

NUTRITIONAL PROFILING OF *FICUS MUCUSO* AND *FICUS EXASPERATA* (MORACEAE)

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ABSTRACT

Ficus mucuso and *Ficus exasperata*, two species in the Moraceae family, are known for their medicinal properties. Yet little is known about their proximate and vitamin composition. This study investigated the nutritional profiles of different plant parts using standard methods. Data were analysed using ANOVA. In *F. mucuso*, the root had the highest ash ($21.38 \pm 0.03\%$), crude fiber ($30.88 \pm 0.06\%$) and protein ($15.64 \pm 0.05\%$), while the stem had the highest moisture ($11.64 \pm 0.01\%$) and fat ($10.71 \pm 0.08\%$). Carbohydrate was highest in the leaf ($52.7 \pm 0.07\%$). In *F. exasperata*, the root had the highest moisture ($6.68 \pm 0.07\%$), ash ($14.52 \pm 0.08\%$) and fiber ($30.18 \pm 0.02\%$) while the stem had the highest protein ($8.3 \pm 0.04\%$) and fat ($5.56 \pm 0.03\%$). Carbohydrate was highest in the leaf ($60.22 \pm 0.02\%$). Vitamin analysis showed *F. mucuso* had higher vitamins A and C, especially in the leaf ($25.15 \pm 0.05 \mu\text{g/g}$ and $2.88 \pm 0.02 \text{ mg/100g}$), than *F. exasperata*. The study highlights the high nutritional potential of both species and their possible use as dietary supplements.

Key words: *Ficus mucuso*; *ficus exasperate*; nutritional value; dietary supplements

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INTRODUCTION

The genus *Ficus*, a prominent member of the family Moraceae, is globally renowned for its ecological significance, medicinal applications and economic value. Comprising over 800 species distributed in tropical and subtropical regions, *Ficus* species play a pivotal role in sustaining biodiversity and supporting food webs in various ecosystems (Berg and Corner, 2005). Among these species, *Ficus mucuso* and *Ficus exasperata* are notable for their ethnomedicinal uses and nutritional potential. However, despite their importance, the detailed nutritional composition and anatomical characteristics of these plants remain understudied.

F. mucuso and *F. exasperata* have been traditionally utilised in various African communities for their medicinal properties. *F. mucuso* is used in the treatment of diarrhoea, dysentery and wounds, while *F. exasperata* serves as a remedy for hypertension, respiratory infections and skin ailments (Olowokudejo *et al.*, 2008; Ejele and Akujobi, 2011). In addition to their therapeutic value, these

plants possess edible parts that may serve as important sources of nutrients. Proximate analysis and vitamin profiling of such plants are essential to reveal their dietary benefits and address the nutritional needs of undernourished populations, particularly in developing countries (Akinmoladun *et al.*, 2018).

Proximate analysis offers insights into the basic nutritional components of a plant, including moisture, ash, crude protein, crude fiber, crude fat and carbohydrate content. These parameters are crucial for assessing the nutritional value of edible plants and their suitability as dietary supplements (AOAC, 2016). Vitamins, as vital micronutrients, play critical roles in metabolic functions, immunity and overall health. For instance, vitamin A supports vision and skin health, while vitamin C acts as a potent antioxidant and enhances iron absorption (Combs, 2012). Understanding the distribution of these nutrients across different parts of *F. mucoso* and *F. exasperata* is important for maximising their utilisation.

Furthermore, anatomical characterisation is a key aspect of plant identification and functional biology. Anatomical studies of leaves, stems and roots provide valuable data on the structural adaptations of plants to their environment and potential applications in drug discovery and taxonomy (Metcalf and Chalk, 1979). For instance, unique anatomical features such as trichomes, vascular bundles and stomatal types often correlate with a plant's ecological adaptations and pharmacological properties (Evert, 2006).

Although *F. mucoso* and *F. exasperata* have been the subjects of ethnobotanical studies, there is a paucity of research focusing on their nutritional profiling and anatomical evaluation. This study aimed to address this gap by providing comprehensive data on the proximate composition, vitamin content and anatomical features of the leaf, stem and root of these two species.

