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Review Article

### ZIZIPHUS JUJUBE (ENNAB) OF THE MIDDLE EAST, FOOD AND MEDICINE

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#### ABSTRACT

*Ennab* (jujube) is a plant of great nutritional and medicinal value that grows readily in many countries worldwide. Despite its great nutritional and medicinal value it has been noticed that it is not commonly known to the public in some Middle Eastern countries. Here we introduce this plant to the scientific community and provide an updated review of its nutritional and medicinal importance in order to promote its cultivation, a step towards improving the health and welfare of individuals and in purpose of drawing scientific focus to this underutilized valuable plant.

**Keywords:** *Ziziphus jujube*, Ennab, Medicinal benefits, Nutrition, Middle East.

#### INTRODUCTION

The common jujube (*Zizyphus Jujube*) is a plant that is native to Asia and Southern Europe. It is called *Ennab* (Arabic) or *Annab* (Persian) and is very common in some Middle Eastern countries but not in others. Own investigation shows that all Lebanese people asked knew the plant and have eaten the fruit while all Syrians asked about the plant did not know or eaten its fruit. It is a thorny rhamnaceous plant<sup>1</sup> that is widely distributed worldwide. It is a deciduous tree that grows very well in Mediterranean climate and can tolerate heat and aridity. It bears Fruits that are edible and delicious and of various shapes and sizes and of great nutritional and medicinal value but has not been exploited commercially on the proper scale. The fruits can be eaten fresh, dried like dates or processed (jams, loaf, cakes, jelly, etc.). Different parts of *Z. jujuba* possess multiple medicinal properties<sup>2</sup>.

It is known as “ber” in Iran and India and is widely used in traditional Iranian medicine as a laxative and blood purifier. In China, it is used as a taste enhancer and it is recommended for treating fatigue, loss of appetite and diarrhea. It is believed the dried fruits of *Zizyphus Jujube* are anodyne, anticancer, pectoral, refrigerant, sedative, stomachic, styptic and tonic and immune response enhancer<sup>3-5</sup>. Some of the compounds isolated from the seeds of *Zizyphus jujuba* exhibit significant pharmacological activities<sup>4</sup>. In India it is as food, fodder, nutrient, medicine, construction material and fuel. *Z. jujube*'s medicinal properties are attributed to a diverse group of

secondary metabolites such as alkaloids, flavonoids, terpenoids, saponin, pectin, triterpenoic acids and lipids (i.e. Jujuboside (saponin) isolated from jujube is reported to have hemolytic, sedative, anxiolytic and sweetness inhibiting properties<sup>6</sup>.

This tree is not appreciated in most Arab countries of the Middle East. It is fairly known in Lebanon, Palestine and Jordan but not well known in Syria and Egypt (own investigation). Anyway, it is not considered a necessity of life like olives for example simply because people are unaware of its true value although it is increasingly invading the local markets in recent years. The aim of this paper is to make the scientific community and the public aware of its nutritional and medicinal value especially in view of recent research of its medicinal benefits and also in order to promote health and economy of these countries.

#### History:

*Ennab (jujube)* is the cultivated form of Seder, dum (Arabic names used interchangeably), of the wild lote tree (*Zizyphus spina-christi*) of the *Rhamnaceae* family that is widely spread in valleys and mountainous regions of the Mediterranean. This wild tree is not used commercially and has not been really exploited for any nutritional or medicinal value on an economical or large scale but Seder honey is well known and is a sought after commodity. There are many subspecies of the jujube tree; such as *Zizyphus lotus*, *Zizyphus vulgaris* and *Zizyphus jujube*.



There is no clear information or records on how the wild lote tree became cultivated and became known as *Ennab*. Cultivation of the tree is generally limited to home gardens and is not grown for commercial production. In Syria, it is only known in Lattakia coastal region<sup>7</sup> where it is used as food and for medicinal benefits.

It reaches 10 meters high, called *Ennab* because its fruits come in “anakeed” like grapes, its fruits are nice, sweet and delicious, olive/date like with white core, The tree is heat and drought resistant, rich in minerals, vitamins and antioxidants therefore it is good against cardiovascular/heart diseases and anticancer (fashion.azyya.com, Arab Wikipedia). It originated from China hence called Chinese dates and likes hot weather and has been used in Chinese medicine for 2500 years.

Chemical ingredients of *Ennab*: Saponins, flavonoids, sugars, vitamins A, B2, C and minerals like calcium, iron and phosphorus. Also known by Romans, crown for soldiers for protection (thorns).

#### ***Ennab* in Oriental Medicine:**

The fruits and seeds of *Ennab* are widely used in Chinese and Korean traditional medicine, they are traditionally used for antifungal, antibacterial, antiulcer, anti-inflammatory and sedatives<sup>8</sup>. It is thought that seeds can alleviate stress<sup>9</sup> and can serve as antiseptic, antifertility/contraception, hypotensive and antinephritic, cardiogenic, antioxidant, immunostimulant, and wound healing properties<sup>10</sup>.

