



E-ISSN: 2321-2187

P-ISSN: 2394-0514

www.florajournal.com

IJHM 2023; 11(5): 22-26

Received: 08-06-2023

Accepted: 16-07-2023

Sheetal S Samant

Assistant Professor, Department
of Pharmacognosy, Yashwantrao
Bhonsale College of Pharmacy,
Sawantwadi, Maharashtra, India

Vijay A Jagtap

Principal, Yashwantrao
Bhonsale College of Pharmacy,
Sawantwadi, Maharashtra, India

Prajakt Kalangutkar

B Pharmacy Student,
Yashwantrao Bhonsale College
of Pharmacy, Sawantwadi,
Maharashtra, India

Raghunath Morye

B Pharmacy Student,
Yashwantrao Bhonsale College
of Pharmacy, Sawantwadi,
Maharashtra, India

Akshaya Gadekar

B Pharmacy Student,
Yashwantrao Bhonsale College
of Pharmacy, Sawantwadi,
Maharashtra, India

Riddhi Rane

B Pharmacy Student,
Yashwantrao Bhonsale College
of Pharmacy, Sawantwadi,
Maharashtra, India

Samidha Desai

B Pharmacy Student,
Yashwantrao Bhonsale College
of Pharmacy, Sawantwadi,
Maharashtra, India

Corresponding Author:**Sheetal S Samant**

Assistant Professor, Department
of Pharmacognosy, Yashwantrao
Bhonsale College of Pharmacy,
Sawantwadi, Maharashtra, India

Phytochemistry and therapeutic uses of *Albizia lebbek*

Sheetal S Samant, Vijay A Jagtap, Prajakt Kalangutkar, Raghunath Morye, Akshaya Gadekar, Riddhi Rane and Samidha Desai

DOI: <https://doi.org/10.22271/flora.2023.v11.i5a.884>

Abstract

Albizia lebbek is herb belonging to the family Fabaceae. It has several phyto-constituents that show many health benefits. Traditionally it is used to cure fever, diarrhoea, dysentery, asthma, cold, cough, conjunctivitis, arthritis, dental problems and skin disease. It has anti-microbial, anti-inflammatory, analgesic, anti-pyretic and immune-modulatory property. The plant contains alkaloids, flavones, flavonoids, tannins, saponins and phenolic compounds. Its leaves contain kaempferol. Pods contain a triterpenoid albigenic acid.

Keywords: *Albizia lebbek*, anti-inflammatory, analgesic, asthma

Introduction

Indian Systems of Medicine have their roots in ayurveda. The potential of natural bioactive components is a major area of interest. There are various plant extracts that have curative benefits [1]. The wide range of disorders can be treated using herbal medicines. The World Health Organization (WHO) reports that traditional and folk medicines are used by about 80% of people in poor nations. Despite significant advancements in contemporary medicine, plants continue to play a significant role in the creation of novel medications. *Albizia lebbek*, also known as Shirish is found in tropical and subtropical Asia, Africa, and Bangladesh. It is a leguminous plant from the Fabaceae family [2]. One of the conventional species of Albizia that is found all over the world is *Albizia lebbek*. It is frequently grown as an ornamental plant in tropical and subtropical regions. There are numerous data on medicinal properties [3].

It is a deciduous tree that typically grows in gardens or by the side of roads. Numerous phytochemicals including alkaloids, anthraquinones, essential oils, glycosides, flavonoids, glycophenols, phytosterols, saponins, steroids, and triterpenoids are present in *Albizia lebbek*. This species exhibits excellent anti-inflammatory, anti-cancer, anti-malarial, anti-allergic, anti-hyperglycemic, anti-diabetic, wound healing, nootropic, neuroprotective, anti-Parkinson's and anti-Alzheimer activities [4]. The *Albizia lebbek* tree has a number of medicinal properties, including those that are antiseptic, antibacterial, anti-fertility, anti-Protozoal, anti-dysentery, anti-tubercular, anti-cancer, anxiolytic and anti-convulsant. The gum of *Albizia lebbek* is used to treat toothache [3, 6]. Various plant parts, including the bark, stems, leaves, roots, fruits, flowers, and seeds, can be used to extract natural fibres [5]. Several diseases are treated with *Albizia lebbek*, including depression, conjunctivitis, influenza, and furuncles [7]. In Asia, it is used as fuelwood plants and rehabilitation of damaged lands in addition to its therapeutic uses. It is also used in agroforestry. Use of *Albizia lebbek* has been traditionally used to remove toxins from the human body. It is also used to treat respiratory tract issues like allergies, asthma and common cold [4].

