

Nutrient and Anti-nutrient Phytochemicals in *Ficus exasperata* Vahl Leaves

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Abstract— *Ficus exasperata* leaves were analyzed for the level of nutrient and anti-nutrients phytochemicals in an effort to determine their food benefits. Proximate analysis revealed that the leaves have 3.85 g/100g moisture, 12.19 g/100g ash, 4.25 g/100g crude fat, 6.91 g/100g crude protein, 17.24 g/100g crude fibre and 72.81 g/100g carbohydrate. The level of Ascorbic acid was 92.4 mg/100g. The mineral elements quantified by XRF were in the order potassium (3.36 g/100g) > calcium (1.13 g/100g) > titanium (0.03 g/100g) > manganese (220.31mg/kg) > iron (122.95 mg/kg) > copper (104.13 mg/kg). The levels of anti-nutrients (mg/100g) were tannin (122.95); saponin (44.50); alkaloid (48.80) and phytate (5.92). The leaves could contribute to nutrient needs of man and the domestication should be encouraged.

Keywords— *Ficus exasperata*, phytonutrients, saponin, tannin

1 INTRODUCTION

The use of medicinal plants has always been part of human culture and is wide spread in Africa. During the last decades, herbs and spices have been used in culinary and traditional therapeutic practices for the treatment of different ailments. The nutritional and medicinal properties of the plant may be inter linked through both nutrient and non-nutrient phytochemicals. Among the plant species that has been ethnobotanically reported to have diverse medicinal uses is the *Ficus exasperata* Vahl [1]. *F. exasperata* Vahl is one of the *Ficus* species of *Moraceae* family globally referred to as "fig plant".

Over 45 different species are found in Nigeria [2], and are primarily located in the rainforest, Savannah and beside rivers and streams. It is a medicinal plant referred to as "sand paper plant" and *Ewe ipin* in Yoruba language of Western Nigeria. Different parts of the plant are used for treating eye-sores, ring worm, stomach pains and leprosy [3]. The young leaves of *F. exasperata* are prescribed as a common anti-ulcer remedy. The leaf extract has been reported to have diverse uses in the treatment of haemostatic ophthalmia, coughs, haemorrhoid [4], epilepsy, high blood pressure, rheumatism, arthritis, intestinal pains, colics, bleeding, ulcer and wounds [5].

Various pharmacological actions such as anti-diabetic, lipid lowering and antifungal activities have been described for *F. exasperata* leaf [6]. The leaf has also been reported to be useful for stabilization of vegetable oils, suppression of foaming and supplement as food stock [4]. Despite the various re-

ported medicinal usefulness, no information could be obtained as regards the nutrient content of *F. exasperata* leaves even though it is ground and ingested for various medicinal benefits. However, proximate and nutrient analysis of medicinal plants, edible fruits and vegetables plays a crucial role in assessing their nutritional significance and can help to understand the worth of these plant species [7].

Also, this leaf has been severally used for different medicinal treatment, it is important to know their elemental contents because some of these elements have either toxic effects or essential properties. Poor nutritive values might also be related to the presence of many anti-nutritional factors such as tannins, phytates, saponin and alkaloids. The deficiency of the elements or excess of anti-nutrients might disturb normal biochemical functions of the body. This study therefore investigates the level of nutrients, antioxidant, mineral elements and anti-nutrient phytochemicals in the leaves of commonly explored *Ficus exasperata* Vahl.

2 MATERIALS AND METHODS

2.1 Collection and processing of sample

Ficus exasperata leaves were harvested from the ficus tree in front of the Department of Chemistry, Ladoko Akintola University of Technology, Ogbomoso, Nigeria. The leaves were air dried at room temperature and pulverized with an electric blender (Nakai blender 248 special, Japan) stored in airtight container kept in refrigerator prior to analyses.

2.2 Proximate analysis

Proximate analysis was carried out using the standard procedures of the Association of Official Analytical Chemists [8]. Moisture content was determined by drying the sample in a vacuum oven at 100°C and dried to a constant weight. Ash content was determined by incineration of 2 g of the sample in a muffle furnace at 600°C for 8 hrs. The percentage residue weight was expressed as ash content. Crude fat was determined by soxhlet extraction method using petroleum ether as

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solvent. Nitrogen was determined using the Kjeldahl method and crude protein was calculated by multiplying the percentage nitrogen content by the conversion factor of 6.25. Carbohydrate was calculated by difference.

