Health Promoting Effects of *Ziziphus mauritiana* : An Overview

Akassh M, Fathima T, Mruthunjaya K*

Department of Pharmacognosy, JSS College of Pharmacy, Mysuru, JSS Academy of Higher Education and Research, Mysuru, Karnataka, India

**Article History:**

Received on: 06.08.2019
Revised on: 04.11.2019
Accepted on: 11.11.2019

**Keywords:**

*Ziziphus mauritiana*, wound healing, antioxidant, anti-inflammatory, anti-diabetic, cytochrome P450

**Abstract**

Natural products are the main source for an alternative system of medicine. *Ziziphus mauritiana*, commonly known as jujubes, belongs to the family Rhamnaceae and is majorly found in the Indian subcontinent. They are traditionally used to treat chronic bronchitis, insomnia, diabetes, diarrhoea, abscesses, wounds, liver diseases, fever, sleeplessness, constipation, urinary diseases, and abdominal pains. Over the course of many years, various parts of *Ziziphus mauritiana* has been found to possess hair growth stimulating, anti-platelet aggregating, anti-inflammation, wound-healing, anti-obesity, antibacterial, and antioxidant effects. Various peer-reviewed research articles were collected from SCOPUS, PubMed, Google, Research Gate, and Web of Science databases. A total of 26 papers were selected based on their relevance. Acetyljujuboside B, Mauritine A, and Jujuboside A are some of the numerous chemical constituents present in *Ziziphus mauritiana*. The present review is an effort to provide a comprehensive review of the literature on the health-promoting effects of *Ziziphus mauritiana*.

*Corresponding Author*

Name: Mruthunjaya K
Phone: +91 9886733404
Email: kmruthunjaya@jssuni.edu.in

**ISSN:** 0975-7538
**DOI:** [https://doi.org/10.26452/ijrps.v11i1.1937](https://doi.org/10.26452/ijrps.v11i1.1937)

**INTRODUCTION**

*Ziziphus mauritiana* (ZM), also known as jujubes, Boroi, or Kul, is widely cultivated in India and other states of the Indian subcontinent. It is a spiny, evergreen shrub/ small tropical fruit tree species, belonging to the Rhamnaceae family. The synonyms, vernacular names, and scientific classification are mentioned in Tables 1 and 2 and Table 3 respectively. It grows up to 15 m high with a 40 cm or more trunk diameter, spreading crown, stipular spines, and many drooping branches. Depending on the variety, the fruit can be obovate, oval, or round with white and crisp flesh and can be 1 - 2.5 inches long. The leaves are either alternate and spiralling or opposite. The plant has symmetrical flowers that have 5 separate sepals and petals. The petals are isomerous, with 5 stemens. The plant also has 2 or 3 ovules ([Macwan et al., 2012](https://doi.org/10.26452/ijrps.v11i1.1937)). ZM has shown to possess many different activities, and the family Rhamnaceae have shown to have high nutritional values. This paper hopes to explain in detail the health-promoting effects of ZM.

**MATERIALS AND METHODS**

The articles for this review was carried out systematically by surveying peer-reviewed research articles from SCOPUS, PubMed, Google, Research Gate, and Web of Science databases. The online search involved the use of keywords such as *Ziziphus mauritiana*, *Ziziphus jujuba*, phytochemical screening, antioxidant, anti-diabetic, anti-obesity, antibacterial, wound healing, hepatoprotective, anti-inflammatory, anti-platelet aggregating, hair growth-promoting activity. Research articles of Non-English origin were not included in the study.
This screening narrowed the article count to 26, and this was used in the study.

