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A Phyto-Pharmacological and Scientific report of Unnab (*Zyziphus jujuba* Mill)

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ABSTRACT

Nature is a treasure of many medicinal plants. Some of them are been explored for their medicinal properties and many are yet to be explored. Few plant and plant products possessing nutritional values also possess medicinal values. *Zyziphus jujuba* Mill commonly known as Jujuba Fruit, Unnab, Ber etc is one of such plant origin drug which is used as edible fruit for its nutritional values and simultaneously as a herbal medicine, since it also possesses medicinal properties as mentioned in the Unani literature.

Keywords: *Zyziphus jujuba* Mill, Unnab, Edible fruit, Herbal Medicine

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INTRODUCTION

About 60% of world's population in both the developing and developed countries traditional system of medicine is used¹. India is the largest producer of medicinal herbs and is appropriately called the "Botanical garden of the world". In rural India, 70 per cent of the population is dependent on the traditional system of medicine². *Ziziphus jujuba* Mill (ZJ) commonly known as *Ber* belongs to the family Rhamnaceae is a spiny, evergreen shrub or small tree up to 15 m height, cultivated and found wild. Fruits of this tree are used as edible fruit and also used medicinally in traditional system of medicine³. In Unani system of medicine jujube fruit is used as an expectorant, digestive, skin diseases etc^{4,5}. It possess many medicinal properties some of them are scientifically evaluated and some are yet to be evaluated.

Taxonomical classification

Botanical name: *Ziziphus jujuba* Mill.

Kingdom: Plantae,

Division: Magnoliophyta,

Class: Magnoliopsida,

Order: Rosales,

Family: Rhamnaceae,

Genus: *Ziziphus*,

Species: *jujuba*



Figure I: Ripe Fruits Of Unnab (*Zyziphus jujuba* Mill)

Vernacular names

Arabic: *Nabq, Dum, Tsal, Sadr* and *Sidr*; Persian: *Anab* or *Annab*; Bulgaria: *Henap*; Sanskrit: *Rajabadari*; Punjabi: *Beri*; Bengali: *Kul*; Assamese: *Bogori*; Uriya: *Bodori*; Gujrati: *Bordi*; Hindi, Urdu: *Ber*; Marathi: *Bor*; Malayalam: *Badaram*; Kannada: *Bogari*; Tamil: *Vadari*; Telugu: *Renu*; Sindhi: *Jangri*

Description of Unnab As Reported In Unani Literature

Ibn Sina in his book *Al Qanoon fil Tib* mention that Unnab are the fruits⁶. According to Najmul Ghani, Unnab are the fruits of a tree resembling ber, it is red colored and sweet to taste⁴. Ibn Baithar in his book mentions that Unnab is the fruit of a tree, which are red colored and sweet to taste having nutritional and medicinal values⁵.

Part Used Medicinally^{4,5,6,7}

Fruits^{6,5,4,7}, leaves, bark, gum⁵

Temperament

Cold⁶, Hot moist⁵, Motadil⁴

Pharmacological actions^{4,5,6,7}

Musaffi khood (Blood purifier), *Mullayan taba*, *Munaffis balgham* (expectorant), *Dafe khushushat sadar*, *Mulayyan* (laxative), *Dafe hikka* (anti scabies) etc

Therapeutic Uses

Unnab purifies the blood hence used in many of the compound formulations of blood purifiers^{4,5,6}.

Gastro-intestinal tract

Unnab (fruit) relieves thirst⁴ and is beneficial in constipation⁵. Chewing of the unnab leaves reduces nausea. Powdered seeds of unnab causes constipation, hence used in diarrhoea⁵. It is also used in diseases of rectum⁴. Jujube is used prophylactically for liver diseases⁸. The fruits are also used in Chinese medicine to strengthen liver function⁹.

Urogenital system

Unnab is used in sozish masana (cystitis)⁴.

Respiratory system

Its joshanda (decoction) and khaisanda is beneficial in dry cough and dryness of throat^{4,5}.

