ferrel [14].

Oxalate content

Oxalate determination was determined as described by Day and Underwood [15].

Saponin Content

The spectrophotometric method of Brunner [16] was used for the determination of Saponin.

Determination of Vitamin C

The vitamin C content was determined using the ascorbic acid as the reference compound. 200 cm^3 of the extract was pipetted and mixed with 300 cm^3 of 13.3 % of TCA and 75 microliter of DNPH. The mixture was incubated at 37 ^oC for 3 hrs and 500 cm^3 of H_2SO_4 was added and the absorbance was read at 520 nm [17].

Determination of Total flavonoid

The total flavonoid content of the extract was determined using a colorimetric assay developed by Bao *et al.* [18].

Statistical Analysis

Statistical analysis was done on replicate results according to Ogundele et al. [11] and the results are expressed as mean±standard deviation.

Results and Discussion

Table 1, shows the result the Anti Nutrients of the aqueous FEVR, FEVS and FEVL. The stem (FEVS) had the highest values in phytate (18.95± 0.12 mg/100g), Oxalate (4.68 ± 0.00 mg/100g), and vitamin C (21.31 ± 1.11 mg/100g), followed by the root, FEVR which has (16.57 ± 0.12, 4.50 ± 0.00 , 6.53 ± 1.11) mg/g for phytate, Oxalate and vitamin C respectively. Comparatively, the leaves (FAVL) had the least values for phytate (6.08 ± 0.12) mg/100g, Oxalate (3.40± 0.06) mg/ 100g and Vitamin C (5.16 ± 0.92) mg/100g. Tannin and Flavonoid were found in trace amount in all the three samples. However, the leaf (FAVL) has the highest value for Tannin (3.53 ± 0.10) mg/100 g, Flavonoid (3.14 ± 0.06) mg/100g, compared with the lesser values in the root (FEVR) and stem (FEVS) with values (1.63 ± 0.08, 2.29 ± 0.08) mg/100g and (0.15 ± 0.06, 0.14 ± 0.06) mg/100 g for Tannin and Flavonoid respectively. The results reported by [19] for *Ficus exasperata* leaves; flavonoids, phenols, saponins, steroids, tannins, terpenoids and glycosides were present in the following concentrations of 23.42%, 1.94%, 1.74%, 0.17%, 0.5%, 1.04% and 0.39% respectively.

Ewegbemi *et al*. [8] reported the phytochemical composition of the composite of three varieties of Ficus spp, which contains flavonoids, tannins, phytates (184.62, 16.46, 69.21) mg/100g respectively. These values are higher than the results presented in this research. Hence, the consumption of the aqueous extracts of FEVR, FEVS and FEVL are likely to be safe for human consumption. Phytochemicals have varying amounts in leafy vegetables. Levels of plant chemicals may vary depending on species and varieties of green leafy vegetables [19]. The tannins and flavonoids found in the samples aid their potential as anti-microbial, anti-inflammatory, and anti-tumour agent and a means of removing harmful free radicals and reactive oxygen species [20,21].

Table 1: Anti Nutrient (mg/g) of Root, Stem, Leaf Sample (mg/100g)

Antinutrients	Root Concentration	Stem Concentration	Leaf Concentration
Tanin	1.63 ± 0.08	2.29 ± 0.08	3.53 ± 0.10
Flavonoid	0.15 ± 0.06	0.14 ± 0.06	3.14 ± 0.06
Phytate	16.57 ± 0.12	18.95 ± 0.12	6.08 ± 0.12
Oxalate	4.50 ± 0.00	4.68 ± 0.00	3.40 ± 0.16
Vitamin C	6.53 ± 1.11	21.31 ± 1.11	5.16 ± 0.92

Table 2 shows the results of mineral analysis (ppm) revealed the presence various elements in study.

The root (FEVR) had higher values in Zinc (106.70 ± 0.00) ppm and Manganese (1030.50 ±0.01) ppm as against (83.50 ± 0.00, 979.80 ± 0.01) mg/100g for Zinc and Magnesium respectively in FEVS.

