

## A REVIEW ON THERAPEUTIC ACTIVITY OF ZIZIPHUS JUJUBA

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**ABSTRACT**

Ziziphus jujuba, commonly known as jujube or red date, is a deciduous fruit-bearing tree belonging to the family Rhamnaceae. Native to South and East Asia, it is well adapted to arid and semi-arid climates due to its deep root system and high drought tolerance. The plant typically grows 5–12 meters tall, featuring a spreading canopy, thorny branches, and small, glossy green leaves with three distinct veins. Its tiny yellowish-green flowers bloom in clusters and are rich in nectar, attracting pollinators. The fruit is an oval drupe that transitions from green to reddish-brown as it ripens. Fresh jujube fruits have a crisp texture and sweet taste similar to apples, while dried fruits resemble dates in flavor and appearance. The plant is valued not only for nutrition but also for traditional medicinal uses, as the fruits are rich in vitamin C, antioxidants, flavonoids, and

minerals. Various parts of the plant, including fruits, seeds, and bark, are used in herbal preparations believed to support immunity, digestion, and sleep quality. Because of its resilience, low maintenance requirements, and economic importance, Ziziphus jujuba is widely cultivated in tropical and subtropical regions, contributing to food security, traditional medicine, and sustainable agriculture. The therapeutic activity of Ziziphus jujuba has made a potential and alternative effect to the actions for the health related disorders by using herbal remedies.

**KEYWORDS:** Red date, Rhamnaceae, thorny branches, ziziphus jujuba, South and east Aisa, traditional medicine.

## INTRODUCTION

*Ziziphus jujuba* is a thorny plant widely distributed in tropical and subtropical regions, particularly in north Africa, Originating in China over 4,000 years ago, it remains the world's leading producer and exporter of red dates. Cultivation also occurs in Europe, the United States, Australia, and Russia, Europe and Southeast Asia.<sup>[1]</sup> Its fruits are rich in carbohydrates, proteins, and bioactive compounds including triterpenoids, flavonoids, saponins, tannins, and polysaccharides. Different plant parts exhibit anti-inflammatory, analgesic, hypoglycaemic, lipid-lowering effects, anti-obesity, hypolipidemic, and liver-protective properties.<sup>[2]</sup>

The mature fruit of *Z. jujuba* is a red to purplish black in colour, resembling small dates, and in China are known as the date or red date. The dried fruit of *Z. jujuba* is known in Persian cuisine as "annab." Jujube trees grow in the arid and semiarid zones of Iran, especially in Birjand, South Khorasan province. Because of the plant's extensive utilization in food and pharmaceutical industries, production has increased sharply over the past decade. China has been the site of 90% of *Z. jujuba* production in the world, as it is indigenous to China with a history of over 4,000 years.<sup>[3]</sup>

Different parts of jujube are being consumed all around the world because of their health benefits, as both food and herbal medicine. Fruits of this plant are widely used in Iranian folk medicine as antitussive, laxative agent and blood pressure reducer. Based on Iranian traditional medicine books, local traditional healers used powders of stem bark and leaves of jujube to cure wounds and oral wounds as aphthous. It is used traditionally as anti-diabetes, tonic, aphrodisiac, hypnotic-sedative and anxiolytic, anticancer, antifungal, antibacterial, antiulcer, anti-inflammatory, cognitive, antispastic, antifertility/contraception, hypotensive, antinephritic, cardiogenic, antioxidant, immunostimulant, and wound healing.<sup>[2]</sup>

It tends to be a more upright tree with bright green, glabrous leaves. The tree is deciduous, losing its leaves in winter; flowers in the spring, and the fruits mature in autumn. It is resistant to winter cold (Guijun and Ferguson, 2010). It is a hardy tree of arid region, which can be grown successfully in saline soil under hot, arid environment (Meena et al., 2003). Its fruit is an edible oval drupe with single hard stone (Nowak a Shulzová, 2002; Azam-Ali et al., 2006). Jujube cultivars vary in size and morphology. After 30 years of growth in an average site, trees of most cultivars will be 40-50 feet tall with a crown diameter of 15-20 feet (Lvrene and Crocker, 1994). Trees bear fruit as early as 1 to 4 years after planting (Lyrene,

