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Review Article

Almond (*Prunus amygdalus* L.): A source of revitalizing health and its therapeutic application

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Abstract

Nature is the source of some exquisite food products, having a wondrous amalgam of beneficial bioactive compounds with diverse health effects, often unattainable in synthetic products. Almond is a one of the valuable health benefiting food, from the Rosaceae family, have long been known as a source of essential nutrients; nowadays, they are in demand as a healthy food with increasing popularity for the general population and producers. They are native to the region which extends from India to Persia; the almond tree had spread to east and west of its native region thousands of years before Christ. Bitter and sweet almond are its types. It consists of Kernel or meat, mid shell and outer green shell. They are a rich source of vitamin E, dietary fiber, B-vitamins, proteins, calcium, magnesium, mono-unsaturated fats and phytosterols. This is also one of the classical Unani drugs prescribed by Hakeems in different body ailments. In Unani literature, it is mainly described as *Muqawwi-i-dimāgh* (Brain tonic), *Murattib-i-dimāgh* (Brain demulcent), *Mulayyin* (Laxative), *Muqawwi-i-bāh* (Aphrodisiac) and *Mughadhhi* (Nutritious) etc. This is a review paper which discuss morphology, pharmacological action, ethno-medicinal and therapeutic uses of this medicinal plant in perspective of Unani medicine. This review has been done through online searches of databases such as PubMed, Google Scholar, Embase, science direct and hand search for classical textbook available in libraries. It concluded that Almond is one of the best herbal medicines in treatment of Palpitation, Amnesia, Hyperlipidemic, Sexual Debility, Dysmenorrhea, as it possess the following properties Antidiabetic, Antifungal, Anticancer, Antioxidant, Antihypertensive, Anti-inflammatory, Immunity enhancer, Hepato-protective Neuro-protective.

Keywords: Unani System of Medicine, Almond, Badam Shireen, Neuroprotective, Immunobooster, *Muqawwi-i-dimāgh*

INTRODUCTION

Nutraceuticals are defined as foods or parts of food with medicinal properties that can play an important role in health promotion and disease prevention. In recent years, these food compounds have attracted a great deal of attention because of their safety, nutritional and therapeutic effects.¹ 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 medicinal plant.^{1,2,3} Nuts are known as a source of nutritious food with high lipid content.^{1,2}

There are three varieties of almonds, all of which produce nuts, but some are edible and some are not. One almond variety produces the sweet nuts we eat, one produces poisonous, bitter nuts and a third variety produces a mixture of bitter and sweet nuts. Two major types of almonds are grown commercially, which can be categorized as sweet almonds (*Prunus amygdalus dulcis*) and bitter almonds (*Prunus Amygdalus amara*).^{1,3,4,5} (Almond consists of three parts: Kernel or meat, mid shell and outer green shell. There is a thin leathery layer known as brown skin or kernel or seed coat. Its kernel part is of high nutritional value.^{1,3,6} The almond (*Prunus dulcis*) is a small deciduous tree in the family Rosaceae native to southwest Asia. It belongs to the subfamily Amygdaloideae, which includes apricots (*Prunus armeniaca*), cherries (*Prunus avium*), nectarines (*Prunus*

persica), peaches (*Prunus persica*), and plums (*Prunus domestica*). These plants are drupes, or stone fruit, with each fruit consisting of a hull (the skin or exocarp and the flesh or mesocarp) that surrounds a single shell (the pit, or stone) of a hardened endocarp with a seed (kernel) inside.⁷ The exocarp and mesocarp are consumed in most stone fruits; however, with almonds, it is the seed that is consumed.

Epidemiological studies and clinical trials have reported positive effects of nuts consumption against a significant number of pathologies such as obesity, hypertension, diabetes mellitus and metabolic syndrome.⁸ Almonds are considered highly nutritious due to rich source of fat and proteins. 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. The almond is useful as health building food, both for the body and the brain power. It is also helpful food remedy for some common ailments like anemia, as they contain copper, iron and vitamins.^{3,5} In a large body of studies, indeed, the consumption of almonds has been associated with various health benefits, including the modulation of serum lipid and glucose levels, the regulation of body weight, and protection from several diseases, such as diabetes, obesity and cardiovascular diseases.⁸ 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 constituents of many important pharmacopeial preparations.³