The plant is well-known, in traditional folk medicine, for the treatment of numerous illnesses in several locations throughout the world. According to Ayurveda, asthma and other inflammatory conditions like arthritis and burns can be treated using any part of the tree, including the roots, leaves, bark, and flowers [8].

Numerous herbal remedies are listed in Ayurveda and other alternative medicines, but their use and popularity in improving the general health of the general public has not yet reached their full potential. The herbal medicines' active ingredients are extremely beneficial for both humans and animals [22]. *Albizia lebbek* is commonly used in Ayurveda and Unani systems of medicine [9].

Materials and Methods

Information regarding *Albizia lebeck* were collected from literatures on traditional practices and from search engines as PubMed, Google Scholar etc.

Result and Discussion



Fig 1a): *Albizia lebeck* pods

b) Tree

Vernacular names ^[10]

Hindi: Garso, Kalshish, Shirish, Siras, Sirin

Marathi: Chichola, Kalashiras, Mothasiras

English: Parrot tree, Acacia amarilla, East Indian walnut.

Bengali: Siris, Sirisha

Punjabi: Sirish, Sareehn

Gujarati: Kalosadasado, Kaliosaras, Pilosarashio

Kannada: Bagey, Bage mara, Hombage

Malayala: Kuttuvaka, Nenmani

Tamil: Vakai

Telugu: Dirisena

Nepal: Harrasiris

3.2 Botanical description ^[10, 11]

Botanical name: *Albizia lebeck*

Synonym: Barhapushpa, Bhandi, Bhandika, Shirisha, Shyamala, Shukataru, Madhupushpa, Kapitana, Viasha Hanta, etc.

Family: Fabaceae

Taxonomical position ^[10]

Kingdom: Plantae

Order: Fabales

Family: Fabaceae

Subfamily: Mimosoideae

Genus: *Albizia*

Habit and general characteristics: Its height of about 60 feet and is deciduous during the winter season. It has a dense crown that casts a lot of shade. Trunk is rather small, with a diameter of 2-3 feet. The stem and branches are covered in deeply irregularly cracked dark grey to brownish bark. They have white or yellowish-white sessile flowers and distinctive straw-colored strap-shaped pendulous pods. Leaves are evenly bipinnate with fairly large obliquely oblong leaflets. The plant flowers throughout the warmer season, generally in March, April, and May, and bears fruit starting in September (Fig., 1a and b).

Morphology

Trunks: The trunk range in diameter from 50 cm to 1 m.

Pod: Each pod has six to twelve seeds inside it and measures between 15 and 30 cm in length and 2.5 and 5 cm in width.

Bark

Barks are significantly rough and thick, dark brown to greyish black in colour. It has transverse and vertical deep fractures. Nearly one third or more of the thickness of the overall bark is made up of the rind or outer bark. On the trunks and more mature branches, the bark has a composite structure made up of sporadic, alternate layers of "woody" and subserous tissue. The middle and inner barks, which make up the officinal tissue, are about two thirds the thickness of the total bark, excluding the corky layer. Its outer layer has a distinctive reddish-brown hue.

Leaf: Leaf has length ranging from 7.5 cm to 15 cm and 1 to 4 pairs of pinnae. It also has grooves on the upper side and taper.

