Phytochemical Screening and Nutritional Assessment of Bioactive Compounds in Two Senegalese Medicinal Plants: *Faidherbia albida* Del. and *Ziziphus mauritiana* Lam

ABSTRACT

Aim: The aim of this study was carry out to determine phytochemical constituents, total polyphenols, flavonoids and dosing proteins of two Senegal flora plants: *Faidherbia albida* Del, *Ziziphus mauritiana* Lam,

Place and Duration of Study: Department of Pharmacy , Faculty of Medecine, Pharmacy and Odontology (FMPO), Cheikh Anta Diop University of Dakar, between May 2024 and July 2024.

Results: Extraction of 50 g of *Z. mauritiana* and *F. albida* leaf powder obtained yields of 21.18% and 20.76% respectively. The phytochemical screening showed the presence of polyphenols, flavonoids, Condensed tannins, Hydrolysable tannins, sterols and triterpenes and saponosids. However, alkaloids are only found in *Z. mauritiana* and anthracenosides are missing in both species. Leaf extracts from *Ziziphus mauritiana* and *Faidherbia albida* contained 26.30±1.78 and 30.32±0.37 mg EAT/g polyphenols respectively. Whereas for total flavonoids the values are respectively 26,91±0,16 and 39,69±0,12 mg ER/g. Extracts from the leaves of *Ziziphus mauritiana* and *Faidherbia albida* contain 13.00±0.14 and 23.97±0.07% protein respectively.

Conclusion: Based on these results, Leaves of *Z. mauritiana* and *F. albida* would be a good candidate in the food industry, phytomedicine and toxicity could investigated for garanted their uses.

Keywords: *Z. mauritiana*, *F. albida*, *phytochemical*, total polyphenols ans flavonoids, proteins.

1. INTRODUCTION

The use of medicinal plants dates back to ancient times, with written evidence going back more than 3,000 years. Today, although the pharmaceutical industry has made great progress, plants continue to play a crucial role in medicine. They are used not only in phytotherapy, but also as the basis for many modern medicines. Actually, around 25% of all medicines available for treating illnesses are derived from natural products. To improve the use of medicinal plants, several phytochemical investigations have been carried out to provide scientific proof **[1].** Different methods in various specialities have been developed for the extraction, identification and quantification of these compounds from several medicinal plants **[2]**.

Ziziphus mauritiana, commonly known as Chinese date, Ber, and Indian jujube, belon gs to the Rhamnaceae family and is native to Southeast Asia. Although it has been n aturalized in tropical regions from South Africa to the Middle East and the Indian subc ontinent, its phytochemical profile remains underexplored **[3]**. *Z. mauritiana* is a multipurpose tree because it bears fruit and its bark, leaves, and roots are of great use.

Both fruit and leaves are edible. In addition, the leaves, fruits, and bark are commonly used in medicinal formulations. The fruit of *Z. mauritiana*, also called jujube, is an effective herbal medication that helps weight gain, improves muscular strength, and increases stamina. In Chinese medicinal practice, it is said to act as a natural remedy to strengthen liver function. The leaves of this plant carry astringent and febrifuge properties that help heal diarrhoea and reduce fever, respectively, and are also identified as boosting hair growth. In addition, leaves are also used as traditional remedies that are beneficial for fever, asthma, and liver problems. The fruits can be dried and carry medicinal benefits, including analgesics, anticancer, pectoral, cooling, sedatives, stomachache, styptic, and tonic. They are believed to promote healthy digestion and blood purification, plus, when taken internally, they can treat hysteria, anaemia, loss of appetite, and chronic exhaustion. The seed has soothing, stomachache-relieving, hypnotic, and narcotic properties and can also be taken internally to treat excessive sweating, palpitations, sleeplessness, nervous weariness, and nocturnal sweats **[3]**. The root is used to treat dyspepsia or indigestion. The root has been used as a decoction to cure fever. In addition, to treat old wounds and ulcers, the root is ground to a powder and applied to the affected area. The herb is a folk treatment for neurological disorders, nephritis, hypertonia, and anemia **[4]**. Phytochemicals are important because they play a role in the exertion of the medicinal properties of *Z. mauritiana*, such as an anti-inflammatory, antimicrobial, antioxidant, anti-tumour, cytotoxic, hepatoprotective, anti-diarrhoeal, anticonvulsant, sedative agent and as an immune system stimulant **[5,6,7,8]**. In addition, this species also exerts effects such as antispasmodic, antimalarial, antihypertensive, antidepressive, hypocholesterolemia, detoxification, and many other potentials **[9]**.

