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**Abdullah**  
Department of Ilmul Advia  
(Pharmacology), State Unani  
Tibbi College, Allahabad, India

**Mohd Khalid**  
Central Research Institute of  
Unani Medicine, Hyderabad,  
India

**Mohd Kashif Hussain**  
Central Research Institute of  
Unani Medicine, Hyderabad,  
India

## **Badam (*Prunus amygdalus* Bail.): A Fruit with Medicinal Properties**

**Abdullah, Mohd Khalid and Mohd Kashif Hussain**

### **Abstract**

Badam (Almond) is a popular nutritious food obtained from middle sized tree found in Europe and Central Asia. In India, it is a principle crop of Kashmir region. The nutritional and medicinal value of Almond fruit is related to its kernel. The kernels are a rich source of fat, proteins enriched with large calorific value. It also used as a natural antioxidant and exhibits various medicinal properties such as laxative, demulcent, nervine tonic and aphrodisiac etc. The aim of this paper is to explain and explore the medicinal and nutritional properties of Almond in the comprehensive way.

**Keywords:** Unani, Badam, Almond, *Prunus amygdalus* Bail

### **1. Introduction**

Diet plays an important role in the maintenance of general health as well as prevention and treatment of diseases. According to Unani System of Medicine, the disease can be treated first through diet; if diet is not sufficient to treat disease, then drug can be administered. Since ancient period, numerous food items are being used as medicine for the prevention and treatment of diseases, among which Almond is an important nutritious plant derived medicinal herb. Almond is a seed of *Prunus amygdalus* Bail that belongs to the *Rosacea* family. The Central and Western Asia is said to be the native of Almond. <sup>[1, 2]</sup> It has been cultivated in China since 10<sup>th</sup> century B.C. and in Greece since 5<sup>th</sup> century B.C. In India, Almond is mainly cultivated in Kashmir and is supposed to be one of the chief crops of this region. <sup>[1]</sup> Almonds are considered highly nutritious due to rich source of fat and proteins. <sup>[1, 3]</sup> They are usually used as snack foods and as ingredients in a variety of processed foods, mainly in bakery and confectionery items. <sup>[4, 5]</sup> A part from its nutritional importance, it is also reported to possess beneficial effects on blood cholesterol level and lipoprotein profile in human; specifically it reduces low density lipoprotein (LDL) cholesterol <sup>[2, 4]</sup>. The major factors behind the almond's successful assault on cholesterol are its fatty acid composition <sup>[2]</sup>. The almond is useful as health building food, both for the body and the brainpower <sup>[6, 7]</sup>. It is also helpful food remedy for some common ailments like anaemia, as they contain copper, iron and vitamins <sup>[6]</sup>. Almonds, when integrated in the diet, have been reported to decrease risk of colon cancer in rats <sup>[4]</sup> and suggested both internally and externally for several purpose <sup>[8]</sup>. It has 44-55% of fixed oil, which is mostly use in the pharmaceutical and cosmetic industries <sup>[4]</sup>. Almond is used in Unani System of Medicine as a main integrant for the treatment and prevention of many diseases and is one of the constituent of many important pharmacopeial preparations.

### **2. Description in Unani Medicine**

In Unani system of medicine, Badam has been described as a famous fruit, the height of plant is equal to Anaar (*Punica granatum*) and Behi (*Cydonia oblonga*). Leaves are large and round shaped, flowers are white in colour <sup>[8-10]</sup>. It has three variety: Bustani (cultivated), Jangali (forest), and Pahadi (hilly) <sup>[8]</sup>. Bustani is a cultivated variety, whereas the rest are of wild variety. Bustani Badam bears fruits after three year of cultivation <sup>[8]</sup>. Fruits are one inch long; its one end is rounded and other one is conical in shape <sup>[8-10]</sup>. The fruit consists of three distinct parts; <sup>[8]</sup> outer most is soft woody shell cover; middle portion is white hard shell with small pores on it; inner thin layer which is the seed coat has leathery brown colored texture and is acrid in taste <sup>[8, 10]</sup>.

Based on the thickness of the middle hard shell, it is of two kinds: the thick shelled and the thin shelled, also known as Kaghazi Badam. The shell of Jangali (forest) and Pahadi (hilly) Badam is harder than Bustani (cultivated) Badam with less sweetness and oil contents. The Almonds which have soft shell are considered of best quality <sup>[8, 10]</sup>.