2.3 Determination of mineral elements

The micro nutrient and macro nutrients elements were quantified using X-Ray fluorescence (XRF) transmission emission technique at the Centre for Energy Research and Development (CERD), Obafemi Awolowo University, Ile-Ife, Nigeria, with model: PX2CR Power Supply and Amplifier for the XR-100CR Si Detector. The ground samples were pelletized and then irradiated with X-Ray for 1000 sec, to obtain the characteristics spectral, each spectral was made up of peaks which was characteristics of certain elements contained in the sample. The spectrum was checked on the computer system and then interpreted for quantitative determination of elements by direct comparison of count rates.

2.4 Quantification of Ascorbic acid (Vitamin C)

Ascorbic acid (Vitamin C) was quantified by the method described previously [9]. Ascorbic acid was measured by titration with phenol indo-2, 6- dichlorophenol (DPIP). The leaves samples (0.2 g) were separately homogenized with 40 ml of a buffer solution made up of 1 g/L oxalic acid and 4 g/L sodium acetate anhydrous. This was titrated against a solution containing 295 mg/L DPIP and 100 mg/L sodium bicarbonate. The results were expressed as mg/100 g dry weight.

2.5 Determinations of anti- nutrients phytochemicals

Tannin was determined using the method previously described [10], using tannin acid as standard, the coloured product developed was measured at 120 nm within 10 min. Saponin was determined gravimetrically by the method of Obadoni and Ochuko (2001) [11]. Alkaloid was determined by being precipitated using concentrated ammonium hydroxide [35]. Phytate was determined by titration method as described by Wheeler and Ferrei (1971) [12], using $FeCl_3$ as standard.

2.6 Statistical analysis

All data were reported as mean \pm standard deviation of three different determinations.

3 RESULTS AND DISCUSSION

The proximate constituents and ascorbic acid content in *Ficus exasperata* leaves were presented in Table 1. The result revealed that the leaf has a low moisture content of 3.85 ± 0.10 g/100g which is slightly higher than 3.21 ± 0.10 g/100g reported for *Moringa oleifera* [13] but lower when compared to 11.82 ± 0.45 g/100g, 10.25 ± 0.70 g/100g reported for *Hibiscus cannabinus* and *Haematostaphis barteri* respectively [14], also much more lower to the moisture content within the range of 79 – 89 g/100g reported for some Nigerian vegetables [15]. Moisture content is a widely used parameter in the processing and testing of food [16]. It is an index of water activity of many

foods and helps in maintaining protoplasmic content of the cell and the texture of leaf. The observed value implies that *F. exasperata* could have a long shelf life since microorganisms that cause spoilage mostly thrive in foods having high moisture content. This also is indicative of high total solids content in the leaf.

Table 1. Proximate and Ascorbic acid content of *Ficus exasperata* leaves

Parameters (g/100g)	Mean composition (\pm SD)
Moisture	3.85 ± 0.01
Crude protein	6.91 ± 0.12
Crude fat	4.25 ± 0.01
Crude fibre	17.24 ± 1.45
Ash	12.19 ± 0.10
Carbohydrate	72.81 ± 2.56
Ascorbic acid	0.0924 ± 0.0001

The ash content which is a measure of inorganic matter in samples in *F. exasperata* was 12.19 ± 0.1 g/ 100g. This value was higher than 7.93 ± 0.12 g/ 100g reported for *Moringa oleifera* leaf and fell within 5.0 - 13.0 g/100g ash content reported for some Nigerian vegetables [15]. Leaves with high ash content are good sources of minerals needed for the body and the high value indicated that *F. exasperata* could be a good source of mineral elements.

The crude protein content of 6.91 ± 0.01 g/100g in *F. exasperata* was found to be relatively low compared to the observed values in conventional vegetables like cabbage, 12.8 g/100g; and lettuce, 14 g/ 100g [16] also much more lower than 17.09 ± 0.10 g/ 100g in *Moringa oleifera* leaf [13]. It has been reported that the crude protein on dry weight basis is within the range of 15 – 30 g/100g for most green leafy vegetables [18]. Even though the leaf might not serve as a sole source of protein for the alleviation of Protein Energy Malnutrition, but when rightly combined with other foods it could be of high biological value and satisfactorily meet the protein needs of man.

