Plant Science Review

PLANT SCIENCE REVIEW

Review Article

Journal homepage: https://psr.crcjournals.org/

ISSN No: 3041-7279

Check for updates

Comprehensive Review on Badam (*Prunus dulcis*): Phytochemistry, Pharmacology, Traditional Uses, and Modern Applications in Unani and Contemporary Medicine

Syed Aqib Feroz[1], Huzaifa Ayyub*[2], Maaz Ahmad[1], Muhammed Nadeem Khan[3], and Nazila Bashir[4]

[1]*Department of Saidla, Faculty of Unani Medicine, Aligarh Muslim University, Aligarh – 202002, Uttar Pradesh, India*
[2]*Department of Kulliyat, Faculty of Unani Medicine, Aligarh Muslim University, Aligarh – 202002, Uttar Pradesh, India*
[3]*Department of Tashreehul Badan, Faculty of Unani Medicine, Aligarh Muslim University, Aligarh – 202002, Uttar Pradesh, India*
[4]*Kashmir Tibbia College Hospital and Research Centre, University of Kashmir, Srinagar – 190001, Jammu and Kashmir, India*

Received 28 March 2025 | Revised 25 April 2025 | Accepted 18 May 2025 | Available Online 09 June 2025

*Corresponding Author: **Huzaifa Ayyub** | Email Address: **gp8793@myamu.ac.in**

Citation: Syed Aqib Feroz, Huzaifa Ayyub, Maaz Ahmad, Muhammed Nadeem Khan, and Nazila Bashir (2025). Comprehensive Review on Badam (*Prunus dulcis*): Phytochemistry, Pharmacology, Traditional Uses, and Modern Applications in Unani and Contemporary Medicine. ***Plant Science Review***.
DOI: https://doi.org/10.51470/PSR.2025.06.01.47

Abstract

Badam, scientifically known as Prunus dulcis (Mill.) D.A. Webb (syn. Prunus amygdalus Batsch.) is a nutrient-dense drupe from the Rosaceae family, revered in Unani medicine as a Ghiza-e-Dawaee (nutraceutical) for its revitalizing health benefits. Native to Central and Western Asia, it has been cultivated globally for millennia. This review synthesizes data from classical Unani texts and modern scientific studies, highlighting its morphology, phytochemistry, pharmacological actions (e.g., neuroprotective, immunostimulant, hypolipidemic), therapeutic uses (e.g., for amnesia, sexual debility, constipation), and safety profile. Key constituents include monounsaturated fats (e.g., oleic acid 62%), proteins (21.2g/100g), vitamin E (25.6mg/100g), and phenolics like quercetin and kaempferol. Preclinical and clinical evidence supports its antioxidant, antidiabetic, antifungal, and anti-inflammatory properties. While sweet almonds (var. dulcis) are safe and nutritious, bitter almonds (var. amara) pose cyanide toxicity risks. This comprehensive analysis underscores Badam's potential in integrative medicine for promoting health and managing chronic conditions.

Keywords: *Prunus dulcis, Unani medicine, Phytochemistry, Nutraceutical, Pharmacological actions.*

Introduction

Nature offers a plethora of food products rich in bioactive compounds that provide diverse health benefits, often surpassing synthetic alternatives [1]. Among these, Badam (almond) stands out as a valuable nutraceutical from the Rosaceae family, long recognized for its essential nutrients and therapeutic potential [2]. Originating from regions extending from India to Persia, the almond tree spread eastward and westward thousands of years before Christ [3]. Classified into sweet (*Prunus dulcis var. dulcis*) and bitter (*var. amara*) varieties, the sweet type is primarily edible and medicinal, while the bitter type is used cautiously due to toxicity [4].

In Unani medicine, Badam is prescribed for ailments like brain weakness (*Du'f al-Dimagh*), sexual debility (*Du'f al-Bah*), and constipation (*Qabz*), acting as a brain tonic (*Muqawwi-i-Dimagh*), aphrodisiac (*Muqawwi-i-Bah*), and laxative (*Mulayyin*) [5]. Modern research corroborates these uses, linking almond consumption to reduced risks of cardiovascular disease, diabetes, and oxidative stress [6]. This review integrates Unani perspectives with contemporary data, covering botany, phytochemistry, pharmacology, and applications.

Botanical Description and Morphology

Figure 1. (a) Plant, (b) Kernels and(c)oil of Prunus dulcis.