Leaflets: Leaflet 4 to 8 pairs, opposite, short stalked, 1 to 2 inches long, 1/2 to 3 inches wide, entire, rectangular, and pale.

Flower: Flowers are sessile or short pedicelled. Flowers are white or yellowish white in color and highly fragrant.

Fruit: Fruit is straight or somewhat curved. It is thin yet firm and straw to yellowish brown in color.

Seed: Seeds are non-endospermic, ovate and brownish-yellow in colour. They are compressed near the border ^[10, 12].

Phytochemistry

Pods: The pods contain 3, 5 dihydroxyl 4, 7 dimethoxy flavones, N-benezol L phenyl alaninol. Pods contain saponins, tannins, alkaloids, phenols, carbohydrates, steroids and flavonoids ^[20].

It contains amino acids like glutamic acid and aspartic acid ^[13-16].

Leaves: The leaves contain Tri-O-glycosides: kaempferol and quercetin 3-O-arhamnosyl-a-, glycopyranosyl-a-agalactophyransides. It contains glycosides, saponin (albiziahexoside) steroids, tannins, terpenoids, flavonoids (kaempferol 3-O-a rhamnopyranosyl(1/6)-b-glucopyranosyl(1/6)-o-galactopyranoside, quercetin 3- O-a rhamnopyranosyl(1/6)-b-glucopyranosyl(1/6)-b-galactopyranoside. It contains alkaloids, kaempferol, 3-rhamnosyl (1-6) glycosyl (1-6) galactoside, flavon, vicenin II, β -sitosterol, keto acids, phosphoenol pyruvate, glyoxalate,

oxalacetate, α -oxoglutarate, reynoutrin, rutin, myricitrin and robinin [4, 13, 14]. Leaves also have alkaloids, flavonoids, tannins, saponins, carbohydrates [16].

Seeds: Seeds contain alkaloids, anthraquinones, eicosane, nonadecane, fatty acid (linolenic acid, oleic acid, palmitic acid, and steric acid), flavonoids, glycosides, octadecane, phenolics, phytol, saponins (glycosaponins), steroids, stigmastadiene, tetradecane, lipids, vitamin E, sterols, methyl sterols, triterpene alcohol, tocopherol, cycloeucaleanol, 24-ethylphenol, cycloartenol hydrocarbons and carotenoids [4, 14, 11].

Seeds contain glycosides, proteins/aminocids (arginine and lysine), resins, reducing sugars, saponins, flavonoids, glucosidsides [16].

Phytochemical studies of *A. lebbeck* have exposed the presence of various chemical constituents, including alkaloids, phenols, flavonoids, saponins, phytosterols, and terpenes [4].

Oil obtained from seeds contains sterols, methyl sterols, triterpene alcohol, tocopherol, hydrocarbons, carotenoids, cycloeucaleanol, 24-ethylphenol, cycloartenol [16].

Besides, seeds are good source of protein, lipids, fatty acid (linolenic acid, oleic acid, palmitic acid, and steric acid), tetradecane, hexadecane, phytol, nonadecane, eicosane, vitamin E, stigmastadiene, and octadecane [2, 4]. However, the seed contains lebbeckalysin (hemolysin), which possesses potent antitumor and antimicrobial effects [17].

Roots: Lupeol, 4-hydroxy-3-methoxycinnamic acid, stigmasterol and trans-p-coumaric acid were isolated from the n-hexane and chloroform fractions of a methanol extract of the root of *Albezia lebbeck*. It contains echinocystic acid (saponin), 23-trien-3-one (lebbeksterone), alcohol (Isotriacontanol), tricosanyloctadec-9-en-1-oate and pentacosanyloctadec-9-en-1-oate [24].

Heartwood: Heartwood contains Melanoxetin, d-pinitol, okanin and leucopelargonidin, a stereoisomer (-) melacacidin (7, 8, 3', 4'- tetrahydroxyflavan-3,4-diol), and lebbeccacidin. The methanol extractive of heart wood contains phenols, proteins, carbohydrates, tannins, flavonoid and glycoside [24].