Nervous system

Chewing of the Unnab leaves has anesthetic effect in the throat and tongue^{4,5}

Skin and wound healing

Powdered bark of Unnab with equal quantity of Safeda is beneficial in non healing ulcers and 200ml Joshanda of leaves of Unnab with sugar is beneficial in itching^{4,5, and 10}. Unnab with arq kasni and sikanjabeen is beneficial in small pox⁴.

Adverse Effect

It is not easily digested, it leads to flatulence and dry Unnab causes Zof baah(anaphrodisiac)⁴.

Correctives:

For indigestion-*khaand* (sugar), *mavez* (Raisins) and *gulab*(*Rosa damascas*) and for *zof baah-shehed* (Honey)⁴ .

Substitutes⁷:Sapistan

Dose:15 number as joshanda⁴

Unani Compound Formulations: *Sharbath unnab*^{4,7}, *Khameer gaozaban sheer unnabwala*⁷

Description of Unnab (*Zyziphus jujuba Mill*) as given in Modern Literature

Habitat and Distribution¹¹

Lebanon, Iran, Pakistan, India, Bangladesh, Nepal, the Korean peninsula, south-eastern Europe and, southern and central China.

Cultivation^{12,13}

It requires hot summers and sufficient water for acceptable fruiting. It tolerates fairly cold winters, surviving temperatures down to about -15 °C, grows in the mountain desert habitats, provided there is access to underground water through the summer.

Botanical description^{12, 14, 15}

It is a small deciduous shrub reaching a height of 5–10 m, usually with thorny branches. Branchlets are densely white pubescent, especially when young and tend to be zigzag. Branches spread erect, becoming flexuous and dull brown grey. Leaves: shiny-green, ovate-acute, 2–7-cm wide and 1–3-cm broad, with three conspicuous veins at the base, and a finely toothed margin. Flowers: small, 5-mm wide, with five inconspicuous yellowish-green petals. Fruit : edible oval drupe 1.5–3-cm deep and 1.5 -2 cm diameter ;when immature it is smooth-green, with the consistency and taste of an apple, maturing brown to purplish-black and eventually wrinkled, looking like a small date but some oval varieties can reach 5 x 3 cm. The pulp is acidic and sweet, reddish. Flowers: small, 5-mm wide, with five inconspicuous yellowish-green petals.

Macroscopic Features of fruit of *Zyziphus jujuba Mill*^{12, 14,15}

This quick growing tree starts producing fruits within three years. The fruit is a soft, juicy, drupe that is 2.5 cm diameter though with sophisticated cultivation the fruit has of size 6.25 cm long and 4.5 cm wide. The form may be oval, obovate, round or oblong; the skin smooth or rough, glossy, thin but tough. The fruit ripen at different times even on a single tree. Fruits are first green, turning yellow as they ripen. The fully mature fruit is entirely red, soft, and juicy with wrinkled skin and has pleasant aroma. The ripe fruit is sweet and sour in taste. Both flesh texture and taste are reminiscent of apples. When under ripe the flesh is white and crispy, acid to sub acid to sweet in taste. Fully ripe fruits are less crisp and somewhat mealy; overripe fruits are wrinkled, the flesh buff-coloured, soft, spongy and musky. At first the aroma is apple like and

pleasant but it becomes peculiarly musky when overripe. There is a single, hard, oval or oblate, rough central stone which contains 2 elliptic, brown seeds, 1/4 in (6mm) long.

Uses ^{9,15}

The fruit is eaten raw, pickled or used in beverages. It is quite nutritious and rich in vitamin C. It is second only to guava and much higher than citrus or apples. In India, the ripe fruits are mostly consumed raw, but are sometimes stewed. Slightly under ripe fruits are candied by a process of pricking, immersing in a salt solution. Ripe fruits are preserved by sun-drying and a powder is prepared for out-of-season purposes. It contains 20 to 30% sugar, up to 2.5% protein and 12.8% carbohydrates. Fruits are also eaten in other forms, such as dried, candied, pickled, as juice, or as ber butter. The seeds are used in Chinese medicine as a sedative.