1979). Often producing some fruit, the second year from seed or grafting (Lyrene and Crocker, 1994). Currently, there are 700 to 800 jujube cultivars in China, including fresh eating, drying, multipurpose (good for both drying and fresh eating), candied, and ornamental. Annual fruit production in China is 450 000 long tons produced on 290 000 hectares. *Zizyphus jujuba* Mill. "Huizao" is the most commonly planted cultivar in China, with the largest orchard area and the highest annual production (Shanmugavasan et al., 2011). Fruits, leaves, seeds and other parts of *Z. jujuba* plant contain many important biologically active substances.<sup>[4]</sup>

The plant typically grows as a small tree or shrub, reaching heights of 5-10 m, with ovate leaves, small yellow-green flowers, and oval to round drupaceous fruits. The fruit undergoes distinct developmental stages, transitioning from green to red or dark brown upon maturation. Jujube fruits are consumed fresh, dried, or processed into various food products and beverages, contributing significantly to local economies and food security in producing regions.<sup>[5]</sup>



**Fig. 1** *Zizyphus jujuba* plant.

#### PARTS OF PLANTS



**SEED**



**FLOWER**



**STEM**



**ROOT**



**FRUIT**

**Fig. 2:** *Zizyphus jujuba* plant parts.

**Toxonomical classification**

Ziziphus jujuba is classified as follows.

Domain	Eukaryota
Kingdom	Plantae
Subkingdom	Virdiplantae
Phylum	Spermatophyta
Subphylum	Angiospermae
SuperDivisions	Embryophyta
Division	Tracheophyta
Sub Division	Spermatophytina
Class	Magnoliopsida
Super order	Rosanae
Order	Rosales
Family	Rhamnaceae
Genus	Ziziphus
Species	Ziziphus jujuba <sup>[6]</sup>

**Vernacular Names**

Tamil	Vadari
Bengali	Kul
Marati	Bor
English	Chinese Date, Jujube
Hindi	Ber
Punjabi	Bogari
Kannada	Renu
Telugu	Ber
Urdu	Jangri
Sindhi	Ber
Gujarati	Bordi
Chinese	Da Zao and Hong Zoe <sup>[7]</sup>

**PHYTO CONSTITUENTS****Alkaloids**

- jubanine
- scuthianine
- zyzyphine A
- juzirine, zuriphine
- isocoldin, asimilobine<sup>[7]</sup>

**Cyclic, peptide, alkaloids**

Sativanine-C, Sativanine-G, Sativanine-E, Sativanine-H, Sativanine-F, Sativanine-D, Coclaurine, Isoboldine, Norisoboldine, Assimilobine, Iusiphine, Iusirine, Sanjoinenine, Franguloine, Amphibine-D.<sup>[8]</sup>

**Terpenoids**

The triterpenic acids have been isolated from the fruits of *Z. jujuba*: some of them are colubrinic acid, alphitolic acid, 3-O- cis-p-coumaroylalphitolic acid, 3-O-trans-p-coumaroylalphitolic acid, 3-O-cis-p-coumaroylmaslinic acid, 3-O-trans-p-coumaroylmaslinic acid, oleanolic acid, betulonic acid, oleanonic acid, zizyberenalic acid and betulonic acid.<sup>[7]</sup>

**Anthocyanins**

Delphinidin-3,5-diglucoside, cyanide ion, cyanidin-3,5-diglucoside, delphinidin-3- glucoside, pelargonidin-3,5-diglucoside, peonidin-3-glucoside, cyanidin-3-glucoside and pelargonidin-3-glucoside.<sup>[9]</sup>

**Flavonoids**

Quercetin-3-O-glucoside, quercetin-3-O-diglucoside, quercetin-3-O-rutinoside, rhamnetin and eriodictiol were isolated from the leaves and identified.<sup>[10]</sup>

**volatile compounds**

Including alcohols, carboxylic acids, esters, and terpenoids. The leading volatile chemical was oleic acid in the GC-MS profile (Fig. 1B). Linoleic acid and stearic acid were the next most prolific volatile chemical. Other volatile compounds with percentage higher than 5% were palmitic acid and 2-monoeicosanoylglycerol.<sup>[11]</sup>