RESULTS AND DISCUSSION

Traditional uses

ZM has been widely used as a medicinal plant in Asian countries. Ancient Chinese books, Huangdi Neijing (475 – 221 BC) and Shennong Bencao Jing (300 BC – 200 AD), states ZM as one of the most valuable and superior herbal medicines in China (Chen et al., 2014). They are traditionally used to treat chronic bronchitis, insomnia (Afroz et al., 2014), diabetes, diarrhoea, abscesses, wounds, liver diseases, asthma, fever, sleeplessness, constipation, urinary diseases, gastrointestinal disorders and abdominal pains (Jarald et al., 2009). They are used on cuts, treat ulcer, and to treat pulmonary ailments (Abalaka et al., 2010). The roots are used against skin diseases while the leaves are used to treat sores, used in the treatment of typhoid, and have antimicrobial, antioxidant, and hepatoprotective effects. When taken with buttermilk, the seeds can stop vomiting and abdominal pains during pregnancy. They are also used as sedatives (Abalaka et al., 2010; Jain et al., 2019).

Ethnobotany

Two ethnobotany surveys were conducted in Lesser Himalayas – Pakistan (Abbasi et al., 2013) and Burkina Faso (Sop et al., 2012) in West Africa. Both of the studies were focused on the species that are most used in the respective communities. The studies in Pakistan yielded a total of 35 wild edible fruits belonging to 21 genera and 17 families, which were used for the treatment of various ailments and consumed. Out of the 17 families, Rhamnaceae (5 spp.) was considered to be one of the most dominating species behind Rosaceae (8 spp.) and Moraceae (6 spp.). ZM was also found to be the most significant species within top fruit plants on the basis of cultural importance index (Abbasi et al., 2013).

3 ethnic groups were subjected to a survey to identify the most important species of their region, Burkina Faso. The survey also shed light on the conservation priorities from the informant’s perspective. ZM was ranked 4th and 5th in the Most Important Species (MIS) and species for conservation priority (SCP), respectively. ZM was also considered as one of the food species with a high socioeconomic value in Burkina Faso (Sop et al., 2012). These data suggest that ZM has significant importance in the livelihood in local communities.

Phytochemistry

Extensive phytochemical investigations on Ziziphus species have proven it to be a rich source of many chemically unique and biologically interesting compounds. The constituents are cyclopeptide alkaloids (Table 4), sedative flavonoids (Table 5), Terpenoids (Table 6), and glycosides (Table 7).

Pharmacological activities

Antioxidant

The antioxidant properties of ZM has been well-documented. Traditional names for ZM are Apple Kul and Bau Kul. Different concentrations of methanolic extract of Apple kul and Bau Kul from Dhaka, Bangladesh was found to increase its inhibitory potential with increasing concentration when tested for DPPH radical scavenging activities. The 50% inhibitory concentration (IC50) was 0.73 mg/mL for Apple Kul which was significantly higher than the standards, catechin (3.30 µg/mL), ascorbic acid (2.80 µg/mL) and gallic acid (3.00 µg/mL) but much lower than the IC50 of an Indian jujube variety (ZM) (6.15 µg/mL) and IC50 values was 1.34 mg/mL for Bau Kul. (Tanvir et al., 2015)

Apple kul also showed promising activity, when tested using Ferric-Reducing Antioxidant Power Assay (FRAP) and compared with 15 other promising jujube genotypes from the Mediterranean regions in Turkey and Indian jujube genotype, while Bau Kul showed appreciable FRAP value. Apple kul and Bau Kul also has the ability to scavenge H2O2 in a concentration-dependent manner in H2O2 scavenging activity carried out by the titration method (Afroz et al., 2014).

Researchers from Burkina Faso have also performed antioxidant studies on leaf extracts of ZM collected from Loumbila, BF. Out of the 5 FRAP fractions used for the study, ethyl acetate extract showed highest inhibition on DPPH radical (8.20 µg/mL) followed by aqueous (9.15 µg/mL), ethanol (9.80 µg/mL) and dichloromethane (12.70 µg/mL) when compared to standard quercetin (6.90 µg/mL). FRAP assay of the extracts were also investigated. The order of FRAP activity was: aqueous (85.58 mg AAE/ 100 mg) > ethyl acetate (82.84 mg AAE/ 100 mg) > ethanol (41.74 mg AAE/ 100 mg) > dichloromethane (26.36 mg AAE/ 100 mg) > hexane (7.50 mg AAE/ 100 mg) (Youl et al., 2019).

