International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979; Impact Factor: RJIF 5.72
Received: 03-06-2020; Accepted: 19-06-2020; Published: 04-07-2020
www.allsubjectjournal.com
Volume 7; Issue 7; 2020; Page No. 40-43

Antibacterial activity of *Faidherbia albida* (Pod and Bark) methanolic extracts against selected pathogens

Yasmin Hassan Elshiekh[1*], Mahdi Abdelmageed Mohammed Ali[2]
[1, 2] Department of Biology & Technology, College of Applied and Industrial Sciences, University of Bahri, Bahri, Sudan

Abstract
Faidherbia albida belong to the family *Mimosaceae*. Traditionally, the plant is used in the treatment of diarrhea skin diseases and asthma. The phytochemical studies were carried out and revealed the presence of flavonoids, alkaloids, saponins, Tannin, Phenols, Triterpenes, Cardiac glycoside and Sterols in the Pod extract. While alkaloids, tannins, saponins, sterols, Phenols, Triterpenes and cardiac glycoside in the bark extract. The antibacterial activity was investigated against two Gram positive and two Gram negative bacteria: *Bacillus subtilis, Escherichia coli, Pseudomonas aeruginosa and Staphyococcus aureus*. The bark methanolic extract showed the highest antibacterial activity against the test organisms, while the Pod methanolic extract reflected high activity against *Bacillus subtilis* and moderate activity against the other organisms.

Keywords: *Faidherbia albida,* Mimosoideae, North Kordofan, Pod, Bark

Introduction
Faidherbia albida is a thorny, deciduous tropical African tree with deep penetrating root. The leaves are bi-pinnate, bluish -green in color with straight whitish thorns, while, the bark is grey, rough and scaly, when old. It possesses pale cream-colored, long-spiked flowers and has fruits that are twisted, glabrous, and shiny, ranging in color from orange to brown. The fruits are soft and fleshy with narrow wings that extend about three quarters way round the body with a corky and knobby flesh surrounding a hard woody shell [1]. Within the fruits are pod-bearing seeds which are orange-brown in color, twisted in shape, containing almost 10-30 dark, shiny brown ovoid seeds and a tough seed coat; usually eaten by animals [2, 3, 4]. Traditionally, the plant is used in the treatment of diarrhea [5, 6], skin diseases and asthma [7]. The plant is also useful as an anti-inflammatory, anti-haemorrhagic and ophthalmic agent [5]. Locally, the seeds of the plant are eaten by humans as foods during famine [5, 8], while powdered pods and seeds are widely used to poison fish in pools [9]. Biologically, the plant's usefulness as anti-microbial [10], anti-diarrheric, anti-pyretic, anti-inflammatory [11], anti-trypanosomiasis [12], anti-diabetic [13], anti-malarial [14], anti-fungal [15] and nematicidal agent [16] has been reported. The Phytochemical studies reveal that plants in this family contain tannins [17] which account for their use in the making of dyes. In addition to this, [18] reported the presence of alkaloids and saponins in the stem bark extract of *F. albida*. In folkloric medicine, it is used to treat fevers by the Masai people of Kenya as well as in the treatement of diarrhoea in Tanganyika [19]. These activities have been reported by [20]. It is also used in treatement of colds and haemorrhage. A liniment, made by steeping the bark, is used for bathing and massage in pneumonia. The bark infusion is used in cases of difficult delivery, and is used as a febrifuge for cough [19, 21]. Reported the antimicrobial activity of *F. albida* against *Pseudomonas aeruginosa, Bacillus subtilis* and *Salmonella typhi*. In northern Nigeria, especially among the cattle rearing nomads, a decoction of the stem bark is taken orally for the management of the sleeping sickness [18]. The aims of the present study is evaluate the secondary metabolites and antibacterial activity of the methanolic crude extracts of the *Faidherbia albida*)

Materials and Methods
Collection of Plant sample
Faidherbia albida (Pod and Bark) was obtained from (Bara) North Kordofan State- Sudan. 2018.

Extraction of Plant Material
Maceration method
Weight of the powdered plant material (100gm) was macerated with 70% methanol at room temperature for 42 hours, then filtrated and dried to constant weight and refrigerated at 4ºC until used for further investigation [22].

Phytochemical Screening
Phytochemical screening for the active constituents was carried out using the methods of [23].

