© AUG 2026 | IRE Journals | Volume 10 Issue 2 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV10I2-1722391

# Proximate Composition, Vitamin, Mineral, and Phytochemical Profile of Adansonia digitata (Baobab) Leaves

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***Abstract-*** ***Adansonia digitata L. (baobab), a multipurpose indigenous tree of sub-Saharan Africa, is widely consumed and used in traditional medicine, yet its nutritional and phytochemical value is often documented only anecdotally. This study evaluated the proximate composition, vitamin content, mineral content, and qualitative and quantitative phytochemical constituents of A. digitata leaves collected in Mubi, Adamawa State, Nigeria, using standard AOAC and phytochemical screening procedures. Proximate analysis showed that the leaves were predominantly carbohydrate (43.69%) and crude protein (27.73%), with moderate crude fibre (13.24%), ash (5.67%), low moisture (6.62%) and fat (3.57%) contents. Vitamin analysis revealed high concentrations of vitamin C (43.54 mg/100 g), with vitamin A, vitamin K, and B-complex vitamins present in smaller amounts. Mineral analysis showed potassium (622.46 mg/100 g), calcium (325.37 mg/100 g), and phosphorus (217.34 mg/100 g) as the most abundant elements, alongside magnesium, iron, and zinc. Qualitative screening confirmed the presence of tannins, alkaloids, flavonoids, phytates, and glycosides, while steroids were not detected; quantitative analysis showed phytates (23.23 g/100 g) and flavonoids (12.57 g/100 g) as the dominant phytochemicals. These findings confirm that A. digitata leaves are a nutrient-dense, phytochemically rich plant material with demonstrable potential as a functional food ingredient and a source of bioactive compounds for nutraceutical and pharmaceutical development. Further toxicological and pharmacological studies are recommended before large-scale therapeutic application.***

***Keywords: adansonia digitata, baobab leaves, proximate composition, phytochemical screening, vitamins, minerals***

## I. INTRODUCTION

Adansonia digitata L., commonly known as the baobab tree, is one of the most economically and medicinally important indigenous tree species in Africa. It belongs to the family Malvaceae and is widely distributed across the semi-arid and savannah regions of sub-Saharan Africa, including Nigeria (Dogara & Al-Zahrani, 2024). The tree is popularly referred to as the "tree of life" because almost every part of it — leaves, fruit, seeds, bark, and roots — is used for food, traditional medicine, livestock feed, cosmetics, and industrial applications.

The growing global preference for natural, functional foods has intensified research interest in medicinal plants with high nutritional and pharmacological potential (Srivastava et al., 2024). Medicinal plants rich in secondary metabolites such as flavonoids, alkaloids, tannins, saponins, phenolic compounds, glycosides, and terpenoids are increasingly valued as resources for drug discovery and nutraceutical development, owing to their antioxidant, antimicrobial, anti-inflammatory, antidiabetic, anticancer, and cardioprotective activities (Dogara & Al-Zahrani, 2024). Proximate analysis — the determination of moisture, crude protein, crude fat, crude fibre, ash, and carbohydrate content — remains one of the most widely used methods for assessing the nutritional quality of such plant materials, while phytochemical analysis identifies and quantifies the bioactive secondary metabolites responsible for their medicinal properties (Sodimu et al., 2020).

Despite its widespread consumption and traditional medicinal use across Africa, the utilization of A.

digitata remains largely based on indigenous knowledge with limited local scientific validation. Because environmental conditions, geographic location, and soil characteristics influence the nutritional and phytochemical composition of plants, findings from one locality cannot be safely generalized to another (Sodimu et al., 2020). Given the rising demand for scientifically validated, nutrient-dense plant materials to address malnutrition and support nutraceutical development, this study was undertaken to determine the proximate composition, vitamin content, mineral content, and phytochemical constituents of A. digitata leaves sourced from Mubi, Adamawa State, Nigeria, thereby generating locality-specific evidence for their nutritional value and medicinal potential.

## II. MATERIALS AND METHODS

### 2.1 Study Design and Sample Collection

This study adopted an experimental laboratory design. Fresh leaves of A. digitata were collected from selected locations within Mubi, Adamawa State, and authenticated by a plant taxonomist in the Department of Biomedical and Pharmaceutical Technology, Federal Polytechnic Mubi. Samples were transported to the laboratory in clean polyethylene bags for processing.