Phytochemistry ¹

Alkaloids ^{16,17,18,19,20,21,22,23}

Alkaloids are distributed in all parts of plants. The cyclic peptide alkaloids sativanine-C, sativanine-G, sativanine-E, sativanine-H, sativanine-F, sativanine-D and sativanine-K isolated from *Z. jujuba* stem bark. The alkaloids coclaurine, isoboldine, norisoboldine, asimilobine, iusiphine and iusirine were isolated from *Z. jujuba* leaves. Cyclopeptide and peptide alkaloids from *Z. jujuba* were found to show sedative. Six Cyclopeptide alkaloids isolated from the stem bark of *Z. jujuba* are Mauritine-A; Amphibine-H; Jubanine-A; Jubanine-B; Mucronine-D and Nummularine-B. Latter reported Sativanine-E. Antibacterial peptide alkaloid Frangufoline from *Ziziphus* species

Glycosides

- Flavonoid glycosides/spinosins²⁴: The structure of spinosin (2"-O- beta - glucosylswertisin) extracted from *Z. jujuba* var. *spinosa* seed. They later identified three acylated flavone-Cglycosides (6"-sinapoylspinosin, 6"-feruloylspinosin and 6"-p-coumaroylspinosin), pharmacologically they have sedative activity in rat.
- Glycosides/saponins: Different parts of *Z. jujuba* that is seeds, leaf and stem contain glycosides. The saponins isolated from the seeds of *Z. jujuba* include jujubosides A, B, A₁ B₁ and C and acetyljujuboside B and the protojujubosides A, B and B₁. It has a structure, 3-O- a - L- rhamnopyranosyl (1-2) - a - arabinopyranosyl 20- O- (2,3)- di - O- acetyl - a - L -rhamnopyranosyl jujubogenin. Ikram *et al.* isolated a saponin from *Z. jujuba* leaves and stem. It was assigned the structure 3-O- ((2-O- alpha - D - furopyranosyl - 3-O- beta - D - glucopyranosyl) - alpha - L - arabinopyranosyl)

jujubogenin. They are being widely researched for cancer prevention and cholesterol
25,26,27

Flavonoids ^{25, 28, 29}

Sedative flavonoids such as Swertish and spinosin were isolated from fruit and seeds of *Z. jujuba*. Puerarin; 6'''-feruloylspinosin; Apigenin-6-C-b-Dglucopyranoside; 6'''-feruloylisospinosin; Isospinosin and Isovitexin-2''-O-b-D-glucopyranoside these flavonoids isolated. Ten flavonoids are reported which are Quercetine 3-O-00-robinobioside; Quercetine 3-O-rutinoside; Quercetine 3-O- α -L-arabinosyl-(1 \rightarrow 2)- α -L-rhamnoside; Quercetine 3-O-b-D-xylosyl-(1 \rightarrow 2)- α -L-rhamnoside; Quercetine 3-O- β -D-galactoside; Quercetine 3-O- β -D-glucoside; 3',5'-Di-C- β -D-glucosylphloretin; Quercetine 3-O- β -D-xylosyl-(1 \rightarrow 2)- α -L-rhamnoside-4'-O-a-L-rhamnoside; Kaempferol 3-Orobinobioside and Kaempferol 3-O-rutinoside.

Terpenoids ^{30,31,32}

The triterpenoic acids have been isolated from the fruits of *Z. jujuba*: some of them are colubrinic acid, alphitolic acid, 3-Ocis-p-coumaroylalphitolic acid, 3-O transp-coumaroylalphitolic acid, 3-O-cis-p-coumaroylmaslinic acid, 3-O-trans-pcoumaroylmaslinic acid, oleanolic acid, betulonic acid, oleanonic acid, zizyberenalic acid and betulonic acid. Some of them have anticancer and anti-HIV properties demonstrated three triterpene esters viz. 2-O-protocatechuoyl alphitolic acid, Caffeoyl alphitolic acid and Ceanothic aciddimethyl ester.

Phenolic compounds ²⁹

Pawlowska et al., reported phenolic compounds from the fruit of *Z. jujuba*, without any biological activity.

