Continental J. Applied Sciences
Osuagwu and Osuagwu (2022) 17 (1): 22 – 36 Doi: 10.5281/zenodo.7750289

**Research Article**

# Chemical Composition and Phytochemical Screening of *Spondias mombin* Leaves

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## Abstract

*The phytoconstituents, proximate and mineral assessments of Spondias mombin leaves were studied. Standard techniques were used to determine the proximate and phytochemicals, and an air acetylene flame-equipped Atomic Absorption Spectrophotometer was used to assess the mineral constituents. The samples' proximate analysis revealed that they were composed primarily of crude fiber (3.34%), crude lipid (7.24%), crude protein (17.65%), ash (7.96%), moisture (0.18%), and carbohydrate (63.64%). The leaves' phytochemical study revealed the presence tannins, steroids, terpenoids, alkaloids, flavonoids, and saponins. Chromium (0.28 mg/100g), calcium (126.50 mg/100g), cadmium (0.36 mg/100g), copper (0.26 mg/100g), zinc (076 mg/100g), magnesium (11.32 mg/100g), nickel (0.08 mg/100g), manganese (1.01 mg/100g), iron (0.31 mg/100g), and cobalt (0.05 mg/100g) were all minerals found in the samples. According to the study, Spondias mombin leaves may contain nutritional constituents and traditional remedies.*

**Keywords**: Terpenoids, Atomic Absorption Spectrophotometer, Manganese, Crude lipid, Phytoconstituents, Antiepileptic, Wound healing.

Received: 14 July 2022 Accepted: 12 October 2022


**ISSN: 1597 – 9928. Science and Education Development Inst., Nigeria**

## Introduction

The use of plants has increased over the past number of years to become one of the most widespread sources of complementary treatments (Lai and Roy, 2004). Studies have shown that people living in Sub-Saharan Africa are almost completely dependent on folk medical practices as a source of their primary health care needs (Moyo et al., 2015; James et al., 2018). This may probably be attributed to such challenges as limited availability and affordability, and ease of accessibility of pharmaceutical drugs. Numerous plants have been used as medicines for thousands of years, playing a crucial role in the discovery of new as well as improved versions of already existing drugs (Newman and Cragg, 2007). Different parts of plants from different parts of the world have been used as essential components in the management of various sorts of ailments in many indigenous communities, and Africa is no exception to this (Masaiti et al., 2019).

*Spondias mombin* is a tree, a species of flowering plant that belongs to the family Anacardiaceae (Elujoba, 1999). It grows in the rain forest and in the coastal area. It can reach a height of 15-22m.The fruit is oval yellow plum and has a leathery skin with a very exotic taste. The young leaves taste slightly bitter and sour (Ibewike et al., 1997). The tree is found in America, India, Bangladesh, Nigeria, Ghana, Sri Lanka, Thailand, Indonesia, Ivory Coast, Sierra Leone, Congo, Brazil, Mexico, and Asia. The bark is used as a purgative and in local applications for leprosy. It is also used for severe cough, and for dressing circumcision wound. The leaves are used for swollen face, common cough, laxative, fever, gonorrhea, worms, Eye lotion, stomach troubles, paralysis, inflammation, diarrhea, and venereal diseases. The extracts of *Spondias mombin* have been tested to be used as antiepileptic, antipsychotic, antiviral, antiageing, antibacterial, antidiarrhoea, antifertility, antihelmintic, antiinflammation, antimalarial, antioxidant, hypnotics, purgative, sedative and wound healing (Villegas et al., 1997; Pauly and Fleury, 2002; Ayoka et al., 2006). Evaluation of the toxicological effects of *Spondias mombin* in adult male Wister rats was carried out, and this revealed that the use of the leaf extracts of *Spondias mombin* is relatively safe, though hepatic and renal toxicity may occur with prolonged use (Oaitan et al., 2012). Also, the evaluation of *Spondias mombin, Senna occidentalis* and *Musa sapientum* against vibrio cholerae in experimental mice has been carried out, and this revealed that the aqueous extracts of *Spondias mombin and Senna occidentalis* are good alternatives in the treatment of epidemic cholera Shittu et al., 2014).