Two consecutive clinical trials have found that the *Ziziphus jujuba* fruits are helpful for chronic constipation<sup>11</sup> and proved to be effective against neonatal jaundice<sup>12</sup>.

In Persian traditional medicine it is used in combination with other herbal medicines to treat colds, flu and coughing (No official publication shown, General website)

Several research papers have shown that jujube fruits have nootropic and neuroprotective properties<sup>13-16</sup>.

The ability to perceive sweet taste is attributed to the compound, Ziziphin which is found in the leaves of jujube<sup>17</sup>.

Fruits, leaves, seeds, roots and bark of jujube have been commonly used as a source of simple medicines in traditional medicine<sup>18-20</sup>. Flowers of Chinese jujube have high-quality nectar, and the leaves are consumed as tea<sup>21</sup>.

#### **Nutritional Value and Composition of *Ennab*:**

Research shows that jujube fruits are rich in the phenolic compounds catechin and rutin while leaves are rich in rutin and apigenin-7-glucoside. Alpha-tocopherol and beta-carotene contents of jujube fruits are very low when compared with fruits rich in alpha-tocopherol and beta-carotene. The total lipid content of jujube fruit is very low. The predominant fatty acids in the four jujube selections that were studied are oleic acid, linoleic acid, palmitic acid and palmitoleic acid. Palmitic acid is the main saturated fatty acid. Unsaturated fatty acids range from 68.54% to 72.44% of the total fat in jujube fruit<sup>22</sup>. The jujube fruit has high sugar content and high levels of vitamin A, C and B complexes, vitamin E, phosphorus and calcium). The Lipid content of the fresh is very low. The main fatty acids in all jujube selections tested were oleic acid, linoleic acid, palmitic acid and palmitoleic acid<sup>23,24</sup>. It's worth mentioning that Fatty acid profiles of fruits were influenced by their developmental stage.

Some phenolics, such as chlorogenic acid, caffeic acid, catechin, epicatechin and rutin, were isolated from jujube fruit<sup>25</sup>. Phenolics play a major physiological role in fruit, especially in resistance to various stress factors, and in fruit quality. In addition, phenolic compounds have significant levels of antioxidant activity and are free radical scavengers<sup>20</sup>. Chemical analysis of different selections of *Ziziphus jujuba* by<sup>26</sup> showed that considerable differences in phenolic and fatty

acid contents were found. Catechin, caffeic acid, p-coumaric acid, ferulic acid, rutin, apigenin-7-glucoside, eriodictyol, quercetin, p-hydroxybenzoic acid, chlorogenic acid and syringic acid were isolated from leaves. Rutin content was very high in the leaves of all the jujube selections. Seven phenolic compounds, catechin, caffeic acid, epicatechin, ferulic acid, rutin, p-hydroxybenzoic acid and chlorogenic acid, were isolated from fruits of jujube selections. The main phenolics were rutin and apigenin-7-glucoside for leaves, and catechin and rutin for fruits. Phenolic, alpha-tocopherol, beta-carotene and fatty acid composition of four jujube (*Ziziphus jujuba* Miller) selections was conducted. Jujube leaves contained higher amounts of phenolic compounds than jujube fruits.

Alkaloids, flavonoids, sterols, tannins, saponin, and fatty acids have been detected in the different species of the genus *Ziziphus*<sup>18,19,21,27</sup>

#### **Sedative Properties of *Ennab***

The oil of the seeds of *Ziziphus vulgaris* has been shown to possess potential sedative properties<sup>28,29</sup>. The sedative properties of jujube was found to be mainly due to the flavonoids: Swertisin, Spinosin, 6-sinapoylspinosin, 6-feruloylspinosin and p-coumaroylspinosin isolated from the seeds of *Ziziphus vulgaris*. Out of the eight flavonoids isolated from it only two of them (Spinosin and Swertish) were shown to possess significant sedative activity. It was believed by some authors that the Spinosin isolated from *Ziziphus jujuba* is responsible for the sedative activity of the plant components<sup>30</sup>.

The alkaloids isolated from *Ziziphus vulgaris*, Sanjoinine-A and Nuciferine have showed strong sedative activity. Sanjoinine-A was observed to be very potent at a dose of 3 mg/Kg. The saponins jujube side A and B isolated from the seeds of *Ziziphus vulgaris* is also thought to be partly responsible for the sedative property of the plant<sup>31</sup>.

Separation and purification of saponins from Semen *Ziziphus jujuba* and study of their sedative and hypnotic effects,<sup>8</sup> showed that saponins extracted from the species *Ziziphus jujuba* Semen that grows in China exhibited significant effect on walking time and coordinated movement, and prolonged the supra threshold barbiturate induced sleeping time.

#### **Anti-cancer activity of *Ennab***

The anti-cancer activity of jujube extract and its underlining mechanisms of action in human hepatoma cells (HepG2) was investigated and found that jujube extract decreased the viability of the cells by inducing a concentration dependent effect on apoptosis and a differential cell cycle arrest in HepG2 cells<sup>32</sup>.