Almonds can be consumed whole, chopped, sliced, ground, roasted, raw, blanched, salted, coated with chocolate or sweetened, or as an oil, butter or paste. Whole kernels, a convenient snack food, are the most efficient way of consuming quantities sufficient to modify LDL-cholesterol concentrations. An observational study in USA adults (≥ 19 year) using data from the National Health and Nutrition Examination Survey (NHANES) 2001–2010 ($n=24,808$) revealed that the prevalence of almond consumption (including whole almond kernels, with and without salt, almond butter, and almond paste) measured by 24 h dietary recalls was 1.6%.⁹

MATERIALS AND METHODS

A literature search was carried out to collect all relevant information on Almond (*Prunus amygdalus L.*) through publicly available electronic databases, including PubMed, Scopus, Google Scholar, Science Direct, Research Gate and other internet sources. A large number of

literature articles published up to 2020 were reviewed. The keywords used for the search included “Badam”, “Almond”, “*Prunus amygdalus dulcis*”, “Badam Shireen”, “Neuroprotective”, “Immunomodulator” “*Muqawwi-i-dimāgh*”,

The name of species has been validated by using ‘World Flora Online’ (<http://www.worldfloraonline.org/>). “Standard Unani Medical Terminology” published by CCRUM has been used to describe the proper Unani terminologies (<http://namstp.ayush.gov.in/#/Unani>), further, books published in urdu and English were used to compile the information as representative literature in unani medicine. This is a review paper which discuss morphology, pharmacological action, ethno-medicinal and therapeutic uses of this medicinal plant in perspective of Unani medicine.

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.^{10,11} It has three variety: *Bustāni* (cultivated), *jangalī* (forest), and *pahādī* (hilly).¹⁰ *Bustāni* is a cultivated variety, whereas the rest are of wild variety. *Bustāni* Badam bears fruits after three year of cultivation.¹⁰ Fruits are one inch long; it's one end is rounded and other one is conical in shape.^{10,11} The fruit consists of three distinct parts; ¹⁰ 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.^{10,11}

Based on the thickness of the middle hard shell, it is of two kinds: the thick shelled and the thin shelled, also known as *Kaghadhi* Badam. The shell of *jangalī* (forest) and *pahādī* (hilly) Badam is harder than *bustāni* (cultivated) Badam with less sweetness and oil contents. The Almonds which have soft shell are considered of best quality.^{10,11,12} *Ibn Baytār* has described two kinds of Almond based on the taste i.e., *Badam Shiryn* (Sweet Almond) and *Badam Talkh* (Bitter Almond). The *bustāni* variety is known as sweet Almond.¹³ The taste of the *Badam Shiryn* is sweet and greasy¹⁰. The explanation of the plant based on the modern scientific studies gives nearly similar report as mentioned by former authors of Unani pharmacognosy.³

BOTANY, MORPHOLOGY, ECOLOGY:

The almond tree is a small deciduous tree which grows to between 4 and 10 meters in height, with a trunk of up to 30 centimeters in diameter. The young twigs are green at first, they become purplish when they are exposed to sunlight and then

grey in their second year. The leaves are 3 to 5 inches long with serrated margins and 2.5 cm (1 inch) petioles. The flowers are pale pink and 3-5 cm in diameter with five petals; they are produced singly or in pairs before the leaves in early spring. Almonds begin to bear an economic crop in the third year after the planting of the trees. The trees reach the full bearing status after five to six years after their planting. The fruit becomes mature in the autumn, 7-8 months after the flowering. In botanical terms, the almond is not a nut, but a drupe which is 3.5 to 6 cm long. The fruit consists of an outer hull and a hard shell with the seed (“hut”) inside. Almonds are commonly sold shelled or unshelled.^{1,4,5,14,15.}

HABITAT:

Almond is a large deciduous or evergreen tree and shrubs mostly unarmed. It is said to be originally a native of central and western Asia^{3,4} and have been cultivated in China as early as the 10th century B.C. and in Greece in 5th century B.C.^{2,4,6} At present it is cultivated throughout Southern Europe, in U.S.A. (California), Australia and South Africa.⁶ In India the almond is cultivated in Punjab, Kashmir and Himachal Pradesh^{3,4,14,16} also in Afghanistan, Baluchistan, Persia and the Mediterranean region. The almond is said to have been extensively planted in some of the hilly areas of Uttar Pradesh also, but the fruiting has not been very encouraging due to heavy rainfall.^{2,17,18}