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## Literature Review

Table 1: Literatures consulted in the Study

| S/N | Country | Study | Results | References |
|---|---|---|---|---|
| 1 | Sudan | Phytochemical analysis of leaves extracts of *Eucalyptus camaldulensis* Dehnh | Tannins, sterol, triterpenoids, saponins, flavonoids, and phenolic compounds were found as a consequence of the phytochemical screening. Alkaloids, Anthraquinone glycoside, and Cyanogenic glycoside were completely absent. Several biologically active substances are found in *Eucalyptus camaldulensis* plants, which may support their widespread medical applications. | Shayoub et al. 2015 |
| 2 | Zambia | Phytochemical Analysis of Leaf, Stem Bark, and Root Extracts of *Cassia abbreviata* Grown in Zambia | The stem bark and roots included significant amounts of tannins, reducing sugars, and sterols, according to the phytochemical examination of the ethanolic extracts. High amounts of proteins, flavonoids, and phenolics were found in the stem bark, whereas the leaves and roots included anthraquinones, glycosides, and alkaloids. | Kabuka et al., 2022. |
| 3 | Nigeria | Evaluation of the Chemical Compositions of the Leaf of *Spondias mombin* Linn from Nigeria | In particular, total carbohydrate (68.92 2.00%), moisture (15.13 0.57%), crude protein (11.04 0.71%), crude fiber (10.51 0.84%), and crude fat (4.82 0.34%) were found to be abundant in the leaves, whereas ash content was minimal (0.09 0.009%). The leaves also include the minerals calcium (10.85 0.14 mg/100 g), potassium | Igwe et al., 2010 |


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|---|---|---|---|---|
| | | | (9.50 0.36 mg/100 g), sodium (0.85 0.01 mg/100 g), magnesium (0.39 0.03 mg/100 g), phosphorus (1.10 0.03 mg/100 g), se (0.24 0.02 mg/100 g), ferrous (0.09 0.009 mg/100 g), manganese (0. The results suggest that *S. mombin* leaves may be a source of phytomedicine and extremely nutritious feed. Considering the various ethnopharmacological uses of the plant in various parts of the world, they are of nutritional, clinical, and veterinary value. | |
| 4 | Nigeria | Phytochemical Screening of the root, bark, and leaves of a flamboyant tree in Nigeria. | Tannins, saponins, sugars, glycosides, resins, paleobotanicals, alkaloids, and flavonoids were all detected in the samples using a straightforward quantitative procedure. | Abulude et al., 2014 |
| 5 | Zambia | Phytochemical analysis and antibacterial activity of *Azadirachta indica* leaf extracts against Escherichia coli. | The phenolic compounds, tannins, and steroids found in the ethanolic and aqueous extracts of A. indica were contrasted with the presence of flavonoids, phenolic compounds, tannins, saponins, and alkaloids in the aqueous extract. | Hikaambo et al. (2022) |
| 6 | Ivory Coast | Phytochemical analysis and ovicidal activity of Cassia sieberiana, Guiera senegalensis and Excoecaria grahamii extracts | The phytochemical study of the root bark, leaves, and leaves' extracts of *C. sieberiana, G. senegalensis,* and *E. grahamii* showed the presence of anthocyanosides, tannins, saponosides, reducing chemicals, carbohydrates, flavonoids, and triterpenic steroids. The hatching of H. contortus eggs was considerably reduced by all extracts (p 0.05). The percentages of inhibition ranged from 60.33 | Traore et al., 2017 |

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| | | | 8.43 to 76.6 4.91% at the dose of 14.25 mg/mL. These findings support the use of the investigated plants for the treatment of gastrointestinal parasite infections by demonstrating that they have anthelminthic properties. | |
| 7 | India | Phytochemical analysis and Antibacterial properties of *Azadirachta Indica* (Neem) leaves extract against E. coli. | The maximum bacterial growth inhibition against E. coli strains by the acetone extract was 58.77%. As a result, the *Azadirachta indica* leaf and other plant components are used for a variety of purposes, including as an antibacterial and antioxidant in powder, tablet, and micro solution form. | Sahrawat et al. (2018) |
| 8 | Nigeria | Phytochemicals and Anti-Microbial Properties of Neem (*Azadirachta indica*) Seed Oil Extract | Phytochemical analysis on the oil showed the presence of triterpenes within which the main ingredient azadirachtin was found while the anti-microbial analysis carried out on the oil indicated a high inhibition zone on fungal microbes – *Candida albicans* and *Rhizopus* which cause Candidiasis and ketoacidosis in man which can be fatal. Hence drugs can be formulated in treating such diseases from the neem oil. | Ojewumi et al., 2022 |
| 9 | Italy | Phytochemical analyses and pharmacological screening of Neem oil | Low toxicity and significant lipase and tyrosinase enzyme inhibitory effectiveness were shown for neem seed oil. Furthermore, anti-leishmanial and anti-malarial actions were seen, however there was little to no activity against strains of Helicobacter pylori, Candida, or Malassezia. Overall, these results support the use of this natural remedy in some illness therapies and support its | Cesa et al., 2019 |