Macroscopic Features

Prunus dulcis is a small deciduous tree, 4-10m tall, with a trunk diameter up to 30cm [7]. Young twigs are green, turning purplish then grey. Leaves are lanceolate, 8-13cm long, with serrated margins and petioles 2.5cm long [8]. Flowers, pale pink to white (3-5cm diameter), bloom singly or in pairs in early spring before leaves [9]. The fruit is a drupe (3.5-6cm long), with a velvety hull splitting at maturity to reveal a pitted shell enclosing the seed (kernel) [10]. Kernels are ovoid, flattened (2-3cm long), with a thin brown seed coat removable after soaking [11]. Sweet kernels are nutritious; bitter ones are toxic due to amygdalin [12].Varieties include cultivated (*Bustani*), wild forest (*Jangali*), and hilly (*Pahadi*), with *Kagzi* (paper-shelled) considered superior for softness and oil content [13]. Fruits mature 7-8 months post-flowering, bearing economically from the third year [14].

Microscopic Features

Transverse sections show a thin seed coat with papilliform epidermal cells (pitted base), crushed middle layers, and tubular inner cells [15]. Endosperm is single-layered parenchymatous. Cotyledons contain aleurone grains, oil globules, and fixed oils [16]. Powder is creamy white, oily, sweet-tasting (sweet variety), odorless [17].

Taxonomy

- Kingdom: *Plantae*
- Division: Tracheophyta
- Class: Magnoliopsida
- Order: Rosales
- Family: Rosaceae
- Subfamily: Amygdaloideae
- Genus: Prunus
- Subgenus: Amygdalus
- Species: dulcis
- Binomial: *Prunus dulcis* (Mill.) D.A. Webb
- Synonyms: *Amygdalus communis* L., *Amygdalus dulcis* Mill., *Prunus amygdalus* Batsch, *Amygdalus sativa* Mill. [18]

Vernacular Names

- Arabic: Lauz-ul-Hulu, Louz
- Persian: Badam-e-Shireen
- Urdu: Badam Shireen
- Hindi: Badam
- English: Sweet Almond
- Bengali: Bilaiti Badam, Kaath Badam
- Gujrati: Badam
- Malayalam: Badam, Vatam-kotta
- Marathi: Badam
- Kannada: Badami
- Tamil: Vadumai, Vadamkottai
- Telugu: Badamu
- Punjabi: Badam
- Sanskrit: Badama, Madhurya badamitte
- Greek: Amygdalia [19]

Habitat and Distribution

Native to Southwest Asia (Iran, Turkey), cultivated in Mediterranean regions, California (largest producer), Australia, South Africa [20]. In India, grown in Kashmir, Punjab, Himachal Pradesh; limited in Uttar Pradesh due to rainfall [21]. Requires temperate climate with cold winters and warm ripening periods [22].

Parts Used

Seeds (kernels), seed oil; occasionally shells, fruits, roots [23].

Temperament (Mizaj)

Hot 1° Moist 1° (most sources); variations include Hot and Moist, Hot 2° Moist 2°, Cold 1° Dry 2° [24].

Taste

Sweet and oily (sweet variety); bitter (bitter variety) [25].

Therapeutic Dose (Miqdar-e-Khuraq)

7-11 kernels; oil 18-60ml [26].
Bitter: 0.5-1g externally [27].

Adverse Effects (MuzirAsraat)

Increases bile, stomach heaviness, delayed digestion (sweet); cyanide toxicity in bitter (lethal at 50 kernels adults, 5-10 children) [28].

Corrective (Musleh)

Sugar, honey, Mastagi [29].

Substitute (Badal)

Maghz Chilgoza, Akhrot, Pista, Filfildaraz [30].

Compound Formulations (Murakkabat)

Laooq-e-Badam, Laooq-e-Sapistan, Luboob Kabir/Sagheer, MajoonAarad Khurma, MajoonMughalliz, Roghan-e-Badam Shireen, Banadiq-ul-Buzoor, Habb-e-Jadwar, Qurs-e-Kaknaj [31].

Actions (Af'al)

Muqawwi-i-Dimagh (brain tonic), Mulattif/Murattib (demulcent), Mulayyin (laxative), Muqawwi-i-Bah (aphrodisiac), Mughazzi (nutritive), Muwallid-i-Mani (spermatogenic), Musammin-i-Badan (fattening), Muqawwi-i-Basr (eye tonic), Jali (detergent), Mudirr-i-Baul (diuretic), Kasir-i-Riyah (carminative), Mufattih (deobstruent), Muqawwi-i-Qalb (cardiotonic), Taqwiyat-i-Hifz (memory enhancer), Musakkin (analgesic), Dafi-i-Qulanaj (antispasmodic), Muhammir (rubefacient), Hazim (digestive), Mufattit-i-Hasah (lithotriptic), Mudirr-i-Hayd (emmenagogue) [32].