**Organic Acids**

Alpha-tocopherol, ascorbic, cinnamic, citric, ferulic, quinic, malic, maleic, malonic, p-hydroxybenzoic, oxalic, succinic, and tartaric acid, are only a few acids of the reported organic acids found in jujube fruit.<sup>[12]</sup>

**Vitamins and minerals**

Jujube fruits contain plenty of minerals and vitamins (especially vitamin C). Mineral analysis showed that jujube fruits contain 17 minerals including 6 macro-elements (K, Ca, Mg, Na, S, and P) and 11 trace elements (Fe, Zn, Cu, Mn, Ni, Se, Pb, Br, Rb, Sr, and Mo). The major vitamins detected in jujube fruits are vitamin A, vitamin B complex, carotene, thiamine,

riboflavin, and ascorbic acid. Ascorbic acid, also known as vitamin C, is a powerful reducing and chelating agent, with numerous biological functions in cells and tissues (Paciolla et al., 2019). Studies have shown that jujube fruits qualify as a good source of vitamin C. A wide range in the concentration of vitamin C was detected among the 15 jujube cultivars.<sup>[13]</sup>

## PHARMACOLOGICAL ACTIVITIES OF ZIZIPHUS JUJUBA PLANT

### ❖ Hepatoprotective activity

Jujube polysaccharides (JP) have hepatoprotective activity in mice and can suppress the injury caused by carbon tetrachloride (CCl<sub>4</sub>) in the liver. JP significantly reduced the CCl<sub>4</sub>-elevated activities of lactate dehydrogenase, aspartate aminotransferase (AST), and alanine aminotransferase (ALT) in the serum of mice ( $p < 0.01$ ). Moreover, JP decreased hepatic MDA levels. Mice treated with JP demonstrated normal GPx and superoxide dismutase (SOD) activities.<sup>[23]</sup> Furthermore, the hepatoprotective activity was evaluated. The results revealed that hepatoprotective activity increased the levels of antioxidant enzymes (SOD and catalase (CAT)) and glutathione (GSH), and decreased the levels of aminotransferase enzymes (ALT and AST) and MDA. Furthermore, hepatoprotective activity improved the histological effects. The investigation showed that hepatoprotective activity possesses hepatoprotective activity because of its potential antioxidant capacity.<sup>[55]</sup> Jujube fruit extract was evaluated for ischemia-reperfusion-induced liver injury by clamping the hepatic artery and portal vein in rats. The findings revealed that JE decreased ischemia-reperfusion-induced liver damage because of its anti-inflammatory and antioxidant activities.<sup>[56]</sup> In addition, JE decreased the levels of aminotransferase (ALT and AST) and MDA and elevated the activity of antioxidant enzymes (glutathione peroxidase (GSH-Px), SOD, and CAT). Moreover, JE was beneficial against liver toxicity.<sup>[57]</sup> Maslinic acid in the pulp of jujube fruit exhibits hepatoprotective activity against CCl<sub>4</sub>-induced liver toxicity.<sup>[9]</sup>

### ❖ Immunostimulant effects

The leaf extract of *Z. jujuba* was found to stimulate chemotactic, phagocytic and intracellular killing potency of human neutrophils (infection fighting white blood cells) at 5-50 microg/ml.<sup>[7]</sup>

### ❖ Antidiabetic activity

Triterpenoids derived from *Ziziphus jujuba* extract were discovered to increase glucose consumption in L6 myotubes through GLUT translocation.<sup>[87]</sup> Treatment with an alcoholic extract of *Ziziphus jujuba* for a prolonged period reduced glucose levels, which might be due

to insulin secretion or increased insulin receptor sensitivity. To indicated that ingestion of ZJF (*Ziziphus jujuba* fruit) has favorable effects on lipid profiles, HbA1c, and, to a lesser extent, antioxidant status in individuals with T2DM. the studies mentioned above suggest the anti-diabetic potential of *Z. jujube* but this needs to be further evaluated.<sup>[12]</sup>

#### ❖ **Antitumor activity**

The antitumor activity of polysaccharides is affected by the size of the molecules, their form, degree of branching, and solubility in water. Generally, the greater the molecular weight and the higher the water solubility of the polysaccharides, the greater is its anti-tumor activity. Many studies have demonstrated that polysaccharides exert strong antitumor activity through different proposed mechanisms. The currently accepted mechanism by which polysaccharides exert their antitumor effect can be summarized as follow;