The above evidences suggest that different parts of the ZM plant can be a potent antioxidant. Among the different plant parts used in the above studies, leaf extracts possess better antioxidant properties when compared to the fruit and bark extracts. The antioxidant property has been largely related to the polyphenol content present in the plant extracts. (Youl et al., 2019) States that plant polyphe-
### Table 1: Synonyms

| Latin Name                        | Common Name                                    |
|----------------------------------|------------------------------------------------|
| Paliurus mairei H. Lév.          | Rhamnus jujuba L.                              |
| Ziziphus mauritana var.          | Ziziphus jujuba (L.) Gaertn.                   |
| Browicz & Lauener                | Ziziphus mauritana var.                        |
| Ziziphus orthocantha DC.         | Ziziphus mauritana var.                        |
| Ziziphus orthocantha DC.         | Ziziphus orthocantha DC.                       |

*The synonyms were obtained from ([India Biodiversity, 2019](#)).

### Table 2: Vernacular names

| Language  | Name                      |
|-----------|---------------------------|
| English   | Jujube tree, jujube, common jujube, Chinese date |
| Assamese  | Bogori, Bagari             |
| Tamil     | Yellande, Ilantha, Ilanthai |
| Hindi     | Ber                       |
| Irula     | Elanthai, Elasi           |
| Kannada   | Yelchi                    |
| Karbi     | Thakri                    |
| Malayalam | Perimthudali, Lanthapazham, Badari, Elantha, |
| Arabic    | annab, aunna-b-hindi, aunna-bhindi, nabig, nabiq, |
| Persian   | kanar, kunar, nabik, sinpo-i-jilani |
| Tibetan   | gya-sug, ko la, rgya sug  |
| Urdu      | annab, baer, ber, unab, unnab |

*The vernacular names were obtained from ([ENVIS, 2019](#); [India Biodiversity, 2019](#)).

### Table 3: Scientific Classification

| Kingdom     | Plantae                  | Order          | Rhamnales    |
|-------------|--------------------------|----------------|--------------|
| Subkingdom  | Tracheobionta            | Family         | Rhamnaceae   |
| Superdivision | Spermatophyta           | Tribe          | Paliureae    |
| Division    | Magnoliophyta            | Genus          | Ziziphus     |
| Class       | Magnoliopsida            | Species        | Ziziphus mauritana |
| Subclass    | Rosidae                  |                |              |

*The scientific classification were obtained from ([India Biodiversity, 2019](#); [USDA, 2019](#)).

### Table 4: Cyclopeptide alkaloids

| Name                          | Formula                                      |
|-------------------------------|----------------------------------------------|
| Melonovine A                  |                               |
| Nummularine H, B              |                               |
| Sanjoinenine                  |                               |
| Daechuine S3                  |                               |
| Mucronine D                   |                               |
| Sativanine F                  |                               |
| Sativanine C-E                |                               |
| Frangulione                   |                               |
| Hysodricanin A                |                               |
| Nummularine A                 |                               |
| Ziziphine A                   |                               |
| Amphibine B                   |                               |
| Aralionin C                   |                               |
| Frangagine                    |                               |
| Sativanine K                  |                               |
| Sativanine H                  |                               |
| Amphibines B, D-F             |                               |
| Daechuine S6                  |                               |
| Amphibine D-E                 |                               |
| Jabanine A-B                  |                               |
| Mucronine D                   |                               |
| Nummularine A                 |                               |
| Franguline                    |                               |
| Sativanine K                  |                               |
| Sativanine H                  |                               |

*Some of the cyclopeptide alkaloids present in ZM ([Hossain et al., 2015](#); [Mahajan and Chopda, 2009](#)).