Crude fibre present in *F. exasperata* was 17.24 ± 0.01 g/ 100g. This exceeds 7.09 ± 0.11 g/ 100g reported for *Moringa oleifera* [13] and 9.74 ± 0.34 g/100g for *Jatropha tanjorensis* [19]. However, higher crude fibre was reported for *Hibiscus cannabinus* leaf (29.61 g/ 100g) and *Haematostaphis barteri* leaf (33.04 g/ 100g) [14]. This high level of dietary fibre in leafy vegetables are advantageous for their active role in the regulation of intestinal transit, increasing dietary bulk and increasing faeces consistency due to their ability to absorb water.

Fibres are known to slow down glucose absorption and reduce insulin secretion which is of great importance to diabetic patients [20]. This high level of fibre in *F. exasperata* leaf might be responsible for anti-diabetic properties reported [6], [21]. Crude fat content of 4.25 ± 0.01 g/ 100g was reported

for *F. exasperata*, this value was closer to 4.5 g/ 100g reported for green variety of *Celosia argentea* [14] but higher than 2.11± 0.11 g/ 100 g reported for *Moringa oleifera* [13]. The leaf is a poor source of lipid which is typical of most leafy vegetables. This is an advantage because the leaf is consumed in many medicinal preparations; it would not add to fat consumption, excess fat consumption is implicated in cardiovascular disorders such as atherosclerosis and cancer [21]. The level of carbohydrate in the leaf is high and thus it could be a source of energy required for the smooth functioning of the body.

Vitamin C is a highly effective antioxidant and a very small daily intake of this vitamin for an adult is required to avoid deficiency disease scurvy. Even in small amounts it can protect indispensable molecules in the body, such as proteins, lipids (fats), carbohydrates, and nucleic acids (DNA and RNA) from damage by free radicals and reactive oxygen species that can be generated during normal metabolism as well as through exposure to toxins and pollutants [22]. The vitamin C content reported in the *F. exasperata* leaf is 92.4 ± 0.01 mg /100g. This is low compared to 345, 408, 421 mg / 100g reported for *Vernonia amygdalin*, *Amaranthus Cruentus* and *Celosia Argnetus* respectively, but higher than 65 mg/100g reported for *Basella rubra* [23]. The Ascorbic acid content of *F. exasperata* lies above the lower range of 70 – 465 mg/100g reported for Nigeria conventional vegetables [24]. Thus the level of the antioxidant might be responsible for some pharmacological actions described for the leaves.

Table 2. Mineral elements in *F. exasperata* leaves

Elements	Concentration
Potassium (g/100g)	3.36 ± 0.04
Calcium (g/100g)	1.13 ± 0.02
Titanium (g/100g)	0.03 ± 0.00
Manganese (mg/kg)	220.31 ± 13.07
Iron (mg/kg)	122.95 ± 3.31
Copper (mg/kg)	104.13 ± 5.67

The levels of different mineral elements in the leaf were reported in Table 2. Elements are essential constituents of enzymes and play a significant role in human metabolism and are very important with regard to life process [24]. Few elements were detected by XRF technique in this study. The presence of these elements in the leaves could also contribute to the various nutraceutical properties displayed by *F. exasperata* leaf. It contains higher level of potassium (3.36 ± 0.04 g/ 100 g) than the highly valued *Moringa oleifera* leaf with 1.13 g/ 100 g potassium [13]. Less than 25 g of the leaf could also provide the 800 mg recommended dietary allowance/ adequate daily potassium dietary intake for adult human reported [24]. Potassium has been implicated as the principal cation in intracellular fluid and functions in acid-base balance, regulation of osmotic pressure, conduction of nerve impulse, muscle con-

traction particularly the cardiac muscle, cell membrane function and Na⁺/K⁺-ATPase. Potassium is also required during glycogenesis. It also helps in the transfer of phosphate from ATP to pyruvic acid and probably has a role in many basic cellular enzymatic reactions[25]. This leaf could be a good source of potassium.