- 1) prevention of oncogenesis by the oral administration of polysaccharides;
- 2) improvement in the immune response to tumors;
- 3) direct antitumor activity that induces the apoptosis of tumor cells;
- 4) prevention of the spread or migration of tumor cells in the body

To clarify the precise antitumor mechanisms of *Z. jujuba* polysaccharides isolated and purified two homogeneous acidic polysaccharides (HJP1 and HJP3) from MZ and showed that HJP3 significantly inhibited the proliferation of HepG2 cells but displayed significantly lower cytotoxicity to nontumorous cell lines.<sup>[14]</sup>

#### ❖ **Antidiarrhoeal**

Antidiarrhoeal effect of the methanolic extract as evaluated exhibited a concentration dependent inhibition of the spontaneous pendular movement of the isolated rabbit jejunum and inhibited acetylcholine induced contraction of rat ileum. A dose dependent decrease of gastrointestinal transit was observed with extracts 25 and 50 mg/kg which also protected mice against castor oil induced diarrhoea and castor oil induced fluid accumulation, respectively.<sup>[15]</sup>

#### ❖ **Intestinal protective effect**

According to the theory of Traditional Chinese Medicine (TCM), jujube is sweet and warm. It is a common herbal medicine for the treatment of spleen deficiency and sloppy stool. Modern pharmacology researches have found that jujube possessed an outstanding effect on animal intestinal movement and metabolism. When studying the function of water-soluble polysaccharides from jujube on intestine and feces of hamster, it was found that jujube

polysaccharides could effectively shorten the passage time of food in gastrointestinal tract, reduce the ammonia gas in caecum, increase the concentration of total short chain fatty acids in caecum, and upregulate the water content in feces. As a result, the gastrointestinal environment was improved, and exposure of intestinal mucosa to toxic ammonia water, other harmful compounds was reduced, and the intestine was protected. As mentioned above, jujube polysaccharides performed strong anti-oxidant activity, which plays an important role in intestinal protection. For example, it could effectively reduce the intestinal malondialdehyde (MDA) level and increase its anti-oxidant enzyme activity in intestinal ischemia/reperfusion rabbits, and play a role in protecting intestinal tract against oxidative damage by ischemia and reperfusion (Wang, 2011). In addition, jujube polysaccharides could also promote the proliferation of intestinal probiotics. According to the literature, *Z. jujuba* cv. Water soluble polysaccharides extracted from it could significantly prevent colon shortening and lower mortality, reduce proinflammatory cytokines in intestine, increase the concentration of total short chain fatty acids in feces and regulate intestinal flora in colorectal cancer mice.<sup>[16]</sup>

#### ❖ **Jujube on Insomnia, Learning, and Memory**

In Chinese herbal medicine, jujube was prepared as a tea that was used against insomnia. Indeed, jujube was found to increase pentobarbital-induced sleep time and to reduce free movement on mice. It was reported that the seed of *Z. jujuba* prolonged the hexobarbital-induced sleeping time in mice and decreased the locomotor activity in rats. Moreover, jujube was shown to possess anxiolytic effect by increasing the first time entry, as well as the total change and time spent in the white chamber of black and white test. Besides, flavonoids and saponins from seed of *Z. jujuba* showed sedative and hypnotic effects, which caused a significant reduction of walking time and coordinated movement ability of mouse, significantly prolonging its sleeping time.<sup>[17]</sup>

#### ❖ **Anti-Inflammatory Effects**

Jujube is used as an antidote in the TCM soup “Shizao decoction” for relieving inflammatory irritation. It exerts anti-inflammatory effects mainly by affecting the growth and metabolism of inflammatory cells and cytokine release and expression. Among the six active compound groups from jujube, triterpenic acids exhibited the strongest anti-inflammatory activity along with a significant inhibition of NO production and splenocyte proliferation. Among 29 triterpenoids from jujube, ursolic acid and oleanolic acid exerted stronger anti-inflammatory

activity by downregulating the expression of inflammatory factors through the NF- $\kappa$ B signaling pathway. Animal experiments have demonstrated that jujube possesses *in vivo* anti-inflammatory activity, showing potential application in the treatment of inflammatory diseases such as plantar fasciitis and pneumonia. Reduced granuloma tissue formation and inflammatory mediators in rats were detected after the gavage administration of jujube extract. In a dermatitis mice model, the increase in ear skin thickness and water content induced by TPA were markedly inhibited by jujube essential oil.<sup>[18]</sup>