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|---|---|---|---|---|
| | | | application in traditional medicine. | |
| 10 | Brazil | Phytochemical study and anti-inflammatory and antioxidant potential of *Spondias mombin* leaves | At doses of 100, 200, 300, and 500 mg/kg, this extract exhibited antiinflammatory effects; however, the results from the ethyl acetate fraction at 200 mg/kg were particularly noteworthy. The migration of leukocytes to the site of inflammation was likewise prevented by ellagic acid and chlorogenic acid (2.5, 5 and 10mg/kg). When tested in several tests, the extract, fractions, and compounds demonstrated considerable antioxidant capability. The findings of this study point to the leaf extract of *S. mombim's* anti-inflammatory potential in a peritonitis model produced by carrageenan. Moreover, antioxidant capabilities coupled with a lack of cytotoxicity in cell culture were noted. More in vivo investigations are required to establish the anti-inflammatories efficacy of *S. mombin* and its putative anti-inflammatory modes of action. | Cabral et al., 2016 |

Despite these medicinal uses for the leaves, nothing is known about their chemical makeup (proximate and elemental compositions). If the results of the nutritional research are established, it won't be out of place. Determining the phytoconstituents, proximate, and mineral compositions of *Spondias mombin* leaves taken in Owerri, Imo State, Nigeria, was the goal of this study.


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## Materials and Methods

### Collection of plant material

The leaves of *Spondias mombin* were gathered at Owerri, Imo State, Nigeria. The plant was verified in the Department of Biological Sciences herbarium at Ahmadu Bello University in Zaria, Nigeria. Before being chopped using a mortar and pestle and processed into a fine powder with an electric blender, labeled, and kept in an airtight sample container for laboratory results, the leaves were cleaned, sun-dried individually for three weeks, and then thoroughly ground.

### Preparation of extracts for phytochemical analysis

For the extraction of the powdered leaves of *Spondias mombin,* hexane, ethanol, and ethyl acetate were employed as solvents. The preparation of leaf extracts involved soaking 10g of each powdered sample in 750 $cm^3$ of each solvent (hexane, ethanol, and ethyl acetate) and mechanically shaking the mixture for three hours. The extracts were then filtered using filter sheets (Abulude, 2001). The filtrates were kept at room temperature in a variety of plastic containers before examination.

### Proximate analysis

Using the soxhlet technique and petroleum ether (40–60 $^oC$) for 8 hours, crude fat was extracted. The microkjeldahl technique was used to calculate the crude protein content. They were assessed using the AOAC's recommended standard procedures, together with the amounts of carbohydrates, crude fiber, ash, and moisture (AOAC, 1990). After doing the analysis three times, the average values were determined.

### Phytochemical analysis

The phytochemical analysis was carried out on the hexane, ethanol and ethyl acetate extracts using standard methods ( Sofowora 1993; Uzama, 2009).

### Phytochemical analyses were done using the following methods:

(i) Test for Carbohydrates using Fehling's Test. In a test tube, 5 mL of Fehling A and B mixture was added to 2 mL of each extract. The mixture was then boiled for 2 minutes. Copper oxide precipitation in the form of bricks was observed.

(ii) Test for Tannins. To 1 ml of extract, two drops of $FeCl_3$ (5%) were added. Each extract produced a dirty-green precipitate.

(iii) Test for Glycosides. In a test tube, 10 mL of $H_2SO_4$ (50%) was added to 1 mL of each extract. For 5 minutes, the mixture was immersed in boiling water. Fehling solutions A


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and B (10 mL) were added and boiled. A brick-red precipitate was observed, indicating the presence of glycosides.