Combination of *Ziziphus jujuba* and green tea extracts exerts excellent cytotoxic activity in HepG2 cells via reducing the expression of APRIL<sup>33</sup>. Hepatocellular carcinoma is a type of tumor highly resistant to available chemotherapeutic agents. It is speculated that jujube extract and green tea extract mixture might provide a lead to a new drug design to treat hepatocellular carcinoma in the future APRIL<sup>33</sup>.

*Ziziphus Jujube* dried fruit extract showed inhibitory effects on human tumor and transformed cell lines, HEp-2, HeLa and Jurkat cell lines<sup>3</sup>. Jujube extract was also found to inhibit the

proliferation of HL-60 cell and also exhibited potent anticancer potential in vivo. Treatment of Ehrlich ascites carcinoma bearing Swiss albino mice with varied doses (100–800 mg/kg b. wt.) of plant extract significantly reduced tumor volume and viable tumor cell count and improved hemoglobin content, RBC count, mean survival time, tumor inhibition, and percentage life span. The enhanced antioxidant status in extract-treated animals was evident from decline in levels of lipid peroxidation and increased levels of glutathione, catalase, and superoxide dismutase<sup>34</sup>.

#### **Blood glucose and lipids:**

There is ample evidence that *Ziziphus jujube* extracts are useful in lowering cholesterol and glucose levels. Pretreatment of rats with aqueous leave extract of *Ziziphus jujube* inhibited alcohol induced increase in cholesterol and triglyceride levels in rats' serum<sup>35</sup>.

Methanolic extract of dried bark of *Ziziphus jujube* was found to cause a significant decrease in the levels of total cholesterol, triglycerides and LDL-cholesterol, and glucose levels in streptozotocin-induced diabetes in rats<sup>36</sup>.

*Ziziphus jujube* leaf extract was also found to cause a marked reduction in the levels of LDL, cholesterol and triglycerides and glucose and increase HDL in Alloxan-induced diabetes in rats<sup>37</sup> and it was concluded that, *Z. Jujuba* leaves can be used in diabetics for the purpose of glucose and lipid reduction

*Ziziphus jujube* can also be used as an anti-appetite herb-. The ingestion of leaf extract causes higher nestafin-1 levels in rats<sup>38</sup>. It was also reported that *Ziziphus jujube* extract increased HDL. Hence it was concluded that exercise and jujube extract may prevent over-weight and cardiovascular diseases<sup>39</sup>.

*Z. jujube* powder possesses hypolipidemic and anti-obesity properties and didn't show any negative impact on liver function as measured by ALT and AST<sup>40</sup>.

#### **Antioxidants, Antimicrobial and Anti-inflammatory activity of *Ennab***

Analyses has shown that higher amounts of ascorbic acid and phenolics in different jujube varieties than in some common fruits. The antioxidative capacity of the jujube extracts, evaluated with reducing power and scavenging methods showed that antioxidant activity and free radical scavenging capacity variations were observed between jujube cultivars investigated with regards to the measured parameters except rutin content of fruit. These results demonstrated that the cultivar was the main factor which influences the physico-chemical properties and antioxidant activity of jujubes<sup>41</sup>.

*Z. jujube* extract seed oil was also found to have high Antioxidant and anti-listerial property<sup>42</sup>. In another study of bacteria involved in diseases and poisoning of humans and on some fungi responsible for toxicosis of livestock, fruits extracts of the wild jujube "*Ziziphus Lotus* (L.) Desf. Showed antimicrobial and anti-fungal activity<sup>43</sup>.

In a study aimed to understand the antimicrobial and antioxidant activities of tropical fruits *Averrhoa carambola* Linn. (Starfruit) and *Ziziphus mauritiana* Lam. (jujube) fruits. The edible parts of the fruits were analyzed for different phytochemicals and phenolics, flavonoids, alkaloids and glycosides were found in all ripe and green star fruits or jujubes. Ripe jujube or *Ziziphus mauritiana* extract showed

strongest free radical scavenging or antioxidant activity among the tested<sup>44</sup>.

Jujube extract has been shown to exhibit anti-inflammatory activity<sup>45</sup> and inhibit 5HT and Histamine caused inflammations<sup>46</sup>. Jujube extract was also found to modulate anti-oxidant activity and the immune response by suppressing T-cell proliferation<sup>24</sup>.

## CONCLUSION

A tree that can be easily grown anywhere in the region even suitable for private gardens, the fruit is delicious and consumption of few hundred grams fresh or dried fruit daily or when available can be of great benefit to the health and well-being of the individual. It is clearly shown that this tree is of great value as food and medicine and should be part of healthy diet and life style.

Many recent research articles have shown its true value. Therefore, this plant needs to be given more attention and publicity. It is thought that the thorny branches might be behind the difficulty in harvesting and utilizing this plant on large commercial scale.

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