MATERIALS AND METHODS

Study Area

This experiment was conducted in the Department of Industrial Chemistry, University of Ilorin, Kwara State, Nigeria.

Collection and Identification of Plant Materials

Plant materials of *F. mucoso* and *F. exasperata* were collected from two locations in Nigeria: Forestry Research Institute of Nigeria (FRIN), Ibadan, Oyo State (Latitude 7° 20' - 7° 25' N, Longitude 3° 51' - 3° 56' E), located within the Ibadan North West Local Government Area, and Adangba Zarumi Street, Ilorin, Kwara State (Latitude 8° 16' 0" N, Longitude 4° 20' 0" E), located within the Ilorin West Local Government Area. The plants were identified and authenticated at the Herbarium Unit of the Department of Plant Biology, University of Ilorin, where voucher specimens were deposited.

Proximate Analysis

The proximate analysis of the plant samples included the determination of moisture, crude fat, ash, crude fiber, crude protein and carbohydrate contents. Standard laboratory equipment and reagents were used as in line with established protocols.

Determination of Moisture Content

Moisture content was determined by drying pulverised plant samples (leaf, stem and root) to a constant weight at 105°C. An empty crucible was weighed, cleaned and dried. Three gram (3 g) of the moist sample was added and the weight was recorded. This was dried in an oven at 105°C for 3 hours, cooled in a desiccator and weighed. The procedure was repeated until a constant weight was achieved.

$$\% \text{Moisture} = \frac{M_{\text{initial}} - M_{\text{Dried}}}{M_{\text{initial}}} \times 100$$

Determination of Crude Fat Content

Crude fat content was analysed using the Soxhlet extraction method. Three hundred (300) mL of n-hexane was placed in a Soxhlet apparatus and heated at 60°C. Five (5) g of the sample was wrapped in filter paper and placed in the thimble. Extraction was allowed to continue for 30 minutes. The sample was dried in an oven, cooled in a desiccator and weighed. Crude fat was computed as follows:

$$\% \text{ Crude Fat Content (on dry weight basis)} = \frac{W_2 - W_3}{W_2 - W_1} \times 100 \%$$

Determination of Ash Content

Ash content was determined by incinerating the pulverised plant sample (leaf, stem and root) in a muffle furnace at 550°C. Five (5) grams of the sample was weighed into a crucible, incinerated in a muffle furnace for 5-6 hours and cooled in a desiccator and reweighed until a constant weight was achieved. The ash content was computed as follows:

$$\% \text{ Ash} = \frac{\text{Wt of sample remaining}}{\text{Wt of original sample}} \times \frac{100}{1}$$

Determination of Crude Fiber

Crude fiber was analysed by sequential boiling with acid and alkali. Two (2) g of sample was boiled in 1.25% NaOH solution for 30 minutes. Later, it was filtered, after which the residue was dried and incinerated in a muffle furnace at 550°C for 5 hours. The crude fiber was computed as follows:

$$\% \text{Crude fiber} = \frac{\text{Weight of crude fiber}}{\text{Weight of sample}} \times 100$$

Determination of Crude Protein

Crude protein was determined using the Kjeldahl method. Two (2) grams of sample was digested with sulfuric acid and catalysts (K_2SO_4 , CuSO_4 , selenium oxide). The digest was distilled and titrated with 0.01 M HCl. Crude protein was computed as follows:

$$\% \text{N} = \frac{(a-b) \times 0.01 \times 14 \times 250 \times 100}{w \times c \times 1000}$$

a= Volume (ml) of acid used in titration of the sample

b= Volume (ml) of acid used in titration of the blank

w= Weight (g) of the sample analysed

c= Normality (N) of the acid used in titration

%Crude protein= %N × 6.25

Determination of Carbohydrate Content

Carbohydrate content was determined by difference:

$$\% \text{ Carbohydrate} = 100 - (\% \text{ Moisture} + \% \text{ Crude Protein} + \% \text{ Crude Fat} + \% \text{ Ash})$$

Determination of Vitamins

Vitamins A and C were determined using standard methods of Association of Analytical Chemists (AOAC,1990).