(iv) Test for Saponins using a frothing test. In a test tube, 2 mL of each extract was vigorously shaken for 2 minutes. There was frothing, indicating the presence of saponins.

(v) Test for Resins. Each extract received a 5 mL of copper solution addition. The resulting solution was vigorously shaken and allowed to separate. A green precipitate was observed, indicating the presence of resin.

(vi) Test for Phlobatannins. 5 mL of distilled water was added to 5cm$^3$ of each extract and boiled for 2 minutes with 5 mL of HCl (1%). There was no visible reaction, indicating the absence of phlobatannins.

(vii) Test for Flavonoids. 2 mL of extract was heated in a water bath with 10 cm$^3$ ethyl acetate and cooled. The layers were separated and the colour of the $NH_3$ layer was noted (red coloration formed).

(viii) Test for Alkaloids. In each test tube, 1 mL of HCl (1%) was added to 3 mL of extract. A few drops of Mayer's reagent were added to each extract. The presence of alkaloids was indicated by the presence of a creamy white precipitate

(ix) Test of sterols and triterpenes: The powder plant material (1g) will be macerated with petroleum ether (60-80 ºC) 20 mL for 6 hour, filtered and the ether will be evaporated to dryness. The residue was dissolved in acetic anhydride (2 mL), transferred to a test tube and cautiously, concentrated sulphuric acid will be poured along the side of the tube. Possible presence of sterols and /or triterpenes is indicated by the immediate appearance of violet colour in case of triterpenes which changes to green on standing in case of sterol.

**Mineral analysis**

A portion, 2g of the ground sample was incinerated in a muffle furnace at 600 C for 3 hours. The ash 0 obtained was cooled, dissolved in 5ml of 6N HCl and allowed to stand for 30 minutes. It was later filtered and its volume made up to 50ml with deionized water. The resulting extract was used for the determination of Chromium, Calcium, Cadmium, Copper, Zinc, Magnesium, Nickel, Manganese, Cobalt, and Iron by the use of an atomic absorption spectrophotometer (GBC Avanta ver 2.02 model, Australia) equipped with air-acetylene flame (Pearson, 1976).


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**Statistical analysis**

Results were expressed as the mean ± standard deviation. The data was analysed using student's t-test. P>0.05 was considered significant.

## Results and Discussions

**Phytochemical analysis**

The results of the phytochemical analysis are shown in Table 1. This revealed the presence of saponins, alkaloids, tannins, steroids, terpenoids, resins, balsams and volatile oils in hexane extract. Saponins, tannins, and terpenoids in the ethanol extract, while saponins, flavonoids, tannins, steroids, and terpenoids were present in the ethyl acetate extract. The result compared with the results of Abulude et al. (2022) on the stem and leaves of *Theobroma cocoa* obtained in Akure, Ondo State, Nigeria and that of flamboyant tree (root, bark, and leaves) (Abulude et al., 2014). The alkaloids, resins and tannins detected in the leaf extracts possess medicinal properties. The presence of saponins in the ethanol extract means that the extract can exhibit cytotoxic effect and growth inhibitions against a variety of cells, making the plant to possess anti-inflammatory and anticancer properties. It may also be used for Tumour inhibiting activity on animals (Akindahunsi and Saulawa (2005).

**Table 1: Phytochemical analysis of the leaves of *Spondias mombin* in different solvent extracts**

| Phytochemical Constituent | Hexane Extract | Ethanol Extract | Ethyl Acetate |
|---|---|---|---|
| Saponins | + | + | + |
| Alkaloids | + | - | - |
| Flavonoids | - | - | + |
| Tannins | + | + | + |
| Steroids | + | - | + |
| Glycosides | - | - | - |
| Terpenoids | + | + | + |
| Resins | + | - | - |