Bark: Bark contains D-catechin, isomers of leucocyanidin, melacacidin, lebbeccacidin, friedelin, β -sitosterol, leucoanthrocyanidin, acacic acid lactone 3-O-beta-D-xylopyranosyl-(1 leads to 2)-alpha-L-arabinopyranosyl-(1 leads to 6)-beta-Dglucopyranoside, 3-O-beta-D-glucopyranosyl (1 leads to 2)- O-[alpha-arabinopyranosyl (1 leads to 6)]-beta-Dglucopyranoside and 3-O-beta-D-xylopyranosyl-(1 leads to 2)-alpha-L-arabinopyranosyl-(1 leads to 6)-O-[beta-D-glucopyranosyl (1 leads to 2)-beta-D-glucopyranoside, anthraquinone glycosides, Albiziasaponins A, B and C. Stem bark yields tannins (7 to 11 %); D-catechin D-leucocyanidin and it yield seven compounds including friedlan-3-one-and ysitosterol. Three Saponins were isolated from bark [16]. Geraldone, luteolin, and isookanin are flavonoids isolated from the bark [4]. The bark contains albiziasaponins (A-E) and lebbeckoside C, which possesses anticancer activity [24, 11].

Flowers: Flowers contain saponins, triterpenoids and labbekanin D. It contains 4, glycosides, lebbekannins D, F, G, and H [16].

Bean: Beans contain Albigenic acid [4].

Amino acids like glutamic acid and aspartic acid are present in the highest concentrations in pods [16].

Tap Root: Saponin are characterized as echinocystic acid-3-0-L-rhamnopyranosyl (1→5)- β - D-xylofuranolsyl (1→4)- β -Dglucopyranoside [19].

Pharmacological activity

Anti-oxidant activity

Many disorders can be treated with *Albizia lebbeck*. As polyphenols have the ability to scavenge free radicals, they can be used to cure illnesses and free radical-related injuries. The methanolic extract of *Albizia lebbeck* bark show highest potential as anti-oxidant. The bark of *Albizia lebbeck* had a much higher antioxidant capacity. Ethanol extract of *Albizia lebbeck* root was tested for its antioxidant capacity. It also showed good anti-oxidant activity [13].

Anti-asthmatic Activity

The studies were conducted on *Albizia lebbeck* stem bark for its Anti-asthmatic activity.

Decoction of stem bark was prepared and studies were conducted. Decoction reported notably decreases in WBC (white blood cells), eosinophilic count and ESR. *Albizia lebbeck* was given in 48 cases of bronchial asthma at a dose 40ml per day for one month. The investigation indicated mild improvement in case of bronchial asthma no adverse reactions were reported [13].

Anti-histaminic activity

The ethanolic extract of *Albizia lebbeck* stem bark inhibited histamine signaling in sensitized rats at a dose of 200 mg/ rat through suppression of H1 receptors and histidine decarboxylase genes (HDC) transcriptions [23].

Anti- tussive activity

In the group of experimental animals, *Albizia lebbeck* showed antitussive action on coughs brought on by sulphur dioxide. The results show a significant reduction in cough incidents compared to the control group [13].

Anti-fertility Activity

The spermatogosity count, spermatocyte count, spermgonia count, sperm density, sperm motility and size of the testes in male rats were decreased when methanolic extract of pods of *Albizia lebbeck* was administered to rats.

When a dosage of 50 mg/kg body weight of methanolic extract of pods was given orally to male rats it showed decrease in weight of testes, epididymis, seminal vesicle, and ventral prostate [13, 18].

Saponins extracted from seeds in the dose of 200 mg/kg shows inhibition of copper-induced ovulation in 60% of rabbits. There was also significant reduction in average number of bleeding points in the ovaries [27].