Ibn-e- Baitar has described two kinds of Almond based on the taste i.e. Badam Shireen (Sweet Almond) and Badam Talkh (Bitter Almond). The Bustani variety is known as sweet Almond <sup>[11]</sup>

**Correspondence**  
**Mohd Khalid**  
Central Research Institute of  
Unani Medicine, Hyderabad,  
India

The taste of the Badam Shireen is sweet and greasy [8]. The explanation of the plant based on the modern scientific studies gives nearly similar report as mentioned by former authors of Unani pharmacognosy.

## 2.1 Pharmacological Actions in Unani medicine

Muqawwi-e-Dimagh (Brain tonic), Mulyan shikam (Laxative), Muqawwi-e-Bah (Aphrodisiac), Jali (Detergent), Mulattif (Demulcent) [8, 9, 11-14], Mufatteh Sudad (Deobstruent), Musakkin (Analgesic) [8, 11], Kasir-e- Reyah (Carminative) [8], Dafa-e-Sual (antitussive), Muwallid-e-Mani, and Musammin Badan [8, 9, 12, 13].

## 2.2 Therapeutic Indications in Unani Medicine

In Unani system of medicine, Badam Shireen and Badam Talkh both are used as medicine in various dosage forms such as Majoon, tablet, oil and decoction, paste etc. for various diseases. Almond also provides good nutrition to the body; good quality of humours are produced (Akhlāt), which provides nutrition to all organs of the body, so that Quwa (faculties) of the related organ becomes stronger enough to discharge their normal functions [8, 9]. It is used to fatten up the body and improve the eyesight [8, 9, 15].

The kernels are used as cerebrotonic, laxative, and antitussive. The almonds are also used in hepato-splenic diseases. The important therapeutic actions of almonds on different systems of the human body which have been described by various authors are as following:

**2.2.1 Central Nervous System:** In cerebral abnormalities such as loss of memory, insomnia, and headache it is very effective [8, 15, 13]; for relieving headache, its oil along with rose oil and vinegar is applied locally on the forehead. Similarly, oil of bitter almond can also be used for the same purpose [8, 11, 15]. It decreases Yabusat (dryness) of brain, for which its oil is also used [7, 8, 15, 13].

**2.2.2 Respiratory System:** paste of almond with wheat starch and mentha is very useful for arresting haemoptysis. It is used in chronic cough and pneumonia. It has been postulated that sweet almond has effective soothing effect on throat, hence, is beneficial in dry cough; bitter almond is used for the same action too [8, 11, 15, 16].

**2.2.3 Gastro-intestinal Tract:** Almonds are beneficial in constipation and thus provides relief in colic pain; it is also useful in peptic ulcer disease, [7-9, 11, 15]. Almond removes the hepatic and splenic obstructions; it also removes obstructions of peripheral vessels [8, 11, 15, 16].

**2.2.4 Urogenital System:** Sweet almond is very effective in vesicle ulcer as well as in renal and vesicle stone. Hence, it helps relieve dysuria, nephralgia, burning micturition, and urinary retention [8, 11, 15, 16]. Bitter almond is also useful for these ailments [8, 11, 15, 16]. It is also useful in uteralgia, inflammation and hardness of uterus, hysteria, Its pessary elicits an emmenagogue action [8, 15]. The almonds are also used in different dosage forms for sexual debility [8, 9, 12, 13].

**2.2.5 Skin:** It enhances glow and fairness of skin. Local application and decoction of its root cures pityriasis. For urticaria and wound healing, almond is used mixed with wine and honey for local application [8, 11, 15].

## 2.3 Some Useful Prescriptions of Almond in Unani Medicine

- Powder of hard shell is useful in bleeding gum; it

increases shining and strength of tooth [8, 9, 11].

- Local applications of almond oil are effective in Sud'a (headache), Warm-e- Tashannuj (spasm), meningitis, pneumonia and insomnia [8]. It is also effective in otalgia, tinnitus, mastitis, and gout [8].
- Almond oil with hot water is used to relieve sore throat; powder of almond with Kateera (...) is effective in dry cough [8]. According to Ibn Sina, almond oil is the best remedy for renal pain, dysuria, renal & urinary bladder stone and hysteria [8].