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**Proximate analysis**

The result of the proximate analysis of *Spondias mombin* leaves is given in Table 2. The result shows that it contains moisture (0.18%), crude lipid (7.24%), crude protein (17.65%), crude fibre (3.34%), ash (7.96%) and carbohydrate (63.64%). Moisture has the least value while carbohydrate has the highest. The high value of the carbohydrate implies that the leaves could serve as source of energy. The carbohydrate content (63.64%) of the leaves is low compared to some other leafy vegetables like *Corchorus tridens* (88.50%) and *Securinega virosa* (64.25%) but higher than *Tribulus terresiris* "Tsaida" (55.67%). The low moisture content of the leaves would hinder the growth of micro-organism and storage life would be high (Iniaghe et al, 2009). The moisture content (0.18%) of *Spondias mombin* leaf is the least compared to that of *Securinega virosa* (10.88%) and a *Calypha huspida* (11.02%) (Uzama et al., 2012). The ash content (7.96%) indicates that the leaves are rich in mineral elements. It has higher value compared to sweet potatoes (1.80%) and *Tribulus terrestris* leaves (5.00%). Crude lipids are also sources of energy. A diet providing 1-2% of its energy as fat is sufficient in human beings as excess may lead to certain cardiovascular disorders. The *Spondias mombin* leaves have a crude lipid (7.24%) which is lower than that of water spinach (11.00%) and *Senna obtusfolia* leaves (12.00%). The *Spondias mombin* leaves could serve as a source of protein with a crude protein of 17.65%.

**Table 2: Proximate analysis of *Spondias mombin* leaves**

| Components | Values (%, n = 3) |
|---|---|
| Moisture | 0.18 |
| Crude Fat | 7.24 |
| Crude Protein | 17.65 |
| Crude Fibre | 3.34 |
| Ash | 7.96 |
| Carbohydrate | 63.64 |

**Mineral analysis**

The result of mineral analysis is given in Table 3. *Spondias mombin* leaves contain 0.31mg/100g of iron. Iron is essential trace element for haemoglobin formation, normal functioning of the central nervous system and oxidation of carbohydrates, protein and fats. The iron content of the leaves is lower than that of *Securinega virosa* leaves (4.39mg/100g). The calcium content *of Spondias mombin* is 126.50mg/100g. Calcium is good for growth and maintenance of bones, teeth and muscles (Turan et al, 2003). The calcium content of the leaves is higher than that of *Securinega virosa* (2.90mg/100g). The copper content of *Spondias mombin* is 0.26mg/100g, which is lower than 4.39mg/100g of *Securinega virosa*. Copper is a very powerful pro-oxidant and catalyzes the oxidation of


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unsaturated fats and oils as well as ascorbic acid. The magnesium content of the leaves is 11.32mg/100g which is lower than that of *Securinega virosa* leaves (25.48mg/100g). Magnesium is an important mineral element in connection with circulatory disease such as ischemic heart disease. The zinc content of *Spondias mombin* leaves is 0.76mg/100g which is lower than that of *Securinega virosa* (0.85mg/100g) but higher than *Mucuna sloanei* (0.25mg/100g) [13]. Zinc functions as an integral part of numerous enzymes. It participates in the synthesis and degradation of carbohydrates, lipids, protein and nucleic acids. The manganese content of the leaves is 1.01mg/100g. This is lower than that of *Securinega virosa* leaves (1.50mg/100g) but higher than *Mucuna sloanei* leaves (0.65mg/100g). Manganese is essential for human nutrition. It acts as an activator for many enzymes (Uzama et al., 2012). The concentrations of nickel and cobalt in the leaves were negligible. Lead was absent, this tallied with the results of vegetables grown in Nigeria (Abulude, 2001). The concentration of the trace elements in the leaves of *Spondias mombin* were very low, this makes the plant safe for human consumption.

**Table 3: Mineral composition of *Spondias mombin* leaves**

| Mineral | Concentration (mg/100g) |
|---|---|
| Chromium | 0.28 |
| Calcium | 126.50 |
| Cadmium | 0.36 |
| Copper | 0.26 |
| Zinc | 0.76 |
| Magnesium | 11.32 |
| Nickel | 0.08 |
| Manganese | 1.01 |
| Cobalt | 0.05 |
| Iron | 0.31 |

## Conclusion

The data reported in this paper suggest that the leaves have bioactive components such as, Steroids, terpenoids, saponins, flavonoids, and resin compounds were identified to be present, but glycosides lacking. This plant may be used to treat a variety of illnesses, including whooping cough, respiratory tract infections, and other conditions. These discovered bioactive chemicals may be connected to the medicinal functions of this plant. The goal should be to characterize all of the bioactive agents that are present. The findings also showed that the plant has nutritional benefits that consumers could take advantage


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of. To confirm the anti-inflammatories function of *S. mombin* and its potential usage as a supplement to other meals, more research is needed.

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