Anti- diarrheal Activity

Aqueous and methanolic extracts of *Albizia lebbeck* showed activity against *Salmonella* and *E. coli*. Extracts made from hexane and petroleum ether showed no action. *Albizia lebbeck* has anti-bacterial properties that are effective against contagious diarrhoea. None of the extracts shown activity against *Candida* and *Shigella*. *Albizia lebbeck* has also been shown to have moderate activity against *V. cholerae*, *A. hydrophilis*, and *B. subtilis* [9].

Antidiabetic Activity

The diabetic disease has possible resistance to *Albizia lebbek's* stem bark extract. The outcomes demonstrated the antidiabetic potential of *Albizia lebbek*. The extract's hypoglycemic effect is mediated by a rise in glucose adsorption, a fall in glucose dispersion rate, and at the cellular level, a promotion of glucose transport across the cell membrane. Significant immunomodulatory action has been observed in the bark extract of *Albizia lebbek*. Experimental animals that were demonstrated to exhibit a substantial immunomodulatory impact were given ethanol and aqueous extracts of *Albizia lebbek* leaves. When taken at a dose of 1g/kg body weight, an ethanol extract of *Albizia lebbek* flower considerably lowers body temperature.

Anti-arthritis activity

Localized bone erosions take as great signs for the diagnosis of rheumatoid arthritis. The effect of *Albizia lebbek* methanol extract on the bone erosion turnover was considered. Various marker of bone erosion like histological and radiological examination of the joints in arthritis induced rats were considered. The results indicate that the methanol extract of *Albizia lebbek* possesses strong antarthritic property [13].

Allergic Conjunctivitis

The impact of *Albizia lebbek* bark extract on rats is demonstrated in contrasting clinical investigations. In a clinical investigation, the effects of 29% of *Albizia lebbek* bark and a 500 mg capsule of *Albizia lebbek* on all types of allergic conjunctivitis.

Clinical trial conducted on 60 patients suffering from allergic type of conjunctivitis. *Albizia lebbek* is used in the form of eye drop given 2 drops 3 times a day for 30 days and compared with standard drug treatment sodium cromoglycate 2% eye drop [16].

Analgesic Activity

The analgesic activity of bark of *Albizia lebbek* was evaluated. At a concentration of 400 mg/kg, the bark extract dramatically decreased the number of writhes at a 52.4% inhibition. Administration of 250 mg/kg of *Albizia lebbek* bark demonstrates analgesic action.

Flowers of *Albizia lebbek* shows analgesic property. Using the hot plate method, the effects of the various *Albizia lebbek* extracts on pain perception were evaluated. N-butanol extract showed good analgesic effect [20].

Using the acetic acid-induced writhing method, the analgesic activity of the total alcoholic extract of *Albizia lebbek's* stem bark was identified. Diclofenac sodium (Novartis) was utilised as the reference standard. Stem bark of *Albizia lebbek* showed good analgesic activity [21].

Anti-Inflammatory Activity

Anti-inflammatory activity of *Albizia lebbek* bark was evaluated. The bark was extracted using methanol. A 400mg/kg dosage of a bark-based methanolic extract of *Albizia lebbek* reduced edema after 4 hours. The methanolic extract of *Albizia lebbek* bark showed good anti-inflammatory activity. When rats were given various *Albizia lebbek* inflorescence extracts in doses of 1 g/kg I.P. (with the exception of the 0.25 g/kg n-butanol extract), it significantly reduced experimentally induced inflammation caused by carrageenan [26].

The flavonol glycoside in stem showed moderate anti-

inflammatory action on albino rats by using non-immunological carrageen induced hind paw edema method. The ethanolic extract of *Albizia lebbek* seed showed highest anti-inflammatory activity at 200 mg/kg dose [11].

The hind paw oedema method was used to test the anti-inflammatory activity of the stem bark of *Albizia lebbek*. As a reference standard, diclofenac sodium was employed. In this investigation, twenty male albino rats weighing 200–220 g were employed. It showed good anti-inflammatory activity [21].