Determination of Vitamin A (Retinol)

One gram of sample was macerated with 20 mL n-hexane. This was evaporated and reagents (acetic anhydride chloroform and 50% trichloroacetic acid) were added to it. Absorbance was measured at 620 nm.

Determination of Vitamin C (Ascorbic Acid)

About 0.5 g of sample was macerated with 10 mL 0.4% oxalic acid to which 2,6-dichlorophenol indophenol was added and absorbance was measured at 520 nm.

Statistical Analysis

Data were expressed as mean $\pm$ standard deviation. Statistical comparisons were performed using Analysis of Variance (ANOVA) test and means were separated using the Duncan's Multiple Range Test (DMRT) at 5% level of probability.

RESULTS**Proximate Composition of *Ficus exasperata***

The result presented in Table 1 shows that nutrients were present in all parts of *F. exasperata* but in varying amounts. Moisture, ash and crude fiber were highest in the root, with values of $6.68 \pm 0.07\%$, $14.52 \pm 0.08\%$ and $30.18 \pm 0.02\%$, respectively. The stem contained the highest levels of crude protein ($8.3 \pm 0.04\%$) and crude fat ($5.56 \pm 0.03\%$), while the leaf showed the highest carbohydrate content of $60.22 \pm 0.02\%$. These results suggest that different parts of *F. exasperata* could serve as valuable sources of nutrients.

Table 1. Mean proximate composition of the leaf, stem and root of *Ficus exasperata*

Plant Part	Crude Fiber (%)	Crude Fat (%)	Ash (%)	Moisture (%)	Crude Protein (%)	Carbohydrate (%)
Leaf	17.5 ± 0.02	4.07 ± 0.15	11.33 ± 0.07	3.51 ± 0.36	6.91 ± 0.03	60.22 ± 0.02
Stem	21.6 ± 0.01	5.56 ± 0.03	12.56 ± 0.05	5.58 ± 0.06	8.3 ± 0.04	57.56 ± 0.34
Root	30.18 ± 0.02	4.13 ± 0.04	14.52 ± 0.08	6.68 ± 0.07	7.1 ± 0.01	44.12 ± 0.03

Proximate Composition of *Ficus mucuso*

As shown in Table 2, all parts of *F. mucuso* contained nutrients in varying proportions. The root exhibited the highest ash ($21.38 \pm 0.03\%$), crude fiber ($30.88 \pm 0.06\%$) and crude protein content ($15.64 \pm 0.05\%$) content. The stem contained the highest levels of moisture ($11.64 \pm 0.01\%$) and crude fat ($10.71 \pm 0.08\%$), while the leaf showed the highest carbohydrate content ($52.7 \pm 0.07\%$). These findings highlight the nutritional potential of *F. mucuso* as a dietary resource.

Table 2: Proximate composition of the leaf, stem and root of *Ficus mucuso*

Plant Part	Crude Fiber (%)	Crude Fat (%)	Ash (%)	Moisture (%)	Crude Protein (%)	Carbohydrate (%)
Leaf	18.19 ± 0.01	8.56 ± 0.04	11.92 ± 0.02	9.55 ± 0.02	8.6 ± 0.03	52.7 ± 0.07
Stem	28.61 ± 0.11	11.64 ± 0.01	15.44 ± 0.02	10.71 ± 0.08	14.69 ± 0.07	29.5 ± 0.14
Root	30.88 ± 0.06	11.25 ± 0.04	21.38 ± 0.03	10.11 ± 0.05	15.64 ± 0.05	20.66 ± 0.05

Vitamin Composition

Table 3 shows that *F. mucuso* contained significantly higher amounts of vitamins A and C compared to *F. exasperata* across all plant parts. For *F. mucuso*, the highest levels of vitamin A and vitamin C were observed in the leaf (25.15 ± 0.05 mg/100g and 2.88 ± 0.02 mg/100 g, respectively). In contrast, *F. exasperata* had much less vitamin with the leaf containing 0.02 ± 0.00 mg/100 g of vitamin A and 0.09 ± 0.00 mg/100 g of vitamin C. These findings suggest that *F. mucuso* was richer in vitamin content than *F. exasperata*.