Test of tannins
0.5 g of the extract was washed three times with petroleum ether (S. D. Fine, India), dissolved in 10 ml hot saline solution and divided in two tests tubes. To one tube 2-3 drops of ferric chloride reagent was added and to the other one 2 – 3 drops of gelatin salts reagent was added. The occurrence of a blackish blue colour in the first test tube and turbidity in the second one denotes the presence of tannins.

Test of sterols and triterpenes
0.5 g the extract was washed three times with petroleum ether and dissolved in 10 of chloroform (S. D. Fine, India). To 5 ml of the solution, 0.5 ml acetic anhydride (Sharlu, Spain) was added followed by 3 drops of conc. Sulphuric acid (Sharlu, Spain) at the bottom of the test tube. At the contact zone of the two liquids, a gradual appearance of

(green to blue) color was taken as an evidence of the presence of sterols and (pink to purple) colour for presence of triterpenses in the sample.

Test for Alkaloids

0.5 g of the extract was heated with 10 ml of 2 N Hcl (Sharlu, Spain) in water bath, stirred for about 10 minutes, cooled, filtered and divided into two test tubes. To one test tube few drops of Mayer's reagent was added while to the other tube few drops of Valser's reagent was added. A slight turbidity or heavy precipitate in either of the tow test tubes was tanked as presumptive evidence for the presence of alkaloids.

Tests for Flavonoids

0.5 g of the extract was washed three times with petroleum ether, dissolved in 30 ml of 80% ethanol. The filtrate was divided in three test tubes and used for following tests: - A/ to 5 ml of the filtrate in a test tube 1ml of 1% aluminum chloride solution was added. Appearance of a yellow color indicated the presence of flavonoids. B/ to 5 ml of the filtrate in a test tube 1ml of 1% potassium hydroxide solution was added. Appearance of a yellow color indicated the presence of flavonoids. C/ to 5 ml of the filtrate in a test tube 1ml of 10 % lead acetate solution was added. Appearance of a yellow color indicated the presence of flavonoids.

Test for Saponins

0.5 of the extract was placed in a clean test tube. 10 ml of distilled water was added, vigorously shaken for about 30 seconds. Tube was then allowed to stand and observed for the formation of foam, which persisted for least an hour, was taken as evidence for presence of saponins.

Test for Coumarins

0.5 g of the extract dissolved in 10 ml distilled water in test tube and filter paper attached to the test tube to be saturated with the vapor after a spot of 0.5N KoH spotted on it. Then the filter paper was inspected under UV light, the presence of coumrins was indicated if the spot have found to be adsorbed the UV light.

Test for Anthraquinone glycoside

0.5 g of thee extract was boiled with 10 ml of 0.5N KoH containing 1ml of 3% hydrogen peroxide solution. The mixture was extracted by shaking with 10 ml of benzene (S. D. Fine, India). To 5 ml of the benzene solution 3 ml of 10 % ammonium hydroxide solution was added and the two layers were allowed to separate. Appearance of pink or red color in the lower layer indicated the presence of anthraquinones.

Test for cyanogenic glycoside

0.5 g of the extract was placed in Erlenmeyer flask and sufficient distilled water was added to moisten the sample, followed by 1ml of chloroform. A piece of freshly prepared sodium picrate paper was carefully inserted between a split crock which was used to stopper the flask, a change in color of the sodium picrate paper from yellow to various shades of red was taken as an indication of the presence of cyanogenic glycoside.

Testing for antibacterial Activity

The cup-plate agar diffusion method [24] (Kavanagh, 1972) was adopted with some minor modifications to assess the antibacterial of the prepared extracts. One ml of the standardized bacterial stock suspension 108–109 C.F.U/ ml were thoroughly mixed with 100 ml of molten sterile nutrient agar which was maintained at 45 ºC. 20 ml aliquots of the inoculated nutrient agar were distributed into sterile Petri dishes. The agars was left to set and in each of these plates 4 cups (10 mm in diameter) were cut using a sterile cork borer (No. 4) and agar discs were removed. Alternate cups were filled with 0.1 ml sample of the extracts using automatic micro-liter pipette, and allowed to diffuse at room temperature for two hours. The plates were then incubated in the upright position at 37 ºC for 18 hours. Two replicates were carried out for the extracts against each of the tested organisms.

Results

Phytochemical Screening of *Faidherbia albida* (Pod and Bark):

The Phytochemical analysis of *Faidherbia albida* showed the presence of the following metabolites as in table (1).