Faidherbia is a monotypic genus. It contains only one species: *Faidherbia albida* (Del.) A. Chev. *F. albida* belongs to the Acacieae family and it is used ethnomedicinally for the treatment of respiratory, tooth, and eye infections. The bark and roots have been reportedly used for the treatment of digestive disorders, malaria, and fever. It is a leguminous plant native to Africa and the Middle East which was later introduced to Pakistan and India. The use of *F. albida* in traditional agro forestry systems is associated with the inverse phenological rhythm of the species and which is important because of the lack of competition between trees and crops during the rainy season, while the persistent foliage during the dry season is an essential source of fodder **[10]**. *F. albida* leaf and stem bark extracts possess robust antibacterial and cytotoxic properties. The leaves have a psychoactive chemical compound “Dimethyltryptamine”, the extract is used to treat ocular infection in farm animals **[11]**. Also used as an emetic, diarrhea, hemorrhage, and ophthalmia in East & West Africa **[12]**. Namibians use its bark for toothbrushes & is reputed to contain fluoride. Some people used for the treatment of colds, pneumonia and other respiratory condition and as antimalarial **[12]**.

The decoction of the stem bark is taken orally for the management of the sleeping sickness **[13]**. The Chloroform extract of *F.albida* roots against three pathogenic fungal species; *Aspergillus fusarium*, *Aspergillus fulvus*, and *Candida albicans*, it shows interesting results by inhibiting the growth of the studied pathogenic fungal species **[14]**. Antimalarial, antimicrobial antipyretic, anti-inflammatory and anti-diarrhea activities of the stem bark of *Faidherbia albida* were observed **[15,16]**. Moreover, anti-trypanosoma activities of aqueous extract of Faidherbia albida stem bark against

Trypanosoma brucei was reported **[17]**. *Faidherbia albida* is also promoted in animal feeding regarding its nutritive properties **[18]**. In a process of reverse pharmacology, the present preliminary studies on phytochemistry and proteins content (*Z. mauritiana, Faidherbia albida*) have been carried out.

2. MATERIAL AND METHODS

2.1. Plant material

Fresh samples of *Z. mauritiana* and *F. albida* (leaves) were collected in May 2023 in the village of Ndiaganiao in the department of Mbour (Thiès region, Senegal). The identification and authentication of the plant and plant parts were done at the Department of Pharmacognosy and Botany (Pr William Diatta, Botanist) and dried in a ventilated room away from light at room temperature before being ground using an electric grinder.

2.2. Extract preparation

A weight (50 gms) were extracted by decoction under reflux for 30 min with 1 litre of the ethanol-water mixture (80/20; v/v). The extract thus obtained was evaporated using a rotary evaporator to give a pasty residue, which was dried in a ventilated oven at 45°C for 48 h to obtain a dry extract for use in phytochemical tests.

2.3. Phytochemical screening

The leaves extract were prepared for the screening of saponins, alkaloid, sterols ,tannins, cardiotonic heterosides, Anthracene heterosides, terpenoids, flavonoids and polyphenols [19].

2.4. Determination of Total Phenolic and Total Flavonoid Content

The total phenolic content of leaves extract was determined by the Folin-Ciocalteu method **[20]**. The aqueous solution of each extract (10% v/v, 0.5 mL) was added to 2.5 mL of 0.2 N Folin-Ciocalteu reagent and placed at room temperature for 5 min. Then, 2 mL aqueous solution of sodium carbonate (75 g/L) was added. The solution was incubated for 2h and the absorbance was measured at 760 nm against a blank (distilled water). A standard calibration curve was plotted using gallic acid (0–250 mg/L). The results were expressed as mg of gallic acid equivalents (GAE)/100 g of extract leaves weight.