Table 2: Mineral Content of Root, Stem Sample (ppm)

Minerals	Root Concentration	Stem Concentration
Zinc	106.70 ± 0.00	83.50 ± 0.00
Copper	33.60 ± 0.34	57.20 ± 0.02
Manganese	16.30 ± 0.00	19.90 ± 0.01
Nickel	97.10 ± 0.09	99.90 ± 0.18
Cobalt	57.10 ± 0.03	89.40 ± 0.16
Magnesium	1030.50 ± 0.01	979.80 ± 0.01
Calcium	24297.50 ± 0.09	82540.00 ± 0.30
Sodium	2802.50 ± 0.02	5970.00 ± 0.01
Potassium	16537.50 ± 0.25	30760.00 ± 0.01
Iron	734.00 ± 0.01	730.10 ± 0.01
phosphorus	221.60 ± 0.00	329.60 ± 0.00

The stem (FEVS) has higher values of (57.20 ± 0.02, 19.90 ± 0.01, 99.90 ± 0.18, 89.40 ± 0.16, 82540 ± 0.30, 5970.00 ± 0.01, 30760.00 ± 0.01, 329.60 ± 0.00) ppm in Copper, Manganese, Nickel, Cobalt, Calcium, Sodium, Potassium and Phosphorus respectively. Compared with (33.60 ± 0.34, 16.30 ± 0.00, 97.10 ± 0.09, 57.10 ± 0.03, 1030.50 ± 0.01, 24297.50 ± 0.09, 2802.50 ± 0.02, 16537.50.025 ± 0.25, 221.60 ± 0.00) ppm in the root (FEVR). These values will adequately meet the daily dietary needs in man, which are Zn (15 mg), Cu (1.5 - 3. 0 mg), Manganese (2.5 - 13 g), Co (0.2 g), Mn (300 – 400 g), Na (1100 – 3300 g), K (2000-5500 g), Fe (10-20 g) [4, 22].

These show that both the root and the stem of *Ficus exparata* are good sources of Sodium. Potassium and Magnesium which are all necessary to have balanced electrolytes in the blood as to regulate the Sodium, needed for good health [21]. However, the Iron values in both the root (FEVR) and leaves (FEVL) are 734.00 ± 0.01 and 730.10 ± 0.01 respectively are almost the same thing. This show that *Ficus exparata* is a good source of Iron for blood production [4].Iron is essential for the transportation of oxygen in man [4]. Zinc supports the immune system, cell growth and wound healing [4]. Copper aids in iron metabolism and connective tissue formation, Manganese is involved in bone formation and metabolic processes [4]. Calcium is for healthy bones and some physiological functions, including blood clotting and nerve transmission [4]. Magnesium is important for muscle function, blood pressure regulation, and blood sugar modulation [23].

Conclusion

Ficus exasperata vahl lea*f* (FEVL) sample contained the least values in almost all the anti-nutrients, while the stem (FEVS) had the highest values of phytate and Vitamin C. The results of mineral analysis of FEVR and FEVS show the presence of Potassium, Iron, Copper, Phosphorus, Nickel, Sodium, Cobalt, Manganese, Calcium, Zinc in the Stem, and Root of *Ficus exasperata Vah*l sample. These results are within acceptable limits for human consumption, meet daily daietry intake of man and support the medicinal use of the plant. In addition, this unveils the possibility of the plant as a potential source of food nutrients and nutraceuticals. However, moderation is important as excessive usage of these parts, especially the stem and the root may be harmful to man,

Acknowledgement

This is to acknowledge the following technologists for their assistance during the practicals of this research: Mr. Akinpelu Samuel, of Faculty of Science, Federal University, Oye Ekiti and the following technologists in the Chemistry Laboratory, Federal University of Technology, Akure during the practicals of this research: Dr. Abe T., Mr. Ajayi, Mrs Ibeto, A. U and Mr. Seye.

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