### Table 5: Sedative flavonoids

| Flavonoid                     | Formula                                      |
|-------------------------------|----------------------------------------------|
| Swertish spinosin             | puerarin (6”-feruloylspinosin)               |
| isospinosin                   | γ-fagarine                                    |
| apigenin-6-C-D-glucopyranoside| ,α-sitosterol                                 |
| ,6”feruloylisopinosin         |                                              |

*Some of the sedative flavonoids present in ZM ([Mahajan and Chopda, 2009](#)).
Table 6: Terpenoids

| Compound                        | Betulin | Betulinic acid | colubrinic acid | 3-O-cis-p-coumaroylmaslinic acid | 2α-hydroxyursolic acid | 3-O-trans-p-coumaroylalpathilic acid | 3-O-trans-p-coumaroylmaslinic acid |
|---------------------------------|---------|----------------|-----------------|----------------------------------|------------------------|-------------------------------------|----------------------------------|
| alpha-tolic acid                | 3-O-cis-p-coumaroylalpha-tolic acid | 3-O-trans-p-coumaroylalpha-tolic acid | Ursolic acid | 3-O-trans-p-coumaroylmaslinic acid |

*Some of the terpenoids present in ZM (Mahajan and Chopda, 2009).

Table 7: Glycosides

| Compound                        | protojujuboside B | Jujuboside A | Jujuboside B | Jujuboside A1 | Jujuboside B1 |
|---------------------------------|-------------------|--------------|--------------|---------------|---------------|
| Jujuboside C                    | acetyljujuboside B | protojujuboside A | protojujuboside B1 |

* Some of the glycosides present in ZM (Mahajan and Chopda, 2009).

Antioxidants are mostly antioxidants. Polyphenols were responsible for 98.63% reduction of DPPH and play a major role in mediating antioxidant effect by scavenging free radicals and/or by chelating metal ions.

**Anti-Obesity**

Bark powders of ZM (ZMBP) have shown to exert good anti-obesity activity. (Deshpande et al., 2013) Performed an anti-obesity study on Wistar rats. The obese rats were administered with 250 and 500 mg/kg dose of ZMBP. ZMBP induced rats showed a significant reduction in the weight of the peri toneal fat pad when compared to the Standard drug Sibutramine after 90 days of treatment. MRI scans of the DEXA analysis also showed 68.99 % and 72.84 % reduction in body fat mass at 250 and 500 mg/kg dose, respectively, when compared to the obese control group. The mechanism of reduction in body fat has been found to be through the excretion of fat through the fecal matter. Fecal fat analysis shows that obese rats treated with 250 mg/kg and 500 mg/kg ZMBP showed an increasing weight of fecal matter when compared to the standard. This shows that ZMBP have far more superior activity when compared to the standard drug. Another study performed by (Deepak and Anurekha, 2018) also showed a dose-dependent reduction of body weight of obese Wistar rats when treated with aqueous extracts of ZM. 200 and 400 mg/kg/day dose of extracts of ZM showed a significant reduction of body weight during a period of 14 days. The polyphenolic compounds that are abundant in ZMBP has been speculated to be responsible for the property of anti-obesity.

**Wound-healing activity**

Wound healing activity has been established in different parts of the Ziziphus plant. (Sumanth and Bhargavi, 2014) Performed exclusion and inclusion wound models to assess the wound-healing activity of ethanolic extracts of ZM leaf. The study was performed over a period of 20 days on albino strains of Wistar rats, and the rate of wound contraction and epithelisation period was calculated. ZM aqueous extract of 300 mg/kg dose showed considerable 20 days wound contraction activity but was overshadowed by gel of ethanol extract of ZM 100 mg/cm² (EEZM) and standard Framycetin skin cream (PSC) 100 mg/cm². It also showed a similar period of epithelisation when compared to EEZM gel and standard FSC. The similar wound-healing activity was performed by (Kumar et al., 2012) on albino rats using 5% and 10% of Z. jujube methanolic extracts to assess their excision wound surface area, wound concentration and wound protein concentration. The 10% methanolic extracts showed similar wound surface area (0 mm² at 24th day) and comparable wound contraction results to that of standard (10% Povidine iodine) and wound protein concentration. The presence of tannins, saponins, flavonoids, and triterpenoids are said to be responsible for promoted wound contraction and decreased the period of epithelisation in the excision wound model (Sumanth and Bhargavi, 2014).