### 2.2 Sample Preparation and Extraction

The leaves were washed with distilled water to remove debris, air-dried under shade at room temperature to constant weight, and pulverized into fine powder using an electric grinder. The powder was stored in airtight containers until analysis. For phytochemical screening, approximately 50 g of powdered sample was extracted with 250 mL of ethanol in a Soxhlet apparatus for about six hours (Harborne, 1998); the extract was concentrated on a water bath and stored in an airtight container until use.

### 2.3 Proximate Analysis

Proximate composition was determined according to standard AOAC (2023) procedures. Moisture content was determined by oven-drying at 105 °C to constant weight; ash content by incineration in a muffle furnace at 550 °C for approximately four hours; crude protein by the Kjeldahl method (nitrogen × 6.25); crude fat by Soxhlet extraction with n-hexane; and crude fibre by successive acid–alkali digestion of the defatted sample. Carbohydrate content was obtained by difference: % carbohydrate = 100 − (% moisture + % protein + % fat + % ash + % fibre).

### 2.4 Vitamin and Mineral Analysis

Vitamin content was determined using standard analytical procedures, with extracted vitamins quantified by high-performance liquid chromatography (HPLC) and/or spectrophotometry, and results expressed as mg/100 g. For mineral analysis, 1 g of powdered sample was digested with concentrated nitric acid, and the digest was filtered and made up to volume with deionized water. Calcium, magnesium, iron, zinc, potassium, and phosphorus concentrations were determined by atomic absorption spectrophotometry (AAS).

### 2.5 Qualitative and Quantitative Phytochemical Screening

Qualitative screening of the ethanolic extract for alkaloids, flavonoids, tannins, glycosides, steroids, and phytates was carried out using standard methods (Harborne, 1998; Sofowora, 2008; Trease & Evans, 2009). Alkaloids were detected using Wagner's reagent (reddish-brown precipitate); flavonoids by the sodium hydroxide/dilute hydrochloric acid colour test; tannins by ferric chloride solution (blue-black/greenish-black colouration); glycosides by the Keller–Kiliani-type ferric chloride–acetic acid–sulphuric acid test (brown ring); steroids by the Salkowski test (reddish-brown ring in chloroform – concentrated sulphuric acid); and phytates by ferric chloride precipitation (white precipitate). Quantitative determination of the same phytochemical classes was carried out gravimetrically/colorimetrically and expressed as g/100 g of sample. Results were expressed as mean values and summarized descriptively; findings were compared with values reported in the existing literature.

## III. RESULTS

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Table 1: Proximate Composition of A. digitata Leaves (% Dry Weight)

| Parameter | Mean value (%) |
|---|---|
| Crude protein | 27.73 |
| Fat | 3.57 |
| Crude fibre | 13.24 |
| Ash | 5.67 |
| Moisture | 6.62 |
| Carbohydrate | 43.69 |

Carbohydrate was the dominant proximate component (43.69%), followed by crude protein (27.73%) and crude fibre (13.24%). Ash content (5.67%) reflects an appreciable mineral fraction, while the low moisture content (6.62%) suggests good storage stability. Fat content was lowest (3.57%), indicating that the leaves are naturally low in lipids.

Table 2: Vitamin Content of A. digitata Leaves (mg/100 g unless stated)

| Vitamin | Mean value |
|---|---|
| Vitamin A (µg/100 g) | 24.46 |
| Vitamin B1 | 0.63 |
| Vitamin B2 | 2.23 |
| Vitamin B6 | 1.32 |
| Vitamin B9 | 0.33 |
| Vitamin C | 43.54 |
| Vitamin D | 3.20 |
| Vitamin E (µg/100 g) | 1.85 |
| Vitamin K (µg/100 g) | 12.16 |

Vitamin C occurred in the highest concentration (43.54 mg/100 g), followed by vitamin A (24.46 µg/100 g) and vitamin K (12.16 µg/100 g). Vitamins B2, B6, D, and E were present in moderate amounts, while vitamins B1 and B9 occurred at lower concentrations.

Table 3: Mineral Content of A. digitata Leaves (mg/100 g)

| Mineral | Mean value |
|---|---|
| Potassium (K) | 622.46 |
| Calcium (Ca) | 325.37 |
| Phosphorus (P) | 217.34 |
| Magnesium (Mg) | 186.24 |
| Iron (Fe) | 22.53 |
| Zinc (Zn) | 8.24 |

Potassium was the most abundant mineral (622.46 mg/100 g), followed by calcium (325.37 mg/100 g) and phosphorus (217.34 mg/100 g). Magnesium was also present in appreciable quantity (186.24 mg/100 g), while iron (22.53 mg/100 g) and zinc (8.24 mg/100 g) occurred at lower concentrations.