TAXONOMICAL CLASSIFICATION²

Kingdom: Plantae

Division: Tracheophytes

Class: Angiosperms

Order: Rosales

Family: Rosaceae^{1,3,4,5,18,19}

Sub-family: Purunaceae,⁴ Spiraeoideae^{4,5}

Genus: *Prunus*

Subgenus: *Prunus* subg. *Amygdalus*¹⁶

Species: *P. dulcis*²

VERNACULAR NAME:^{2,3}

Arabic-*Lauz-ul-Hulu*^{2,4,10,12,20,21,22,23}

Persian-*Badam-e-Shireen*^{1,4,10,12,21,22,23}

Urdu-Badam^{1,4} Shireen²¹

English-Sweet Almond^{4,12,14,16,20,22}

Hindi-Badam^{1,4,10,12,14,17}

Sanskrit-Badama^{14,24}

Malayalam-Badam², Vatam-kotta^{14,17}

Marathi-Badam

Kannada-Badami^{2,17}

Tamil-Vadumai^{2,24}, Vadamkottai^{14,17}

Telugu-Badamu^{4,24}

Bengali-Bilaiti Badam,⁴ Kaath Badam^{12,22,23}

Gujrati-Badam

Punjabi-Badam^{2,17}

Binomial name: *Prunus dulcis* (Mill.) D. A. Webb

Synonyms: *Amygdalus amara* Duhamel, *Amygdalus communis* L.^{1,14,16,17} *Amygdalus dulcis* Mill.¹ *Prunus amygdalus* Batsch^{1,14,16}, *Amygdalus sativa* Mill)^{2,19}

TEMPERAMENT (Mizāj)

Hot 1⁰ Moist 1⁰ 2,3,10,12,16,20,21,22,25

Hot and Cold 1,2,10,20,21

Cold 1 & Dry 2 2,10,20

PART USED:

Seeds and seed oil 2,16,21

Fruits and Roots, Almond shell 2,3

DOSAGE (Miqdār khūrāk):

2 tole - 5 tole 21

7 Badam seeds 3

7-11 Badam seeds 3,12,22

1.5 Tola or Not more than 2.5 Tola in one time, Badam seed oil 2

PHYTOCHEMISTRY 3

Almond contains carbohydrates, fat, proteins . It also contains many important and essential minerals and vitamins like

calcium, phosphorous, iron 4, potassium, magnesium, manganese, zinc, copper, sulphur, chlorine, iodine, thiamine, riboflavin, nicotinic acid and folic acid 1,4. Almond is a very good source of vitamin E , Monounsaturated fatty acid, polyunsaturated fatty acid and Arginine. The active constituents of almonds are globulins such as amandine and albumin;1 amino acids such as arginine, histidine, lysine, phenylalanine, leucine, valine, tryptophan, methionine and cystine. The oil has been estimated to consist principally of diolein and triolein4. 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).1 Many phenolic compounds have been extracted from almond byproducts which were identified as 3’Omethylquercetin, 3Oβ Dglucopyranoside, 3’Omethylquercetin 3Oβ Dgalactopyranoside, 3’Omethylquercetin, 3Oα Lrhannopyranosyl (1→6) βDglucopyranoside, catechin, protocatechuic acid, vanillic acid, and phydroxybenzoic acid.4 Four different flavonol glycosides-isorhamnetin, rutinoides, isorhamnetin glucoside, kaempferol, rutinoides, and kaempferol glucoside have been reported in almond seed coats.1,4