Table I: Nutritional values of Unnab ³³

Nutritional values of Unnab (ripe/ 100 Gm)	Nutritional values of Z.jujube per 100g dried
<u>Energy</u> ; 331 kJ (79 kcal)	<u>Energy</u> : 1,201 kJ(287 kcal)
<u>Carbohydrates</u> ; 20.23 g	<u>Carbohydrates</u> : 73.60 g
<u>Fat</u> ; 0.20 g	<u>Fat</u> : 1.10 g
<u>Protein</u> ; 1.20 g	<u>Protein</u> : 3.70 g
<u>Water</u> ; 77.86 g	<u>Water</u> : 19.70 g
<u>Vitamin A</u> ; 40 IU	<u>Vitamin A</u> : 40 IU
<u>Thiamine (vit. B₁)</u> ; 0.020 mg (2%)	<u>Thiamine (vit. B₁)</u> : 0.210 mg (18%)
<u>Riboflavin (vit. B₂)</u> ; 0.040 mg (3%)	<u>Riboflavin (vit. B₂)</u> : 0.360 mg (30%)
<u>Niacin (vit. B₃)</u> 0.900 mg (6%)	<u>Niacin (vit. B₃)</u> : 0.500 mg (3%)
<u>Vitamin B₆</u> : 0.081 mg (6%)	<u>Vitamin B₆</u> : 0.00 mg (0%)
<u>Vitamin C</u> : 69 mg (83%)	<u>Vitamin C</u> : 13 mg (16%)
<u>Calcium</u> : 21 mg (2%)	<u>Calcium</u> : 79 mg (8%)
<u>Iron</u> : 0.48 mg (4%)	<u>Iron</u> : 1.80 mg (14%)

Magnesium: 10 mg (3%)

Phosphorus: 23 mg (3%)

Potassium: 250 mg (5%)

Sodium: 03 mg (0%)

Magnesium: 37 mg (10%)

Phosphorus: 100 mg (14%)

Potassium: 531 mg (11%)

Sodium: 09 mg (1%)

Scientific Studies

Hypnotic-sedative and Anxiolytic effect

The seeds and leaves of many *Ziziphus* species have been found possess anxiolytic and hypnotic-sedative effects without causing anticonvulsant or muscle relaxant³⁴ and inhibitory effect of Jujuboside A (JuA) on rat hippocampus³⁵. An Anxiolytic effect in mice of a polyherbal substance containing seed extract of *Z. jujube* was reported³⁶. Both sanjoinine A and nuciferine, alkaloids obtained from fruit, prolonged the sleeping time produced by hexobarbital²¹.

Hepatoprotective activity

In view of the firm belief of Chinese and Indian system of medicine, for hepatoprotective role of *Zizyphus jujuba* in treating hepatic diseases, we thought it is imperative to evaluate the hepatoprotective activity of *Zizyphus jujuba* fruits using modern scientific techniques in experimental models³.

Sweetness inhibitors

Triterpenoid sweetness inhibitors were isolated from *Z. jujuba* was found to suppress sweet taste sensation in fly (*Pharma regina*), rat and in hamster. Antisweet substances isolated from *Z.jujuba* included jujubasponins II, III, IV, V and VI and from the leaves, jujuboside B from the leaves and seeds and *ziziphus* saponins I-III from dried fruit. Ziziphin and jujubosaponins II and III, the only three of the anti-sweet saponins from this plant with acyl groups, were up to 4 times more active in suppressing the sweet taste of sucrose than the other anti-sweet constituents and thereby reducing obesity in diabetic or overweight people³⁷. The saponin, ziziphin extracted by Kurihara *et al.*³⁸ suppressed the sweetness induced by D-glucose, D-fructose, stevioside, glycine, sodium saccharin, aspartame and naringin dihydrochalcone. It however showed no suppressive effect on the sour taste of hydrochloric acid and the bitter taste of quinine indicating that ziziphin is highly specific to sweet taste³⁹. Ziziphin was found to inhibit the sweet taste receptors in humans⁴⁰.