Antibacterial Activity

Using the agar well diffusion method, the antibacterial efficacy of ethanol, water, and ethyl acetate leaf extract of *Albizia lebbek* was determined. Using sterile cotton swabs, the cultures from the standardised broth were aseptically swabbed onto sterile nutrient agar plates. Using a sterile borer, 6 mm wells were made in the inoculated plates. The bottoms of each ditch were then sealed with molten agar. 400 mg/ml of each extract was placed into wells with labels. The zones of inhibition were obtained after the plates were incubated [25].

Anti-bacterial activity The methanolic extracts of *Albizia lebbek* illustrated inhibitory activity against the pathogens *Bacillus subtilis*, *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Salmonella typhi* and *Staphylococcus aureus*; whereasthe ethyl acetate extract demonstrated inhibition against *Escherichia coli*, *Pseudomonas aeruginosa* and *Klebsiella pneumonia* [16].

The stem bark of *Albezia labbeck* also showed good anti-microbial property [22].

Nootropic and anxiolytic activity

The n-butanol fraction of the methanolic extract of *Albizia lebbek* leaves showed nootropic and anxiolytic activity at dose of 25 mg/kg administrated to albino mice. This effect was evaluated using the elevated plus maze test [23].

Antipyretic Activity

Flowers of *Albezia lebbek* showed good anti-pyretic effects. The dichloromethane extract demonstrated the largest temperature drop of 8^o C [26].

Conclusions

Over the past few decades, acceptance of natural medicines has grown significantly. They are used by 80% of people around the world as part of primary healthcare. However, there is a lack of scientific evidence on the majority of these plants. Ethnobotanical surveys play a crucial part in the identification and documentation of folklore and traditional usages of plants. The descriptions about *Albizia lebbek* found in books of traditional practices and ethnobotanical surveys are compiled and presented in this work. The plant is reported to have many therapeutic uses which have to be confirmed by further research studies.

Acknowledgement

The authors express sincere gratitude traditional healers for providing valuable data regarding the plant.

References

1. Muragi A, Samant S, MB P. Formulation and evaluation of herbal emulgel loaded with extract of *Cedrus deodara* for its in-vitro anti-inflammatory activity. International Journal of Ayurvedic Medicine.