NUTRITIONAL VALUE OF ALMONDS (Per 100g/3.5 oz) 1,2,6,26

<u>NUTRIENTS</u>	<u>VALUE PER 100 GRAMS</u>
ENERGY	579 kcal (2,423 kJ)
CARBOHYDRATES	21.6g
STARCH	0.7g
SUGARS	4.4g
DIETARY FIBER	12.5g
FAT	49.9g
SATURATED	3.8g
MONOUNSATURATED	31.6g
POLYUNSATURATED	12.3g
PROTEINS	21.2g
VITB1 (THIAMINE)	211mg (18 % DV)
VIT B2 (RIBOFLAVIN)	1.014mg (85 % DV)
VIT B3 (NIACINE)	3.385mg (23 % DV)
VIT B5 (PANTOTHENIC ACID)	0.469 mg (9 % DV)
VIT B6	0.143mg (11 % DV)
FOLATE (B9)	50 micro g (13 % DV)
VIT E	25.6mg (171 % DV)
CALCIUM	264mg (26 % DV)
COPPER	0.99mg (50 % DV)
PHOSPHORUS	484mg (69 % DV)
MAGNESIUM	268mg (75 % DV)
IRON	3.72mg (29 % DV)
POTASSIUM	705mg (15 % DV)
ZINC	3.08mg (32 % DV)
WATER	4.4g

PHARMACOLOGICAL ACTION(Afa’I):

- *Muqawwī-i-dimāgh* (Cerebral and mental tonic) 1,3,4,12,16,20,22,23
- *Mulayyin* (laxative) 1,2,3,10,12,16,20,22
- *Muqawwī-i-bāh* (Aphrodisiac) 1,2,3,10,12,16,20,21,23
- *Taqwiyat-i-Hifz* (Memory Enhancer) 1,2,20
- *Mughadhdhi* (Nutritious) 2,20,22
- *Muwallid-i-manī* (Semen Productive) 2,3,10,20,22
- *Musammin-i-Badan* (Body Fattening) 2,3,10,12,20
- *Muqawwī-i-Chasm* (Eye Tonic) 1,2,21
- *Mulattif* (Demulcent) 2,3,10
- *Muḥarrik-i-‘aşab* (Nervine Stimulant) 2
- *Jali* (Detergent) 2,3,10,22,23
- *Mudirr-i-bawl* (Diuretic) 1,2
- *Şudā’* (Headache) 2,4
- *Sū’al-i-yābis* (Antitussive) 1,2,3,4,10,20,22
- *Muqawwī-i-mida’* (Stomach Tonic) 2,10
- *Muqawwī-i-Amā* (Intestinal Tonic) 1,2,20
- *Kāsir-i-Riyāh* (Carminative)
- *Mufattiḥ* (Deobstruent) 2,3,10
- *Munaqqi*
- *Mukhrij-i-akhlāṭ ghalīza wa sawdā* 10
- *Muṣaffi-i- dam* (Blood detoxifier) 20
- *Musakkin*(Analgesic) 1,3
- *Dāfi’-i-qūlanj* (Antispasmodic) 19,20,21

THERAPEUTIC USES IN UNANI MEDICINE (Isti’mālāt):²

- *Ḍu’f al-Dimāgh* (Brain Weakness) 1,20,21
- *Ḍu’f al-Qalb* (Heart weakness) 21
- *Khafqān* (Palpitation) 21,22
- *Nisyān* (Amnesia) 1,19,20,21,22
- *Muqawwī-i-Mana’t* (Immunity Enhancer) 20,22
- *Ḍu’f al-Aām* (General Weakness), 10
- *Ḍu’f al-Bāh* (Sexual Debility) 19,10,20,22
- *Qabz* (Constipation) 10,20
- *Ḍu’f al-Başar* (Weak Eyesight) 10,12,20,21
- *Sū’al* (Cough) 1,12,19,10,20,22
- *Ziqun Nafas* (Asthma) 1,10,20
- *Dhāt al Janab* (Pleuricy), 10,20,21
- *Nafth al-Dam* (Haemoptysis) 3,10
- *Ru’āf* (Epistaxis)
- *Khushnat-i-Halaq* (Sore Throat) 1,10,20
- *Qarḥq Medi’* (Peptic ulcer) 1,19,20

- *Humuzat-i- Medi’* (Hyperacidity) 10
- *Ishāl* (Diarrhoea) 10
- *Zāhir* (Dysentery) 10,20,21
- *Bawāsīr* (Piles)
- *Yaraqān* (Jaundice) 1
- *Istisqā* (Ascites)
- *Waja’-i-Asāb* (Neuralgia) 3,19
- *‘Usr-i-Ṭamth* (Dysmenorrhoea)
- *Kathrat al-Bawl* (Polyuria)
- *Sozāk* (Gonorrhoea) 20
- *Ḥurqa al-Bawl* (Burning Micturition) 3,10,20,21
- *Waram al-Mathana* (Cystitis) 10,20
- *Waram al-thadī* (Mastitis) 10
- *Waram al-Rahim* (Endometritis) 3,10
- *‘Usr-i- bawl* (Dysuria) 1,3,10
- *Ḥaşāt al-Kulya* (Renal stone). 4,19,10,20