## 2.4 Part Used: Kernel and hard shell

**2.5 Mizaj (Temperament):** Hot and Moist 1<sup>0</sup>[8, 11].

**2.6 Mazarrat (Harmful effects):** For Intestine [9].

**2.7 Musleh (Correctives):** Khand, Shaker [9].

**2.8 Badal (Substitutes):** Maghz Khandaq, Pista [9].

**2.9 Miqdare Khurak (dose):** 7-11 Kernels [17].

## 2.10 Murakkabat (Compound Formulations)

Banadiqul Buzoor, Habbe Bohhatus Saut Muzmin, Habbe Jadwar, Habbe Mus'hil, Habbe Surfa Qawi, Qurse Kakanj, Sufoof Suranjan, La'uq Badam, La'uq Hulba, La'uq Sapista, La'uq Zeequn Nafas, Lubub Kabir, Lubub Sagheer, Majoon Arad Khurma, Majoon Falaksair, Majoon Mughalliz, Roghan Badam Shireen, and Roghan Lubub Saba Barid [17].

## 3. Description in Modern Literature

The modern description of Almond can be studied under the following subheadings:

### 3.1 Geographical distribution

It is indigenous to West Asia, and is cultivated in Baluchistan, Kashmir, Punjab, Afghanistan, Persia, and the Mediterranean region [5, 18]. The United States of America is the largest almond producer in the world and most of the US almond crops are grown in California [4].

### 3.2 Morphological Features

Fruits are drupe, about 36 cm long, pubescent, with tough flesh splitting, at maturity, [1, 5] exposing the pitted stones, endocarp thin or thick, seed flattened, long, oval with a brownish seed coat, generally one seed is found enclosed in each stony shell [1, 5]. This species includes three varieties, viz. var. *Amygdalus*, var. *Amara* (DC) Focke and var. *Sativa* (Ludw.) Focke. [1] The first one includes wild types found in West Asia, Greece, and North Africa; the second and third includes large number of cultivated types of almonds [1].

### 3.3 Vernaculars Names

**Arabic:** Lauzul Hulu; **Persian:** Badam Shireen; **Bengali:** Bilaiti Badam; **English:** Sweet Almond; **Hindi:** Badam; **Kanada:** Badami; **Malayalam:** Badam; **Marathi:** Badam; **Punjabi:**

Badam; **Sanskrit:** Badam; **Tamil:** Vadumai; **Telugu:** Badamu; **Urdu:** Badam Shireen [17].

**Botanical Name:** *Prunus amygdalus* Bail. [17, 18, 19]

**Synonym:** *Prunus communis* Arcang.; *Prunus communis* L.; *Prunus amygdalus* Batsch [17]

**Family:** *Rosaceae* [18, 19]

## 4. Ethno-Pharmacological Reports

### 4.1 Pharmacological Actions and Therapeutic Uses

It possesses highly nutritious, demulcent, stimulant, nervine tonic, lithotriptic, and diuretic, [1, 5, 18, 20] emollient, laxative and, sedative in cough, deobstruent [18, 19] aphrodisiac actions. [18, 21] it is used in cough, for removing obstruction of the liver

and spleen, [18, 20] skin eruption, peptic ulcer, and intestinal colic. [1, 18, 21] Unripe fruits having astringent action are used for gums and mouth ulcer [22]. The oil has laxative action; beneficial to brain, and useful in delirium; it is also used to relieve neurological and renal pain [18].

#### 4.2 Phytochemistry

It contains protein, fat, carbohydrates, calcium, oxalic acid, phosphorous, iron, thiamine, nicotinic acid, riboflavin, folic acid, sodium, potassium, magnesium, copper, sulphur, chlorine, and iodine [1, 5]. Almond is good source of vitamin E, MUFA, PUFA, and Arginine [6]. The active constituents of almonds are globulins such as amandine and albumin; amino acids such as arginine, histidine, lysine, phenylalanine, leucine, valine, tryptophan, methionine and cystine [1, 5, 6]. The oil has been estimated to consist principally of diolein and triolein [1]. Almond contains approximately 49% oil, of which 62% is monounsaturated oleic acid (omega 9 fatty acid), 24% is linoleic acid (a poly unsaturated omega 6 essential fatty acid), and 6% is palmitic acid (saturated fatty acid). [3, 6] Various phenolic compounds have been extracted from almond byproducts which were identified as 3-O-methylquercetin, 3O $\beta$  Dglucopyranoside, 3-O-methylquercetin 3O $\beta$  Dgalactopyranoside, 3-O-methylquercetin, 3O $\alpha$  Lrhamnopyranosyl (1 $\rightarrow$ 6)  $\beta$ Dglucopyranoside, catechin, protocatechuic acid, vanillic acid, and phydroxybenzoic acid [23]. Four different flavanol glycosides—isorhamnetin, rutinose, isorhamnetin glucoside, kaempferol, rutinose, and kaempferol glucoside have been reported in almond seed coats [24].

