

Acute Toxicity, Antioxidant Activity and Photochemistry of Bark Aqueous Extracts from *Faidherbia albida* (Del.) A. chev. Synonym *Acacia albida* Del. (*Mimosaceae*), Used in Traditional Medicine in Burkina Faso

M.B. Ouattara, M. Kiendrebeogo and O.G. Nacoulma

Université Joseph KI-ZERBO, Unité de formation et de recherche en sciences de la vie et de la terre,
département de Biochimie-Microbiologie, BP 7021 Ouagadougou 03, Burkina Faso

Abstract: The aim of this study is to evaluate acute toxicity and antioxidant potential of bark from *Faidherbia albida* (Del.) A. Chev. (*Mimosaceae*). The bark of *Faidherbia albida* is used in traditional medicine in Burkina Faso to treat broncho-pulmonary infections that are cough-related. Aqueous decoction of the bark, which is the form of use recommended by traditional healers, was used for the tests. Acute toxicity was studied in NMRI strain mice. Antioxidant activity was evaluated by the method of reduction of DPPH radical. The aqueous extracts were not toxic at the maximum dose of 2 000 mg/kg of body weight. The extracts presented antioxidant activity with an IC_{50} which was $8\mu\text{g/ml}$. The extracts showed no bacterial activity on three strains of bacteria tested: *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Phytochemicals compounds that we have identified are alkaloids, flavonoids, tannins and phenolics compounds, triterpenoids and steroids, saponosides.

Key words: *Faidherbia albida* • Acute Toxicity • Antioxidant Activity • Phytochemicals Compounds

INTRODUCTION

The secondary metabolites of plants are responsible for several biological activities highlighted by the scientific community. The antioxidant activity of plant extracts has been highlighted by several studies, Fikreyohannes Gedamu Mihretu [1], Dalia *et al.* [2], Fraga *et al.* [3] and Giustarini *et al.* [4].

Antibacterial and antimicrobial activity has been promoted by authors, Delmulle *et al.* [5], Ouattara *et al.* [6], Damintoti *et al.* [7] and Khan *et al.* [8]. Phytochemical molecules have an inhibitory activity of enzymes involved in pathologies such as Alzheimer's disease, cancers, Khan *et al.* [8] and Pham *et al.* [9].

In order to find and propose new therapeutic formulations through the phytomedicine pathway encouraged by the WHO [10], we conduct ethnobotanical studies to identify the plants used in apathology. The plants we founded are grouped in their respective family and are subject to phytochemical screening to determine the secondary metabolites they contain and their biological activities.

Faidherbia albida (Del.) A. Chev. (*Mimosaceae*), synonymous *Acacia albida* Del., is a tree with straight bole, light gray bark (or beige in young twigs) brownish, deeply fissured, striated on the trunk, formed of shoots with short segments in broken line. Straight and strong spines, inserted in pairs at the base of the leaves. Fruits in strong, rounded, blistered pods, bright orange when ripe, spirally wrapped and containing 10-20 dark brown shiny seeds. The parts of the plants that are used are the leaves, fruits, bark, roots, flowers, gum and, mistletoe. The medicinal use of bark is discussed in this paper. Indeed, the bark of this plant is used in traditional medicine in Burkina Faso, for internal use, to treat coughs, bronchitis, joint pain, rheumatism, whooping cough, toothache. In external use, the bark is used against rheumatic pains and toothaches.

In view of the very frequent use of this plant in traditional medicine, the study aimed to check the toxicity of the bark.

Medicinal plants can be toxic [11]. We first studied the toxicity of aqueous extracts of the bark of the trunk *Faidherbia albida* (Del.) A. Chev. in order to know if the

population that uses it is not exposed to harmful effects of decocted bark of the plant. We further investigated the antioxidant activity, antibacterial activity and phytochemical composition of *Faidherbia albida* (Del.) A. Chev.