VARIOUS PHARMACOLOGICAL STUDIES**1) THE CHOLESTEROL LOWERING ACTION 2,3,5,7,8**

CE Berryman et al have found that almonds have a consistent LDL-cholesterol lowering effect in healthy individuals and in individuals with high cholesterol and diabetes, in the controlled and free – living settings. ⁵ Almond consumption increases vitamin E level in plasma and red blood cells thus, it lowers the cholesterol level.it is a study published in the journal of the American dietetic association. Vitamin E is powerful antioxidant that prevents artery clogging oxidation of cholesterol. Consumption of Almond (*Prunus Amygdalus*) on daily basis gives you vitamin E which helps to reduce cholesterol. ⁶

In a study among adults with hyperlipidemia, Nishi et al. showed that almond consumption favorably alters the serum fatty acid profile by increasing the proportions of total MUFA (oleic acid in particular) and decreasing saturated fatty acids. These findings correlate with improvements in blood lipoproteins and with a decreased 10-year coronary heart disease risk.²⁷

2) IMMUNOSTIMULANT PROPERTIES^{2,3,5}

Adriana Arena, et al, evaluated in their study, that with almonds, high levels of cytokine production were observed i.e., interferon- α (INF- α), interleukins (IL-12), INF-gamma and tumour necrosis factor (TNF- α). Their data suggested that almonds improved the immune surveillance of the peripheral blood mono nuclear cells towards viral infections. Almonds also were found to induce a significant decrease in the Herpes simplex virus (HSV-2) replication.⁵ An analysis of the United Kingdom’s National Diet and Nutrition Survey 2008– 2017 showed that whole almond consumers’ diets had a higher nutrient quality score than non-consumers based on their higher intakes of protein, unsaturated fats, fiber, folate, vitamin E, and magnesium, and lower intakes of total carbohydrates, sugar, and sodium.²⁸

3) ANTI-INFLAMMATORY 1,2,3,4,5

Ali Jahanban Isfahan, et al demonstrated that the methanolic extracts of almonds possessed anti-oxidant and anti-radical activities and that their phenolic extract may be helpful in preventing or slowing the processes of various oxidative stress

related diseases.⁵ The anti-inflammatory potential of almond consumption has been investigated through a randomized, crossover study involving 25 healthy subjects, randomized into three–four week and high-almond diet. After the intervention period, E-selectin levels were significantly lower in the high-almond group compared to the placebo; interestingly, it was estimated that for every 1% increase in energy replaced with almonds, E-selectin decreased by 0.18 µg/L.

On the other hand, both of the almond diets significantly reduced serum levels of C-reactive protein (CRP). According to the authors, the anti-inflammatory effects might be mainly attributed to the high MUFA content, which has been considered responsible for the decreased levels of E-selectin and CRP. Additionally, further almond components, including magnesium, arginine and phytochemicals, may also contribute to reducing the levels of inflammatory mediators.

4) ANTI-OXIDANT ACTION^{1,2,3,4,5}

The antioxidant activity of almonds has been evaluated in two studies on habitual smokers. A pilot study was conducted on 30 young subjects habitual smoking 10–20 cigarettes daily, and with at least a five-year smoking. Subjects were randomized into three groups (n = 10 per group): control (no almonds), 84 g and 168 g almond supplementation daily for four weeks. After the treatment period, the percentage of tail DNA was reduced in both the almond-supplemented groups, with statistically significant differences in the higher-dose group (p < 0.05 compared to the control group); in addition, in both the almond-supplemented groups significantly reduced levels of 8-hydroxy-20-deoxyguanosine (8-OH-dG) and malondialdehyde (MDA) (p < 0.05 for all, compared to the control group) were found. Also, in this case, after the period, DNA damage, MDA and 8-OH-dG were significantly reduced (23%, 34% and 28%, respectively).⁸