**Anti-platelet aggregating activity**

The seeds of Z. jujuba (SZJ) has been used in this study. The ethanolic extract of SZJ (ESZJ) and Jujuboside A and B were assessed for their antiplatelet effects using 3 different models: collagen-, thrombin- and arachidonic acid (AA)-induced platelet aggregation model. Results showed that 300 μg/ml of aspirin (standard antiplatelet drug) and ESZJ showed the same activity at collagen and AA models, but ESZJ showed better activity than aspirin in the thrombin-induced platelet aggregation model with IC₅₀ of 181.3 ± 1.6 and
325.9 ± 2.2 respectively. Studies further performed on Jujuboside A, and B showed that Jujuboside B showed better activity comparatively in all the 3 models. ESZJ treated mice also showed an increase in bleeding time and protection against acute pulmonary thromboembolism, further solidifying its activity against platelet aggregation (Al-Reza et al., 2009).

**Hair growth-promoting effect**

The essential oils of seeds of Z. jujuba showed hair growth-promoting activity by an in-vivo method. Investigations on BALB/c mice showed that 1% and 10% essential oils show better hair length, hair weight, hair thickness, and relative area of hair follicle when compared to treatment. On comparison within oils, 1% essential oil showed better activity than 10% essential oil (Yoon et al., 2010).

**CONCLUSIONS**

With the recent global concern regarding the change of lifestyle choices, herbal remedies are gaining more traction, importance, and relevance. ZM has been well-documented and used as a remedy in many cultures. With this review article, we have concluded that ZM contains many different constituents such as alkaloids, glycosides, and terpenoids of different nature and are used to treat diabetes, wounds, liver diseases, asthma, fever, constipation, urinary diseases, and gastrointestinal diseases. ZM has also shown to have potent properties of hair growth, anti-platelet aggregation, myocardial ischemia, anti-diabetic, anti-inflammation, hepatoprotection, wound-healing, anti-obesity, antibacterial and antioxidant effects. By understanding the health-promoting properties of ZM, it can help provide better solutions to diseases that do not have a comprehensive treatment with the constituents that are less researched.

**REFERENCES**

Abalaka, M. E., Daniyan, S. Y., Mann, A. 2010. Evaluation of the antimicrobial activities of two Ziziphus species (Ziziphus mauritiana L and Ziziphus spinachristi L) on some microbial pathogens. Afr. J. Pharm. Pharmacol, 4:135–139.

Abbasi, A. M., Khan, M. A., Khan, N., Shah, M. H. 2013. Ethnobotanical survey of medicinally important wild edible fruits species used by tribal communities of Lesser Himalayas-Pakistan. J. Ethnopharmacol, 148:528–536.

Afroz, R., Tanvir, E. M., Islam, M. A., Alam, F., Gan, S. H., Khalil, I. 2014. Potential antioxidant and antibacterial properties of a popular jujube fruit: Apple Kul (Zizyphus mauritiana). J. Food Biochem, 38:592–601.

Al-Reza, S. M., Bajpai, V. K., Kang, S. C. 2009. Antioxidant and antilisterial effect of seed essential oil and organic extracts from Zizyphus jujuba. Food Chem. Toxicol, 47:2374–2380.