The total flavonoid content was determined according to the Zhishen et *al.,* (1999) method **[21]**. 400 µl of extract (or standard or distilled water for the control) is placed in a glass haemolysis tube with 120 µl of 10% $AlCl_3$ and the medium is vortexed. After 6 minutes, 800 µl of 1 M NaOH was added to the medium. The absorbance was read immediately at 510 nm against the control. Rutin was used as reference compound to produce the standard curve, and the results were expressed as mg of rutin equivalents (RE)/100 g of extract leaves weight.

2.5. Determination of protein content

The protein content was determined according to the Bradford method (1976) **[22]**. To 100 µl of sample or distilled water (for the blank) was added 2 ml of Bradfort reagent consisting of Coomassie Blue G-250. Absorbance was measured at a wavelength of

595 nm after 5 min incubation at room temperature. The protein content was determined using a calibration range prepared under the same conditions with a standard solution of bovine serum albumin (BSA) at 1 mg/ml.

2.6. Statistical analysis

To compare the total polyphenol, flavonoid and protein content of the different samples, a statistical analysis was carried out using STATVIEW software. The difference is considered significant if $p < 0.05$.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Phytochemicals screening

The phytochemical screening carried out on the hydroethanol extracts of the plants gave the results shown in Table 1.

Table 1. Phytochemical screening on the hydroethanol extracts of the plants

Phytochemical constituents	*Ziziphus mauritiana*	*Faidherbia albida*
Flavonoids	+	+
Polyphenols	+	+
Alkaloid	+	-
Sterols	+	+
Tannins	+	+
Cardiotonic heterosid	+	+
Anthracene heterosid	-	-
Terpenoids	+	+
Saponins	+	+

(+): detected et (-): not detected

3.1.2. Results of Total Phenolic and Total Flavonoid Content

Leaf extracts from *Ziziphus mauritiana* and *Faidherbia albida* had polyphenol contents of 26.30±1.78 and 30.32±0.37 mg EAT/g respectively. There was a significant difference between the contents of the different samples ($p<0.05$).

Leaf extracts from *Ziziphus mauritiana* and *Faidherbia albida* had flavonoid contents 26,91±0,16 ; 39,69±0,12 mg ER/g respectively. There was a significant difference between the contents of the different samples. Table 2 shows the result of total phenolic and total flavonoid content.

Table 2. Result of of total phenolic and total flavonoid content.

	Ziziphus mauritiana	***Faidherbia albida***
Total phenolic (mg EAT/g)	26.30±1.78*	30.32±0.37*
Total flavonoid (mg ER/g)	26,91±0,16*	39,69±0,12*

* : $p<0.05$

3.1.3. Results of protein contents

Extracts from the leaves of *Ziziphus mauritiana* and *Faidherbia albida* had protein contents of 13.00±0.14 and 23.97±0.07% respectively. For the extracts, there was a significant difference between their contents ($p<0.05$). Table 3 shows results of protein contents.

Table 3. Results of protein content of extract leaves of *Ziziphus mauritiana* and *Faidherbia albida*

	Ziziphus mauritiana	***Faidherbia albida***
Protein content (%)	13.00±0.14*	23.97±0.07*

* : $p<0.05$

3.2. Discussion

The extraction of bioactive compounds from plants is the first stage in their use in various fields **[26]**. It is influenced by the method and solvents chosen according to the phytochemical compounds to be studied in order to optimise the yield and content of bioactive compounds.

The ethanol used to extract the active substances contained in these plants is a polar solvent **[26]**. In fact, it has the ability to extract hydrophilic compounds (polar, such as polyphenols) but also apolar lipophilic compounds (genins, terpenes, etc.). Water is a good extraction solvent for polar phytochemicals such as flavonoids and tannins, which are polyphenolic constituents. This could have significant effects on pharmacological activities of the plant extracts.

Extraction of *Ziziphus mauritiana* and *Faidherbia albida* leaves with the ethanol/water mixture (80/20; v/v) gave yields of 22.38% and 21.18% respectively. Ohouko *et al.,* 2020, obtained a yield of 16% (*F. albida*), this yield is significantly lower than our results. Diarra (2021) **[27]** obtained a yield of 28.73% after hydroethanol extraction of *Z. mauritiana* fruit pulp peel. This yield is significantly higher than those found for *Z. mauritiana* trunk and leaf barks in our study.