- 2022;13(3):749-753.
2. Balkrishna A, Chauhan M, Dabas A, Arya V. A Comprehensive insight into the phytochemical, pharmacological potential and traditional medicinal uses of *Albizia lebbbeck* (L.) Benth. Evidence-Based Complementary and Alternative Medicine. 2022;21:2022
 3. Kamala Lakshmi B, Valarmathi S. *In vitro* anti-inflammatory activity of aqueous extract of *Albizia lebbbeck* leaf (L.). J Phytopharmacol. 2020;9:356-60.
 4. Manimaran P, Solai Senthil Kumar K, Prithiviraj M. Investigation of physico chemical, mechanical and thermal properties of the *Albizia lebbbeck* bark fibers. Journal of Natural Fibers. 2021;18(8):1151-62.
 5. Suman A, Prasad M. Pharmacognostical standardization of *Albizia lebbbeck* (L.) BENTH (Fabaceae). Journal of Drug Delivery and Therapeutics. 2019;9(4):1129-37.
 6. Kanga Y, Djeneb C, Aubin KK, Noël ZG. Screening phytochemical and anti-methicillin resistant (MSRA) activity of 70% ethanolic extract of *Albizia lebbbeck*. Asian Journal of Pharmaceutical Research and Development. 2018;6(6):1-6.
 7. Farag M, Abdel-Kader M. New acyclic secondary metabolites from the biologically active fraction of *Albizia lebbbeck* Flowers.
 8. Mishra SS, Gothecha VK, Sharma A. *Albizia lebbbeck*: a short review. Journal of herbal medicine and toxicology. 2010;4(2):9-15.
 9. Mangwal Ketan, Tiwari RC, Sharma Pragya. Shirish (*Albizia lebbbeck* (L.) Benth.) A drug review, World Journal of Pharmaceutical Research. 2019;8(13):765-777.
 10. Kokila K, Priyadarshini SD, Sujatha V. Phytopharmacological properties of *Albizia* species: a review. Int J Pharm Pharm Sci. 2013;5(3):70-3.
 11. Tomar S, Jawanjal P. Critical review of *Albizia lebbbeck*- A multi potent drug. Journal of Ayurvedic and Herbal Medicine. 2019;5(2):76-81.
 12. Chouhan ES, Yadav S, Tiwari A. A review on biochemical and pharmacological property of *Albizia lebbbeck*.
 13. Vd. Kesha Agrawal, Vd. Amrapali Patil, Vd. Sagar Sudhakar Narode, A review of literature on panchashirisha agad: (*Albizia lebbbeck* Benth), World journal of pharmaceutical research. 2022;11(13):668-675.
 14. Kaur H, Harisha CR, Galib R, Prajapati PK. Pharmacognostical and preliminary phytochemical profiles of pod of Shirisha (*Albizia lebbbeck* Benth.). Annals of Ayurvedic Medicine. 1970;5(3):78-87.
 15. Praengam K, Muangnoi C, Charoenkiatkul S, Thiyajai P, Tuntipipat S. Antioxidant and anti-inflammatory activity of aqueous fraction from *Albizia lebbbeck* leaves. International Food Research Journal. 2017;24(3):1174-1185.
 16. Ekun O. Antioxidant Properties of *Albizia lebbbeck* Seed Protein Hydrolysates. International Journal of Applied Biology. 2022 Dec 29;6(2):101-14.
 17. Gupta RS, Kachhawa JB, Chaudhary R. Antispermatogenic, antiandrogenic activities of *Albizia lebbbeck* (L.) Benth bark extract in male albino rats. Phytomedicine. 2006;13(4):277-83.
 18. Mary OD, Dangana A, Nasir IA, Adisa J. Aqueous leaf extracts of *Albizia lebbbeck* induce histological changes of reproductive organs of alloxan induced diabetic albino rats. J Clin Med. 2017 Jan 16;1(2):336-53.
 19. Yadav SS, Galib PP, Harisha CR. Pharmacognostical screening and phytochemical evaluation of *Albizia lebbbeck* Benth. heartwood. Asian Journal of Biomedical and Pharmaceutical Sciences. 2011;1(5):01-6.
 20. Abd El-Ghany AE, Dora G, Abdallah RH, Hassan W, El-Salam EA. Phytochemical and biological study of *Albizia lebbbeck* stem bark. J Chem. Pharma. Res. 2015;7:29-43.
 21. Khan LH, Varshney VK. Chemical utilization of *Albizia lebbbeck* leaves for developing protein concentrates as a dietary supplement. Journal of Dietary Supplements. 2018;15(4):386-97.
 22. Maya C, Kumar SA, Rajesh K, Bhupendra C, Kovidendra K, Vipin A. Comparative immunomodulator activity of leaves and bark of *Albizia lebbbeck* (LINN.) benth. Int. J Res. Dev. Pharm. L. Sci. 2012;1(1):21-3.
 23. Verma SC, Vashishth E, Singh R, Kumari A, Meena AK, Pant P, *et al.* A review on parts of *Albizia lebbbeck* (L.) Benth. used as ayurvedic drugs. Research Journal of Pharmacy and Technology. 2013;6(11):1307-13.
 24. Sheyin Z, Maimako J, Shindang J, Essien CU, Bigwan EI, Ede FR. Antimicrobial activity of *Albizia lebbbeck* leaf extract on some medically important bacteria. 2015;4(9):473-477.
 25. Farag M, El Gamal A, Kalil A, Al-Rehaily A, El Mirghany O, El Tahir K. Evaluation of some biological activities of *Albizia lebbbeck* flowers. Pharmacology & Pharmacy. 2013;4(6):473-477.