### 5. Scientific Reports

#### 5.1 Memory Improving Activities

A study was carried out in scopolamine induced amnesia in rats. PA which were administered in different doses in the respective groups significantly reversed scopolamine induced amnesia, [25] as evidenced by a decrease in the transfer latency in the elevated plus maze (EPM) task and step down latency in the passive avoidance task. PA reduced the brain ChE activity in rats. PA also exhibited a remarkable cholesterol and triglyceride lowering property and slight increase in glucose levels in the present study [25]. In another study, Nootropic effects of almond were evaluated in rat models wherein almond paste was given orally with the help of feeding tube for 28 days. Memory function in rats was assessed by Elevated plus Maze (EPM) and Radial Arm Maze (RAM). [26] Brain tryptophan, 5HT and 5HIAA were estimated at the end of the treatment by HPLCEC method. It was founded that a significant improvement in learning and memory of almond treated rats was reported compared to control [26].

#### 5.2 Hepatoprotective Activities

In a preclinical study, it was founded that animals who received almond oil prior to the administration of CCl<sub>4</sub>, had significantly decreased serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), lactate dehydrogenase (LDH) activities and total cholesterol (TC), triglyceride (TG) and low density lipoprotein (LDL) content and increased serum high density lipoprotein (HDL) content [27]. Whereas, pretreatment with almond oil markedly increased rat hepatic superoxide dismutase (SOD), catalase and glutathione peroxidase (GPx) levels and decreased malondialdehyde (MDA) level [27].

#### 5.3 Hypoglycemic activities

A study was carried out by Teotia S *et al.* on albino rabbits; the results showed that almond seeds were found to exert significant hypoglycemic effect [21].

#### 5.4 Anxiolytic Activity

A study was carried out using open field tests in mice wherein *Prunus amygdalus* was given in two different doses- 800 and 1600 mg/kg, the efficacy was compared with standard anxiolytic drug-diazepam (1mg/kg) [6]. Both diazepam and almond (1600 mg/kg) treated groups showed significant increase ( $p < 0.001$ ) in both the number of rearing against the wall and the time spend in central squares with significant increase in the number of crossed squares ( $p < 0.01$ ) and ( $p < 0.05$ ) respectively. The number of grooming was significantly decreased ( $p < 0.001$ ) while the duration of grooming showed no significant difference ( $p > 0.05$ ) in compare to the control group [6].

#### 5.5 Anti-aging Activity

In a scientific study, skin extract of *Prunus amygdalus* was used in herbal cosmetic formulation and evaluated for the protection of skin from solar ultraviolet induced photo-aging. The skin of treated mice groups showed stronger antioxidant activity by significantly decreased and increased MDA and GSH level respectively as compared to irradiated control groups. [28]

#### 5.6 Antioxidant activity

Many studies have been conducted on antioxidant effect of fruit and various part of *Prunus amygdalus*. Ali Jahanban Isfahlan *et al* inferred that methanolic extract of almond possesses anti-antioxidant and anti-radical activities and their phenolic extract may be helpful in preventing or slowing the growth of various oxidative stress related diseases [4]. In another study conducted by Shengmin Sang *et al*, nine phenolic compounds were isolated from the ethyl acetate and *n*butanol fractions of almond (*Prunus amygdalus*) skins. 2,2D iphenylpicrylhydrazyl (DPPH) free radical scavenging activities were determined. Some Compounds showed very strong DPPH radical scavenging activity. [23]

### 6. Conclusion

This review shows that Badam (almond) is an important medicinal as well as dietary plant immensely cultivated in West Asia and many other part of the world since long time. In Unani medicine, it has been successfully used as cerebrotonic, cardiogenic, antitussive, laxative, deobstruent of liver and spleen, and aphrodisiac drug. Some of these activities have been scientifically evaluated and some are yet to be evaluated. It is recommended that preclinical and clinical studies should be conducted in order to prove its other actions which are still scientifically unexplored.

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