The use of antioxidants is related to their ability to reduce tissue damage from free radicals in several diseases such as cardiovascular diseases, cancers, inflammatory diseases, diseases, skin, malaria, immune deficiency diseases, etc. Scientific research of secondary metabolites of plants should be encouraged for their antioxidant effect to combat the effects of free radicals in several diseases.

MATERIALS AND METHODS

Biological Materials: The studies were conducted at Ouagadougou's University Joseph KI-ZERBO, (Burkina Faso), UFR/SVT, Department of Biochemistry-Microbiology, in the Laboratory of Biochemistry and Applied Chemistry, specializing in medicinal plants. The barks of *Faidherbia albida* (Del.) A. Chev. were harvested at Ouagadougou.

Aqueous Extraction: 50 g of vegetable powdered was extracted with 500 ml of distilled water during one hour at 100°C. Then the mixture was filtered on Whatman paper after cooling. The decoction is lyophilized and kept in a box, for studies.

Evaluation of Acute Toxicity: The method is that described by Lompo *et al.* [12]. Female NMRI strain mice, approximately 10 weeks old, weighing between 25-35 g were used for testing. Dry extracts diluted in water (200 mg/ml) was prepared for the dose 2000 mg/kg to be administered to each mouse. The test mice and the control group of mice are fasted 12 hours before the test. Two batches of mice are made as homogeneous as possible. The administration of the extracts is done by gavage according to the dose 2000 mg/Kg.

Antioxidant Activity by the Reduction of the DPPH°: The antioxidant activity of the extracts was evaluated *in vitro* by the capacity of reduction of the radical DPPH (1, 1 Diphenyl 2 Pycril Hydrazil) according to the method of Sharma *et al.* [13].

Antibacterial Activity: Aqueous extracts of *Faidherbia albida* (Del.) A. Chev. Barks were used to determine their antibacterial activity. Reference strains from ATCC (American Type Culture Collection, Rockville):

Staphylococcus aureus ATCC 6538, *Escherichia coli* ATCC 25922 and a wild strain of *Pseudomonas aeruginosa*. The following reference antibiotics were used: Ampicillin, Bactrim, Erythromycin and Penicillin.

Activity of extracts on bacterial growth inhibitory was evaluated by the method of Ezoubeiri *et al.* [14].

Minimum inhibition concentration (MIC) was determined by the microdilution method in culture broth as recommended by Eloff [15] and the National Committee for Clinical Laboratory Standard [16].

Phytochemical Studies: Methods of Ciulei [17] are used to identify alkaloids, flavonoids, polyphenols and tannins, triterpenes, steroides and saponosides.

Statistical Analyzes: All experiments are performed in triplicate and the results are expressed in means +/- standard deviation using Microsoft excel 2013.

RESULTS

Toxicity: The results of the toxicity tests are shown in Table 1. There were two batches of mice: controls and 2000 mg/kg body weight. The results indicate that there were no dead animals, either for controls or for mice that received 2000 mg/kg. The mortality rate is 0%. This result indicates that aqueous bark extracts of *Faidherbia albida* were non-toxic.

Antioxidant Activity: The ability of extracts to reduce DPPH has been tested. The reduction of DPPH by the extracts reduces the initial violet coloration. The first parameter determined is the percentage reduction (Pr) of the DPPH by the extracts, which is calculated according to the formula:

$$Pr = \frac{\text{Absorbance of Controle} - \text{Absorbance Extract}}{\text{Absorbance Control}} \times 100$$

These Pr values (Table 2) allowed us to determine the IC₅₀. IC₅₀ is the concentration of antioxidant required to reduce the initial concentration of DPPH by 50%. The aqueous extracts of *Faidherbia albida* (Del.) A. Chev. (*Mimosaceae*) have an IC₅₀ which is 08 µg/ml, determined from the Pr = f (extracted concentration).

Phytochemical Studies: The phytochemicals identified by the simple characterization tests are shown in Table 3. They are mainly represented by tannins and phenolic compounds, followed by triterpenes and sterols, saponosides and finally flavonoids.