Chen, J., Yan, A. L., Lam, K. Y. C., Lam, C. T. W., Li, N., Yao, P., Xiong, A., Dong, T. T. X., Tsim, K. W. K. 2014. A chemically standardized extract of Ziziphus jujuba fruit (jujube) stimulates expressions of neurotrophic factors and anti-oxidant enzymes in cultured astrocytes. Phytother. Res, 28:1727–1730.

Deepak, J., Anurekha, J. 2018. Study of antiobesity activity of polyherbal formulation in correlation with antidiabetic activity. Asian J. Pharm. Clin. Res, 11:486–490.

Deshpande, M. S., Shengule, S., Apte, K. G., Wani, M., Piprode, V., Parab, P. B. 2013. Anti-obesity activity of Ziziphus mauritiana: A potent pancreatic lipase inhibitor. Asian J. Pharm. Clin. Res, 6:168–173.

ENVIS 2019. Plant Details for a Zizyphus mauritiana LAM. accessed 9.3.19.

Hossain, M. J., Sikder, M. A. A., Kaisar, M. A., Haque, M. R., Chowdhury, A. A., Rashid, M. A. 2015. Phytochemical and biological investigations of methanol extract of leaves of Ziziphus mauritiana Lam. Boletin Latinoam. Caribe Plantas Med. Aromat, 14:179–189.

India Biodiversity 2019. Ziziphus mauritiana Lam. accessed 7.2.19.

Jain, P., Haque, A., Islam, T., Alam, M. A., Reza, H. M. 2019. Comparative evaluation of Ziziphus mauritiana leaf extracts for phenolic content, antioxidant, and antibacterial activities. J. Herbs Spices, Med. Plants, 25:236–258.

Jarald, E. E., Joshi, S. B., Jain, D. C. 2009. Antidiabetic activity of extracts and fraction of Zizyphus mauritiana. Pharm. Biol, 47:328–334.

Kumar, S., Arutla, C., Swaroopa, R., Rao, D. S., , K. 2012. The wound healing potential of Ziziphus jujuba bark extract on albino rats. Int. J. Res. Ayurveda Pharm, 3:830–832.

Macwan, C., Palejkar, J., Patel, A., Patel, M. 2012. A PLANT REVIEW ON ZIZIPHUS MAURITIANA. International Journal of Universal Pharmacy and Life Sciences, 2:202–211.

Mahajan, R. T., Chopda, M. 2009. Phyto-Pharmacology of Ziziphus jujuba Mill- A plant review. Pharmacogn. Rev, 3:320–329.

Sop, T. K., Oldeland, J., Bognounou, F., Schmiedel, U., Thiombiano, A. 2012. Ethnobotanical knowledge
and valuation of woody plants species: A comparative analysis of three ethnic groups from the sub-Sahel of Burkina Faso. Environ. Dev. Sustain, 14:627–649.

Sumanth, M., Bhargavi, Y. 2014. Evaluation of the wound-healing effect of Ziziphus mauritiana L. leaf extract in rats. Int. J. Green Pharm, 8:263–266.

Tanvir, E. M., Afroz, R., Karim, N., Mottalib, M. A., Hossain, I., Islam, A., Gan, S. H., Khalil, I. 2015. Antioxidant and antibacterial activities of methanolic extract of BAU kul (Ziziphus mauritiana), an improved variety of fruit from Bangladesh. J. Food Biochem, 39:139–147.

USDA 2019. Classification | USDA PLANTS [WWW Document. accessed 7.3.19.

Yoon, J. I., Al-Reza, S. M., Kang, S. C. 2010. The hair growth-promoting effect of Zizyphus jujuba essential oil. Food Chem. Toxicol, 48:1350–1354.

Youl, E. N. H., Ouédraogo, C. A. P., Gambo, M., Ouédraogo, M., Kiendrébéogo, M., Traoré, A., Guissou, I. P. 2019. Antioxidant activity of crude ethanolic extract and fractions of Ziziphus mauritiana Lam. (Rhamnaceae) leaves from Burkina Faso. Clin. Physiol. Pharmacol, 30: J.