Cancer (chemotherapy)

The *in vitro* cytotoxicities of the triterpenoic acids extracted from *Z. jujuba* were tested against tumour cell lines and the results suggest that the coumaroyl moiety at the C-3 position of the lupane-type triterpene may play an important role in enhancing cytotoxic activity³⁰. The triterpenoic acid, betulinic acid, extracted from *Z. jujuba* and *Z. mauritiana*, showed selective

toxicity against cultured human melanoma cells⁴¹. Betulinic acid is currently undergoing preclinical development⁴². Recently, considerable in vitro evidence has demonstrated that betulinic acid is effective against small- and non-small-cell lung, ovarian, cervical, and head and neck carcinomas⁴² and the data suggest that betulinic acid induces apoptosis^{41,43} in sensitive cells in a p53- and CD95-independent fashion⁴⁴.

Antimicrobial activity

Sarfraz *et al.*,⁴⁵ reported antifungal effects of *Z. jujuba*. Ethanol extract of the root showed significant inhibitory activity on fungi *Candida albicans*, *C. tropicalis*, *Aspergillus flavus*, *A. niger* and *Malassezia furfur* (strains 1374 and 1765). Additionally, extract of root bark of *Z. jujube* exhibited antibacterial activity against 20 bacteria⁴⁶. Leaf extracts of *Z. mauritiana* were found to show antibacterial effects against *E. coli*, *Klebsiella spp.*, *Pseudomonas spp.*, *Proteus vulgaris* and *Bacillus subtilis* when methanol and acetone extracts were used⁴⁷. Betulinic acid isolated from stem bark of *Z. jujuba* has also been found to retard the progression of HIV 1 infection that is antiviral activity⁴⁸.

Anti-inflammatory and antispastic effect

The compound prescription containing the fruit of *Z. jujuba* showed marked anti-inflammatory and significant antispastic or antispasmodic effect⁴⁹.

Antiallergic

The anti-allergic activity of the aqueous extracts of leaves of *Z. jujuba* was studied by measuring its inhibitory effect on hyaluronidase (bovine testes) activation in vitro. *Z. jujuba* was shown to have strong anti-allergic activity⁵⁰.

Permeability enhancement activity

The permeability enhancing activity of *Z. jujuba*, an aqueous extract of seeds was compared to two members of a known series of permeability enhancement agents belonging to the alkyl glycosides⁵¹.

Cognitive activities

The methanolic *Z. jujuba* showed 34.1 % activation effect on choline acetyltransferase in vitro, an enzyme that controls the production of acetylcholine which appears to be depleted in the brains of Alzheimer patients⁵².

Antifertility/ contraceptive property

The ethyl acetate extract of *Z. jujuba* bark was found to effect antisteroidogenic activity and hence fertility in adult female mice. It was found to arrest the normal estrus cycle of adult female mice at diestrus stage and reduced the wet weight of ovaries significantly. Hematological

profiles, biochemical estimations of whole blood and serum remained unaltered in extract-treated mice. Normal estrus cycle and ovarian steroidogenesis were restored after withdrawal of treatment. Antifertility activities of crude extracts were found to be reversible in rat ⁵³.

Hypotensive and Antinephritic effect

Ziziphus jujuba has been found to stimulate nitric oxide release in vitro, in cultured endothelial cells and *in vivo*, in the kidney tissues of rats ⁵⁴.

Immuno-stimulant effects

The leaf extract of *Z. jujuba* was found to stimulate chemotactic, phagocytic and intracellular killing potency of human neutrophils ⁵⁵.

Antioxidant effects

confirmed antioxidant effect of *Z. jujuba* (*in vitro*) ^{56, 57}.

Wound healing activity

Ansari et al., ¹⁰ has mentioned the root of *Z. jujuba* as a wound healer in their book entitled Herbal Drugs. The wound healing activity of the root of *Z. jujuba* in experimental animal, rat model, in an ointment form at a dose 0.5% and 1% on topical application ⁵⁸

Elemental analysis

The fruit of ZJ were studied for elemental analysis of Na, K, Zn, Fe, Cr, Cu, Ni, Pb, Mn, Ca, Mg, Cd ⁹.

CONCLUSION

Z. jujuba is the fruit having nutritional and medicinal values. This review is based on the available literature and the scientific reports. Many such herbal drugs are yet to be studied for their medicinal values and are to be reviewed.

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