Table 1: The results of Phytochemical screening

Part Used	Extracts	Metabolites								
		1	2	3	4	5	6	7	8	9
Pod	70% Methanol	+	+	+	+	-	+	+	+	+
Bark	70% Methanol	-	+	+	+	-	+	+	+	+

Key: 1= Flavonoids, 2=Alkaloids, 3=Sterols, 4= Triterpenes, 5 = Coumarins, 6 = Cardiac glycosides, 7=Tannin, 8 = Saponins, Phenol. (+) = detected and (-) = not detected.

The Phytochemical screening of methanlic extracts shows the presence of alkaloids, saponins, tannin, triterpenes, cardiac glycosides, sterols and absent of coumarins in both part of the plant extract.

Antibacterial Activity of *Faidherbia albida* (Pod and Bark):

Table 2: Antibacterial Activity of *Faidherbia albida* (Pod and Bark) against Standard bacterial strains at concentration 100mg/ml.

Part Used	Plant extracts	Standard bacterial strains (100mg/ml)			
		Gram Positive		Gram Negative	
		Tested bacteria used			
		B. s	***S.a***	***Ps.a***	***E.c***
Pod	70% Methanol	18	15	15	14
Bark	70% Methanol	25	28	24	16

Key: B.s, Bacillus subtilis; S.a -Staphyllococcus aureus; E.c - Escherichia coli; P.a - Pseudomonas aeruginosa. Concentration of extracts

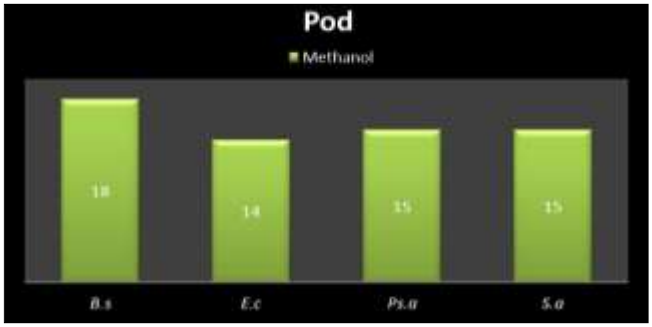

Fig 1: Antibacterial Activity of *Faidherbia albida* (Pod).

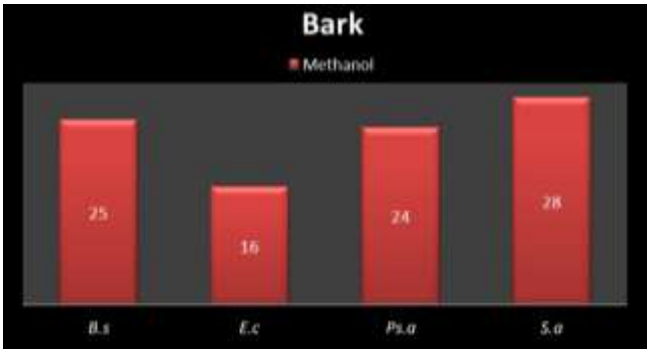

Fig 2: Antibacterial Activity of *Faidherbia albida* (bark).

Discussion

Phytochemical screening of *Faidherbia albida* bark extract showed the presence of alkaloids, tannins, sterols, terpenes, saponins andcardiac glycosides while flavonoids and coumarins were absent. These results were agreement with the findings of [25]. while the Pod extracts showed the presences of alkaloids, sterols, triterpenes, coumarins, flavnoids, tannins and saponins, while coumarins gave negative results. These results were agreement with [26]. These phytochemicals are known to have antimicrobial activity [27]. The presence of phenoilc compounds in the *Faidherbia* species may be the reason for the therapeutic, antiseptic, antifungal or bactericidal properties of the plants [28]. Alkaloids are known to exhibit marked physiological activity when administered to animals [29]. Pure isolated plant alkaloids and their synthetic derivatives are used as basic medicinal agents for analgesic antispasmodic and bactericidal effects [30]. The high concentration of tannins detected in the Pod and bark makes them of high demand in the world market. Tannins have been found to posses astringent properties hasten the healing of wounds and inflamed mucous membranes [28, 31, 32]. Methanolic extract of *Faidherbia albida* bark showed the highest activity against all bacteria when compared to Pod extract. The presence of these secondary metabolites probably contributes to the antibacterial potential of this plant.

Conclusion

The present study showed interesting preliminary phytochemical constituents in *Faidherbia albida* (Pod and Bark). Further characterization and quantitative assay may be carried out to test the plant extracts for various therapeutic and pharmacological activity.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding the publication of this paper.

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