5) HYPOGLYCEMIC ACTION^{2,3,5,7,8}

David J.A. Jenkins et al showed that almonds lowered postprandial glycaemia, insulinaemia and oxidative stress. Gulati S et al, demonstrated that daily almond consumption at 20% of total energy intake for 24 weeks helped improve anthropometric, glycemic, and lipid parameters significantly in Asian Indian subjects with T2D. Subjects in their study demonstrated a concurrent and significant decrease in HbA1C, waist circumference, and serum triglycerides thereby providing strong evidence in support of this association.²⁹

6) HEPATOPROTECTIVE ACTION^{1,2,3,4,5}

A study was performed to investigate hepatoprotective effect of *Prunus Amygdalus* L. Model animals (rats) were first treated with almond and then with CCl₄. Pretreatment of oil reduced the levels of ALT (alanine amino-transferase), AST (aspartate amino transferase), ALP (alkaline phosphatase), LDH (lactate dehydrogenase), TC (total cholesterol), TG (triglycerides), MDA (malondialdehyde), and LDL (lipoproteins), significantly. In addition to this, remarkable increase in concentrations of GPx (glutathione), SD (superoxide dismutase), and catalase was observed.⁴

7) AMNESIA^{2,4,5}

Kulkarni, et al, in their study, suggests that almonds possess a memory enhancing activity in view of its facilitatory effect on the retention of special memory in scopolamine induced amnesia. They concluded that almonds lowered the serum cholesterol in rats. They were also found to elevate the Ach level in the brain and ultimately improve the memory (special and avoidance) of rats. It was observed that PA was administered orally at three doses (150, 300 and 600 mg/kg) for 7 and 14 consecutive days to the respective groups of rats.³⁰ In another investigation, memory improving effect of almonds paste was

evaluated using EPM (Elevated plus Maze) and RAM (Radial Arm Maze) assays. Oral administration of almond paste in rats for 28 days significantly enhanced learning and memory parameters of model animals.⁴

8) PRE-BIOTIC POTENTIAL^{1,2,4,8}

Almond seeds as the main source of prebiotics can increase *Bifidobacteria* and *Eubacterium* populations, which subsequently increase the concentration of butyrate.

Administration of raw and roasted almond to rats can regulate their intestinal microbiome. The underlying mechanisms comprise beneficial bacterial stimulation, harmful bacterial inhibition, modification of bacterial enzymes' activity, and metabolic activity improvement.¹

9) ANTI-CANCER ACTIVITY¹

Some studies have demonstrated cytotoxic activities of almond and its fractions against several human cancers. It is believed that almond can be considered as a new drug in the management of cancerous tumors. Adding almond or its oil to the rats' diet could significantly decrease the aberrant crypt foci (ACF) and colonic cell turnover.¹ Almond reduces cancer risk. The person who consumed Almond in a higher quantity reduces breast cancer 2 to 3 times. Almonds are a good source of anti-oxidants. It can be protected against oxidative stress which contribute to inflammation, aging and cancer. Antioxidants are rich in brown layer of Almond. It is helpful to treat cancer.⁶

10) OBESITY:^{6,7,8}

A 12-week clinical trial was carried out with 86 healthy subjects with a body mass index (BMI) that ranged from 25 to 40 kg/m² who were randomized into two diet intervention groups: an almond-enriched hypocaloric diet (AED, 15% of total kcal from almonds) and a nut-free hypocaloric diet (NFD). Each diet provided a daily 500-kcal deficit, with the energy requirement estimated by predictive equations. After the intervention period, although subjects in both groups lost body weight, in those that followed the AED significantly higher reductions in total and truncal fat mass were observed, as well as an increase in the total and truncal fat-free mass (p < 0.05).⁸

Li et al., in a 2018 meta-analysis (62 RCTs, 7184 individuals), evaluated the mean differences between specific nut and control diets on body mass (weight), BMI, and WC. Almonds were the only nut that significantly lowered mean body mass by 0.56 kg based on 20 RCTs compared to an overall mean body mass loss of 0.22 kg (Figure 1) for all nuts studied, where almonds accounted for 48% of the overall nut body mass loss effect. In addition, almond diets lowered mean BMI by 0.49 kg/m² and waist circumference (WC) by 2.4 cm compared to a lowered overall mean nut BMI by 0.16 kg/m² and WC by 0.51 cm, where almonds accounted for 34% and 29% of this overall mean nut effect size.²⁸