#### ❖ Anti-viral activities

*Ziziphus jujuba* (jujube) has attracted attention for its significant antiviral properties against human, animal, and plant viruses. Betulinic acid, a pentacyclic triterpenoid first isolated from jujube fruit, shows strong antiviral activity. It effectively inhibits Influenza A virus replication in infected A549 cells. At 50  $\mu$ mol/L, betulinic acid demonstrated potent activity without significant cytotoxicity. *In vivo* studies in mice showed reduced lung necrosis and edema caused by influenza infection. Jujube is widely used in traditional Chinese medicine antiviral formulations. Yakammaoto, containing jujube, inhibits viral attachment, internalization, and replication. It was shown to protect cells from damage induced by Coxsackievirus B4. Eight cyclopeptide alkaloids were isolated from dried jujube roots. Compounds jubanines-G, jubanines-H, and nummularine-B showed antiviral potential. These compounds exhibited inhibitory effects against Porcine epidemic diarrhea virus. This was the first report of antiviral activity of plant-derived cyclopeptide alkaloids from jujube. Additionally, two new flavonoids were isolated from jujube fruits. These compounds showed strong inhibition of Tobacco mosaic virus replication. Overall, jujube contains diverse bioactive compounds with promising antiviral applications.<sup>[19]</sup>

#### ❖ Antipyretic effect

*Z. jujuba* leaves has been undertaken to investigate the antipyretic effect of methanolic extracts. The antipyretic activity of *Z. jujuba* (leaves) was evaluated using Brewer's yeast induced pyrexia in rats. The result revealed that *Z. jujuba* at a dose of 200mg/kg caused a highly noteworthy reduction at third hour ( $p < 0.001$ ). However, the consequence increases significantly at the dose of 400 mg/kg having  $p < 0.01$  at first, second and fourth hour. The antipyretic effect was comparable with that of a standard paracetamol. Thus above finding justified that methanolic leaves extract of *Z. jujuba* developed to have beneficial effects in antipyretic activity.<sup>[20]</sup>

## CONCLUSION

*Ziziphus jujuba* represents a valuable medicinal and nutritional plant with extensive traditional use and growing scientific validation. Its rich phytochemical profile, including flavonoids, polysaccharides, triterpenic acids, and saponins, underpins its antioxidant, anti-inflammatory, neuroprotective, hepatoprotective, and immunomodulatory properties. Emerging pharmacological and clinical evidence supports its role in managing insomnia, anxiety, metabolic disorders, and immune dysfunction. However, standardization of extracts, detailed mechanistic studies, and large-scale clinical trials remain necessary. Future research should focus on bioactive compound isolation, safety profiling, and formulation development to fully harness its therapeutic and functional routes like diabetes, anxiety, inflammatory and lipid profiles.