The phytochemical constituents of the leaf extracts of *F. albida* and *Z. mauritiana* are shown in Table 1. These showed that flavonoids, tannins, alkaloids, saponins, glycosides, flavonoids, polyphenols, terpenoids and sterols were present in both the stem bark and leaf extracts of plant. However, anthracene heterosids were absent in both in the leaf extracts and alcaloids were absent of *F. albida* extract. Olujenjo *et al.,* 2021 **[14]** identified alkaloids in *F. albida* leaf extract. In another study, the leaves extract of *F. albida* showed, metabolites like gallic tannins, alkaloids, anthocyanins, leucoanthocyanins, saponins, terpenoïdes, mucilages and coumarins were identified **[23]**. The study of Karoune *et al.,* (2015) **[24]** revealed the presence of phenolic acids and flavonoids in the leaves, fruits and stem bark of *F. albida*. These authors has also reported in the presence of saponin, terpenoids, flavanoid, tannins, and cyanogenic glycosides in the pulp of *Z. mauritiana* **[29, 30]**. Another study was carried out to find the approximate composition of the *Z. mauritiana* plant, which reported that it was an excellent source of fiber, proteins, and carbohydrates. It was found that its fruits, leaves

and seeds can act as a nutraceutical ingredient and may be utilized in pharmaceutical and food products due to its benefits **[31]**. Several investigations report the antioxidant potential of *Z. mauritiana* **[32]**. In one such study, it was reported that the good antioxidant and H_2O_2 scavenging activities can be owed to the presence of a high amount of total proteins, reducing sugars, flavonoids, ascorbic acid contents, β-carotene, polyphenols, tannins, and DPPH free radicals **[33, 34]**. It was also reported by researchers that there are about eight different flavonoids in fruits, leaves, and seeds of *Z. mauritiana* **[35]**. Previous researchers indicated that the crude methanolic extract of *Z. mauritiana* leaves is rich in phytochemical constituents, which have significant antioxidant and antimicrobial activities. The isolation and purification of these bioactive phytochemical constituents may further produce more potent antioxidants [34].

Quantitative analysis of phenolic compounds provides an estimate of the total phenol content of the samples. This content was estimated by a method using the Folin-Ciocalteu reagent [20]. Leaf extracts from *Ziziphus mauritiana* and *Faidherbia albida* contained 26.30±1.78 and 30.32±0.37 mg EAT/g polyphenols respectively. Total flavonoids values are respectively 26,91±0,16 and 39,69±0,12 mg ER/g. An author confirmed the total phenolic content of the root chloroform extract of *F.albida* was 53.960 mg GAE /g. These results are largely superior to those of our study. According to Siddig et al., 2024 **[36]** the bark methanolic extract of *F. albida* had phenolic content of 32.32 ±4.19 mg GAE /g. These results are comparable to our study. However, the chloroform extract of the fruits had flavonoid content (21.88 ±1.25 mg ER /g.). These results are lower than in this study, which could be explained by the extraction solvent used. Another study of Keita S *et al.,* 2020 revelead the leaves and pulps of *Zizyphus mauritiana* Lam were rich in phenolic compounds and have interesting antiradical activity.[41].

Intensive usage of the stem bark of FA in traditional medicine reported by Tijani *et al.,* **[37]**, Oluwakanyinsola *et al.,* **[38]**, Usman *et al.,* **[39]** and Alhaji *et al.,* **[40]** could found a solution way for the biodiversity conservation through substitution possibilities of stem bark by the fruit or leaves, showed in this present study. This will preserve from anthropic pressure, source of biodiversity menace.

4. CONCLUSION

The present study shows that leaves of *Z. mauritiana* and *Faidherbia albida* contain a variety of chemical compounds that justify their use phytotherapy and in animal Ethnomedicine. According to phytochemical analysis, the two species contain practically the same compounds. Which could then allow bark to be substituted for leaves or fruit by leaves or fruit when the active ingredients could reveal identical biological and pharmacological properties, for the conservation of biodiversity.

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