The level of calcium in *F. exasperata*, 1.13 ± 0.02 g/100g was higher than the value reported for *Vernonia amygdalina* 1,010 mg/ 100g [26]. Calcium functions as constituent of bones and teeth, regulation of nerve and muscle function. In blood coagulation, calcium activates the conversion of prothrombin to thrombin. It activates large number of enzymes such as adenosine triphosphatase, succinic dehydrogenase and lipase and also required for membrane permeability, normal transmission of nerve impulses and in neuromuscular excitability. Reduced extracellular blood calcium increases the irritability of nerve tissue and very low levels may cause spontaneous discharge of nerve impulses leading to tetany and convulsions [27].

The result also revealed 220.31± 13.07 mg/kg of manganese which was higher than 84.35 ± 0.18mg/kg reported for *Clerodendrum volubile* [28] and 81.65± 2.31ppm for *Moringa oleifera* [13]. Manganese has antioxidant properties that are important for proper food digestion and for normal bone structure. It is also a cofactor in the function of antioxidant enzymes such as superoxide dismutase [28]. *F. exasperata* leaves could therefore serve as a potential source of the antioxidant. Iron was also quantified in the leaf. The quantity was higher than 9.55 ± 0.28 mg/kg reported for *Clerodendrum volubile* [28]. Iron is useful in prevention of anemia and other related diseases.

Copper is another element detected in *F. exasperata* leaves. Copper has been reported to be constituent of enzymes like Cytochrome *c* oxidase, amine oxidase, catalase, peroxidase, ascorbic acid oxidase, plasma monoamine oxidase, erythrocyprin, lactase, uricase and plays role in iron absorption. Also it is an essential micronutrient for haematologic and neurologic systems [29]. The concentration of copper in *F. exasperata*, 104.13 mg/kg was higher than the range of 8.71 to 15.06 mg/kg quantified in various vegetables [leek (*Allium ampeloprasum*), sweet basil (*Ocimum basilicum*), parsley (*Petroselinum crispum*), garden cress (*Lepidium sativum*) and tarragon (*Artemisia dracuncululus*)] cultivated around Sanandaj City in Iran [30]. Clinical deficiencies associated with copper are aneamia, bone disorders, neonatal ataxia, depigmentation and abnormal growth of hair, fur or wool, impaired growth and reproductive system [31]. Thus, the leaf could serve as nutrient source in the prevention of these disorders.

Table 3 revealed that *F.exasperata* leaves contained tannin (123 mg/ 100g), saponin (44.50 mg/ 100g), alkaloid (48.8 mg/ 100g) and phytate (5.92 mg/ 100g). The levels of these secondary metabolites/ anti-nutrients were low in the leaf com-

pared to the reported low levels of tannins (21.19 g/ 100g ± 0.25), phytates (2.57 g/ 100g ± 0.13), saponins (1.6 g/ 100g ± 0.05), oxalates (0.45 g/ 100g ± 0.01) in *Moringa oleifera* leaves [12]. Some of these metabolites were also reported to have beneficial effect; phytate is an anticarcinogenic that protect against colon cancer and it is known to be a potential antioxidant that inhibit fenton reactions leading to lipid peroxidation and inhibition of polyphenol oxidase [32]. Alkaloids are also use in the pharmaceutical industries in the production of analgesic, owing to its analgesic properties [33]. *F. exasperata* could also be a potential source of analgesic.

Table 3. Level of some antinutrient components in *F. exasperata* leaves.

Anti- nutrients	Concentration (mg/100g)
Tannin	122.95 ± 1.10
Saponin	44.50 ± 0.01
Alkaloid	48.80 ± 0.20
Phytate	5.92 ± 0.41

Although the distinction between medicinal plants and nutraceuticals can sometimes be vague, a primary characteristic of the latter is that nutraceuticals have a nutritional role in the diet and the benefits to health may arise from long-term use as foods (i.e. chemoprevention) [34]. In contrast, many medicinal plants exert specific medicinal actions without serving a nutritional role in the human diet and may be used in response to specific health problems over short- or long-term intervals. *F. exasperata* leaves could act both as source of food nutrients and as medicinal ingredient.

4 CONCLUSION

Ficus exasperata leaves were screened for their nutrient content, results showed that it contained high level of fibre, ash, carbohydrate, mineral elements and low level of moisture and anti-nutrient phytochemicals. These nutrients may not be strictly medicinal but could be valuable in preventing diseases that are health related. The results however support the medicinal use of the plant, and in addition, unveils the possibility of its acting as a potential source of food nutrients and nutraceuticals. The domestication of the plant should be encouraged.

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