Table 3. Vitamin composition of the leaf, stem and root of *F. exasperata* and *F. mucuso* (mg/100 g)

Plant Part	<i>Ficus exasperata</i>		<i>Ficus mucuso</i>	
	Vitamin A	Vitamin C	Vitamin A	Vitamin C
Leaf	0.02 ± 0.00	0.09 ± 0.00	25.15 ± 0.05	2.88 ± 0.02
Stem	0.02 ± 0.00	0.08 ± 0.00	20.55 ± 0.05	2.10 ± 0.01
Root	0.01 ± 0.00	0.09 ± 0.00	20.35 ± 0.25	1.32 ± 0.04

DISCUSSION

Proteins play a crucial role in building and repairing body tissues, regulating physiological processes, and forming enzymes and hormones. The high crude protein content observed in the stem of *F. exasperata* ($8.3 \pm 0.04\%$) and the root of *F. mucuso* ($15.64 \pm 0.05\%$) highlights their potential nutritional value for human and animal consumption. This finding aligns with Isong and Essien (1990), who emphasised the nutritional significance of protein-rich plant materials. The elevated ash content, particularly in the roots of both species, underscores their utility in maintaining dietary quality and balancing the acid-alkaline environment of the bloodstream.

The high fiber content in both *Ficus* species, especially in the roots (*F. exasperata*: $30.18 \pm 0.02\%$; *F. mucoso*: $30.88 \pm 0.06\%$), indicates their potential for promoting digestive health. Dietary fiber is essential for maintaining intestinal regularity, preventing constipation and aiding in toxin elimination, as reported by Bello *et al.* (2015). Their findings underscore the importance of high-fiber vegetables in improving bowel consistency and supporting overall gut health.

Moisture content significantly affects the storage and processing of food products. The higher moisture levels found in the root of *F. exasperata* ($6.68 \pm 0.07\%$) and the stem of *F. mucoso* ($11.64 \pm 0.01\%$) suggest that these parts may be more susceptible to spoilage and enzymatic degradation than the drier leaves and roots of *F. mucoso*. This observation aligns with earlier studies by Dorman *et al.* (2000) and Ilodibia *et al.* (2014), who reported that high moisture content accelerates food spoilage and reduces shelf-life.

The results revealed that the leaves of both *Ficus* species had the highest vitamin content, with *F. mucoso* containing a significantly higher concentration of vitamins A (25.15 ± 0.05 mg/100 g) and C (2.88 ± 0.02 mg/100 g) compared to *F. exasperata*. This suggests that *F. mucoso* leaves are a superior source of these essential nutrients. Vitamin A is vital for vision, while vitamin C supports immune function, promotes iron absorption and acts as a potent anti-oxidant. These findings align with Ilodibia *et al.* (2016), who reported similar trends in the vitamin composition of *Gomphrena celosioides*.

The nutritional profile of *Ficus* species, including their high fiber, protein, and vitamin content, highlights their potential as valuable dietary resources. These attributes make them suitable for various health and nutritional applications, particularly as sources of essential nutrients and bioactive compounds.

In conclusion, this study. This study has detailed comparative analysis of the proximate and vitamin composition of *F. exasperata* and *F. mucoso*, highlighting their potential as nutrient-rich plants for human and animal consumption. It identified the roots of both species as excellent sources of dietary fiber and the stems and roots as valuable protein sources, thus supporting their inclusion in dietary interventions. *Ficus mucoso* has been identified as a superior source of vitamins A and C, particularly in its leaves, underscoring its potential role in combating vitamin deficiencies. The parts of the plant with higher moisture content (e.g., roots and stems) are more prone to spoilage, offering insights into post-harvest handling and processing. The study supports and expands upon existing literature regarding the nutritional importance of *Ficus* species, further contributing to their potential application in food and health industries.

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