11) REDUCES CARDIOVASCULAR RISK

An association was observed between the consumption of almonds and the reduction of the Framingham 10-year CHD risk score (R = - 0.247, p = 0.026), which translates into a 3.5% reduction of CHD risk for every 30 g increase in almond intake. Nevertheless, although they should be interpreted with caution, the data presented herein might allow for considering almonds as a useful dietary approach in the long-term prevention of cardiovascular risk.^{6,7,8}

12) SERUM URIC ACID

A large, randomized, nut-free diet-controlled study demonstrated the uricemia-lowering effect of 12 weeks of regular consumption of almonds (10 g daily) in 150 coronary artery disease patients. After the intervention period, at week 6

and week 12 significantly reduced serum levels of uric acid were registered in both men (-15% and -17%, respectively; $p < 0.05$ for all, compared to nut-free diet group) and women (-12% and -16%, respectively; $p < 0.05$ for all, compared to nut-free diet group).⁸

- Anti-aging Activity^{2,3,4,5}
- Memory enhancing⁴
- Anti-inflammatory
- Antimicrobial¹
- Hepatoprotective^{1,2,3,5}

TOXIC STUDIES:

HCN levels in bitter almond (1062 ± 148.70 mg/kg) are approximately 40 times higher than levels found in sweet almond (25.20 ± 8.24 mg/kg). This could be explained by the fact that the amount of amygdalin contained in the bitter almond largely exceeds the amount contained in the sweet one. After enzymatic hydrolysis, the amygdalin which is the most important cyanogenic glycoside in *Prunus*'s species releases a high level of hydrocyanic acid, and a benzaldehyde which is responsible for the bitterness. Knowing that the acute lethal dose of cyanide for mammals is as low as 0.5 mg CN/kg of the body weight, the acute oral lethal dose of HCN for humans is reported to be 0.5–3.5 mg/kg of body weight and the consumption of 50 bitter almonds is deadly for adults. However, for young children, 5–10 almonds are fatal.³¹

Toxicity or adverse effect (Muzir asrat):

It raises bile, produces heaviness in stomach, delayed digestion.^{2,3,20,21}

Correctives (Musleh): Khand, Shaker,³ Mastagi^{10,21,22}

Substitute (Badal): Maghaz-i-chilgoza, Akhrot^{3,20,21,22}

Unani Compound formulation containing Almond:^{2,3,16,22}

*Banādīqul buzūr, habb-i-bohatus sawt muzmin, habb-i-jadwār, habb-i-mus'hil, habb-i-surfa qawī, qurs-i-kākanj, sufūf suranjān, la'uq badam, la'uq hulba, la'uq sapistān, la'uq zīqun nafas, lubūb kabīr, lubūb saghīr, majūn arad khūrmā, majūn falaksair, majūn mughalliz, roghan-i-badam shirīn, and roghan lubūb saba bārid.*³

CONCLUSION:

Almonds are a nutrient dense food, and extensive research during the last decade on the potential health benefits of almonds has linked consumption patterns to reduced risk of chronic diseases such as coronary heart disease (CHD) and type 2 diabetes, as well as to weight maintenance and weight control. This review discussed in detail about the nutritional value, phytochemistry, pharmacological actions, therapeutic uses and also the pharmacological studies conducted so far of the commonly used almond that is sweet almond (*Prunus dulcis*). In Unani system of medicine Almond has been commonly used as cerebrotonic, cardiogenic, antitussive, laxative, deobstruent of liver and spleen, Carminative, Antispasmodic, Memory enhancer, immunostimulant and aphrodisiac drug. Current pharmacological studies represent that *Prunus dulcis* has several biological activities including prebiotic, anti-microbial, antioxidant, anti-inflammatory, anti-cancer, hepatoprotective, cardiometabolic protection, nootropic, anxiolytic, sedative-hypnotic and nervous-improving effects. Some of these activities have been scientifically evaluated and some are yet to be evaluated. Further clinical trials and meta-analysis are required to draw a definitive conclusion on the efficacy and therapeutic activities of almond.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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