Table 1: Acute toxicity tests performed with aqueous extracts of leaves from *F. albida*

| Mice | Weight (g) | Administered volume (ml) | | | Number of of dead animals | | | Weight (g) | | |
|--|------------|--------------------------|-----|-----|---------------------------|------------|------------|-------------|--|--|
| | | Day 0 | 24H | 48H | 72H | 24H | 48H | 72H | | |
| Controls mice | | | | | | | | | | |
| 1 | 29,28 | 0 | 0 | 0 | 0 | 30,40 | 31,44 | 31,37 | | |
| 2 | 34,96 | 0 | 0 | 0 | 0 | 35,80 | 36,68 | 37,55 | | |
| 3 | 27,90 | 0 | 0 | 0 | 0 | 28,85 | 29,70 | 30,17 | | |
| Average | 30,71±3,74 | | 0 | 0 | 0 | 31,68±3,65 | 32,61±3,63 | 33,03± 3,96 | | |
| With 2 000 mg/Kg with extracts from <i>F. albida</i> , (200 mg/ml) | | | | | | | | | | |
| 1 | 34,45 | 0,35 | 0 | 0 | 0 | 35,65 | 36,50 | 37,71 | | |
| 2 | 28,45 | 0,29 | 0 | 0 | 0 | 29,34 | 30,57 | 32,31 | | |
| 3 | 27,35 | 0,28 | 0 | 0 | 0 | 29,35 | 30,87 | 32,97 | | |
| Average | 30,08±3,82 | | 0 | 0 | 0 | 31,45±3,64 | 32,65±3,34 | 34,33±2,95 | | |

Table 2: Percentage of DPPH● radical Reduction obtained with Aqueous Extracts of barks from *F. albida*

| Concentrations µg/ml | 1,56 | 3,125 | 6,25 | 12,5 | 25 | 50 |
|-----------------------------------|------------|------------|------------|------------|------------|------------|
| Percentage of DPPH● reduction (%) | 22.47±0.41 | 35.74±0.65 | 47.33±1.13 | 56.93±1.75 | 67.71±2.61 | 74.32±2.55 |

Table 3: Phytochemicals compounds identified in aqueous extracts of brks from *Faidherba albida*

| | Alkaloids | Flavonoids | Tannins and phenolics compounds | Saponosides | Triterpenes and/or steroids |
|------------------|-----------|------------|---------------------------------|-------------|-----------------------------|
| <i>F. albida</i> | +++ | + | +++ | ++ | +++ |

Legend: negative reaction (-), weakly positive reaction (+), moderately positive reaction (++) , strongly positive reaction (+++)

The identified compounds may be supplemented by subsequent TLC and HPLC analyzes, as well as by the determination of the active ingredients responsible for the recognized biological activities.

DISCUSSIONS

The aqueous bark extracts of *F. albida* were not toxic at 2000 mg / kg. The aqueous bark extracts of *F. albida* showed no antibacterial activity. This was a surprise, considering the strong presence of tannins revealed in the extracts. The use of the plant to cure the cough had allowed us to glimpse the positive reactivity of the extracts on the bacteria. The roles of tannins were demonstrated by several works, as Bassene *et al.* [18] and Mahamat [19]. We did not want to use methanoic or hydroacetic extracts, because we want to discover what is present and has a defined biological activity in the same form as that of the health healers. The antioxidant activity observed is high: $IC_{50} = 8 \mu\text{g} / \text{ml}$. It is certainly due to tannins and other compounds, known for their strong antioxidant potential [20-24].

CONCLUSION

The main objective of our work was to know if the aqueous extracts of *F. albida* bark used in traditional pharmacopoeia in Burkina Faso were toxic or not. According to the results obtained, the aqueous extracts are not toxic. Then other potentialities of these extracts

were evaluated. The aqueous extracts of *F. albida* bark showed no antibacterial activity on three strains of bacteria used.

Antioxidant activity is high. The IC_{50} is $08 \mu\text{g} / \text{ml}$. Our studies have shown that the phytochemicals present in *F. albida* are: tannins and polyphenols, steroids and triterpenes, saponosides, alkaloids and flavonoids.

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