## REFERENCES

1. Zhang Y, Sun X, Vidyarthi SK, Zhang R. Active components and antioxidant activity of thirty-seven varieties of Chinese jujube fruits (*Ziziphus jujuba* Mill.). *International Journal of Food Properties*, 2021 Jan 1; 24(1): 1479-94.
2. Miri MS. Cultivation, chemical compositions and health benefits of jujube (*Ziziphus jujuba* Mill.). In *1st National Congress and International Fair of Medicinal Plants and Strategies for Persian Medicine that Affect Diabetes*. Mashhad, Iran 2018 Oct.
3. Tahergorabi Z, Abedini MR, Mitra M, Fard MH, Beydokhti H. "*Ziziphus jujuba*": A red fruit with promising anticancer activities. *Pharmacognosy reviews*, 2015 Jul; 9(18): 99.
4. Grygorieva O, Abrahamová V, Karnatovská M, Bleha R, Brindza J. Morphological characteristics of fruits, drupes and seeds in genotypes of *Ziziphus jujuba* Mill. *Slovak Journal of Food Sciences/Potravinárstvo*, 2014 Jan 1; 8(1).
5. Gao, Q. H., Wu, C. S., Wang, M., Xu, B. N., & Du, L. J. (2013). Effect of drying of jujubes (*Ziziphus jujuba* Mill.) on the contents of sugars, organic acids, and phenolics. *Journal of Agricultural and Food Chemistry*, 61(16): 3799-3805.
6. Popstoyanova D, Gerasimova A, Gentsheva G, Nikolova S, Gavrilova A, Nikolova K. *Ziziphus jujuba*: Applications in the pharmacy and food industry. *Plants*, 2024 Sep 29; 13(19): 2724.
7. Mahajan RT, Chopda M. Phyto-Pharmacology of *Ziziphus jujuba* Mill-A plant review. *Pharmacognosy Reviews*, 2009 Jul 1; 3(6): 320.
8. Soni H, Malik JK. Phyto-pharmacological potential of *Zizyphus jujube*: A review. *Sch Int J Biochem*, 2021; 4(2): 1-5.

9. Aafi E, Reza M, Mirabzadeh M. Jujube (*Ziziphus jujuba* Mill. (Rhamnaceae)): A review on its pharmacological properties and phytochemistry. *Tradit. Med. Res*, 2022; 7(4): 38.
10. Souleles C, Shamma G. Flavonoids from the leaves of *Zizyphus jujuba*.
11. Yang B, Yang H, Chen F, Hua Y, Jiang Y. Phytochemical analyses of *Ziziphus jujuba* Mill. var. *spinosa* seed by ultrahigh performance liquid chromatography-tandem mass spectrometry and gas chromatography-mass spectrometry. *Analyst*, 2013; 138(22): 6881-8.
12. Agrawal P, Singh T, Pathak D, Chopra H. An updated review of *Ziziphus jujube*: Major focus on its phytochemicals and pharmacological properties. *Pharmacological Research-Modern Chinese Medicine*, 2023 Sep 1; 8: 100297.
13. Lu Y, Bao T, Mo J, Ni J, Chen W. Research advances in bioactive components and health benefits of jujube (*Ziziphus jujuba* Mill.) fruit. *Journal of Zhejiang University-SCIENCE B*, 2021 Jun; 22(6): 431-49.
14. Liu SJ, Lv YP, Tang ZS, Zhang Y, Xu HB, Zhang DB, Cui CL, Liu HB, Sun HH, Song ZX, Wei SM. *Ziziphus jujuba* Mill., a plant used as medicinal food: a review of its phytochemistry, pharmacology, quality control and future research. *Phytochemistry Reviews*, 2021 Jun; 20(3): 507-41.
15. Goyal M, Nagori BP, Sasmal D. Review on ethnomedicinal uses, pharmacological activity and phytochemical constituents of *Ziziphus mauritiana* (*Z. jujuba* Lam., non Mill). *Spatula DD*, 2012; 2(2): 107-16.
16. Ruan J, Han Y, Kennedy JF, Jiang H, Cao H, Zhang Y, Wang T. A review on polysaccharides from jujube and their pharmacological activities. *Carbohydrate Polymer Technologies and Applications*, 2022 Jun 1; 3: 100220.
17. Chen J, Liu X, Li Z, Qi A, Yao P, Zhou Z, Dong TT, Tsim KW. A review of dietary *Ziziphus jujuba* fruit (Jujube): Developing health food supplements for brain protection. *Evidence-Based Complementary and Alternative Medicine*, 2017; 2017(1): 3019568.
18. Zhu D, Jiang N, Wang N, Zhao Y, Liu X. A literature review of the pharmacological effects of jujube. *Foods*, 2024 Jan 6; 13(2): 193.
19. Lu Y, Bao T, Mo J, Ni J, Chen W. Research advances in bioactive components and health benefits of jujube (*Ziziphus jujuba* Mill.) fruit. *Journal of Zhejiang University-SCIENCE B*, 2021 Jun; 22(6): 431-49.
20. Soni H, Malik JK. Phyto-pharmacological potential of *Zizyphus jujube*: A review. *Sch Int J Biochem*, 2021; 4(2): 1-5.