Table 4: Qualitative Phytochemical Screening of A. digitata Leaves

| Phytochemical | Result |
|---|---|
| Phytates | +++ |
| Tannins | ++ |
| Alkaloids | ++ |
| Flavonoids | ++ |
| Glycosides | + |
| Steroids | − |

Key: +++ = highly present; ++ = moderately present; + = slightly present; − = not detected.

Phytates were the most prominent phytochemical detected (+++); tannins, alkaloids, and flavonoids were moderately present (++); glycosides were slightly present (+); and steroids were not detected.

Table 5: Quantitative Phytochemical Composition of A. digitata Leaves (g/100 g)

| Phytochemical | Mean value |
|---|---|
| Phytates | 23.23 |
| Tannins | 13.43 |
| Flavonoids | 12.57 |
| Alkaloids | 9.27 |
| Glycosides | 7.35 |
| Steroids | 0.0017 |

Consistent with the qualitative screening, phytates recorded the highest concentration (23.23 g/100 g), followed by tannins (13.43 g/100 g), flavonoids (12.57 g/100 g), alkaloids (9.27 g/100 g), and glycosides (7.35 g/100 g). Steroids were quantified at a negligible level (0.0017 g/100 g).

## IV. DISCUSSION

The high carbohydrate and protein content of A. digitata leaves indicates that they are a valuable source of dietary energy and plant protein, particularly for communities where plant-based foods dominate the diet. The relatively high crude fibre content suggests a role in promoting healthy digestion, while the low moisture content implies good shelf stability and reduced susceptibility to microbial spoilage. These findings are consistent with earlier reports that A. digitata leaves possess high carbohydrate, protein, fibre, and mineral contents (Chadare et al., 2009; Moyo et al., 2013; Muthai et al., 2017).

The prominence of vitamin C confirms the well-documented antioxidant potential of baobab and supports its traditional use for immune support and wound healing, consistent with reports identifying baobab as one of the richest natural sources of vitamin C (Brady, 2011; Gebauer et al., 2016; Cuni Sanchez et al., 2021). The appreciable levels of potassium, calcium, and phosphorus point to a role in electrolyte balance, cardiovascular function, and bone health, while iron and zinc support haemoglobin synthesis, immune response, and enzymatic activity — findings that corroborate those of Osman (2004) and Addy et al. (2022) on the mineral richness of baobab.

The phytochemical screening detected tannins, alkaloids, flavonoids, phytates, and glycosides, all of which are associated with antioxidant, antimicrobial, anti-inflammatory, antidiabetic, and anticancer activities, lending scientific support to the traditional medicinal use of A. digitata. The absence of steroids may reflect geographical or environmental variation, or differences in extraction method, and is consistent with the variability reported by Sodimu et al. (2020) across sampling locations. The predominance of phytates and flavonoids in the quantitative analysis is noteworthy: while phytates are traditionally regarded as antinutritional factors owing to their mineral-chelating activity, they have also been credited with antioxidant, anticancer, and cardioprotective properties, suggesting a dual nutritional and pharmacological relevance that merits further investigation (Dogara & Al-Zahrani, 2024).

Overall, the results reinforce the view that the nutritional and therapeutic value of baobab leaves derives from a synergistic combination of macronutrients, micronutrients, and bioactive phytochemicals (De Caluwé et al., 2010), and they provide locality-specific evidence to complement findings previously reported from other parts of Africa.

## V. CONCLUSION

Adansonia digitata leaves collected from Mubi, Adamawa State, were found to be nutritionally dense, with appreciable carbohydrate, protein, fibre, vitamin, and mineral contents, alongside a diverse profile of bioactive phytochemicals dominated by phytates, flavonoids, and tannins. These findings validate the traditional nutritional and medicinal use of the plant and support its potential application as a functional food ingredient and a source of raw material for nutraceutical and pharmaceutical development.

## VI. RECOMMENDATIONS

Based on these findings, it is recommended that: (i) A. digitata leaves be promoted as a nutritious food supplement, particularly in communities affected by malnutrition and micronutrient deficiency; (ii) pharmaceutical and nutraceutical industries further investigate the isolated bioactive compounds for the development of herbal medicines and natural antioxidant products; (iii) comprehensive toxicological and pharmacological studies be conducted to establish safety, efficacy, and appropriate dosage before large-scale medicinal use; and (iv) sustainable harvesting and conservation of A. digitata be encouraged to safeguard its continued availability.

Acknowledgement
The Authors wishes to acknowledge Tetfund Nigeria for sponsoring this research work.

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