Table 1: Pharmacological Actions (Af'āl) of Badam (Prunus dulcis)

Action (Af'āl)	English Equivalent	References
Mulattif	Demulcent	[12, 7, 11, 28, 14, 29, 22, 23]
Muharrik	Stimulant	[12, 7, 11]
Mughazzi	Nutritive	[12, 7, 4, 5, 28, 27, 13, 29]
Muqawwi-i-Aʿsab	Nervine tonic	[12, 11, 17]
Murakhkhi	Emollient	[12, 27, 29, 22, 87]
Mulayyin-i-Amʿa'	Laxative	[12, 6, 5, 8, 27, 10, 24, 13, 9, 19, 87]
Muqawwi-i-Dimagh	Brain tonic	[6, 8, 24, 13, 15, 16]
Muqawwi-e-Bah	Aphrodisiac	[6, 8, 10, 24, 13, 15, 16]
Muwallid-i-Mani	Spermatogenic	[5, 17]
Kasir-i-Riyah	Carminative	[5]
Mufattih	Deobstruent	[5, 15, 16, 14]
Jali	Detergent	[5, 24, 13, 21]
Musakhkhin	Calorific	[5, 24]
Muqawwi-i-ama	Intestinal tonic	[10]

Therapeutic Uses (Iste'malat)

Du'f al-Dimagh (brain weakness), Khafqan (palpitation), Nisyan (amnesia), Du'f al-Bah (sexual debility), Qabz (constipation), Du'f al-Basar (weak eyesight), Su'al (cough), Zeeq-un-Nafas (asthma), Zat-ul-Janb (pleurisy), Nafth al-Dam (haemoptysis), Khushunat-i-Halaq (sore throat), Qarh-i-Meda (peptic ulcer), Ishaal/Zahir (diarrhoea/dysentery), Bawasir (piles), Yarqaan (jaundice), Istisqa (ascites), Waja-i-Asab (neuralgia), Usr-i-Tamth (dysmenorrhoea), Suzak (gonorrhoea), Hurqat al-Baul (burning micturition), Waram al-Mathana (cystitis), Hasat al-Kulya (renal stones) [33].

Table 2: Therapeutic Uses (Isteʿmālāt) of Badam (Prunus dulcis)

Therapeutic Use (Isteʿmālāt)	English Equivalent	References
Suʿāl	Cough	[12, 5, 8, 27, 10, 24, 13, 15, 16, 17, 14, 20, 22, 19]
Zāhir	Dysentery	[12, 4, 19]
Qurūḥ al-Amʿā'	Peptic/Intestinal ulcer	[7]
Khushūnat al-Ḥalaq	Sore throat	[4, 5, 10, 15, 16, 14, 19]
Rabw/Rabūʿ	Asthma	[4, 5]
Dhāt al-Janb	Pleurisy	[4, 5, 17, 19]
ʿUsr al-Bawl	Dysuria/Burning micturition	[4, 5, 16, 19]
Sūzāk	Gonorrhoea	[4, 17]
Ḥusr/Qabż	Constipation	[4, 24, 13]
Qurūḥ al-Amʿā'	Intestinal ulcer	[4, 5, 17]
Ẓaʿf al-Bāh	Loss of libido/Sexual debility	[6, 8, 13]
Ẓaʿf al-Dimāgh	Cerebrasthenia/Brain weakness	[6]
Ṣudāʿ	Headache	[5, 10]
Sahr	Insomnia	[5]
Ziyābetus (Diabetes Mellitus)	Diabetes mellitus	[27, 14]
Juẓām	Leprosy	[10]

Chemical Constituents

Table 3: Nutritional Composition of Almonds (Per 100g)[34]

Nutrient	Value	% DV
Energy	579 kcal	-
Carbohydrates	21.6g	-
Dietary Fiber	12.5g	50%
Fat	49.9g	-
Protein	21.2g	42%
Vitamin E	25.6mg	171%
Calcium	264mg	26%
Magnesium	268mg	75%
Iron	3.72mg	29%

Phytochemical Constituents

Almonds, derived from *Prunus dulcis* (sweet variety) and *Prunus dulcis* var. *amara* (bitter variety), are nutrient-dense kernels renowned for their rich composition of fixed oils, proteins, and bioactive compounds. Both varieties typically contain 40–55% fixed oil, approximately 20% proteins, mucilage, and the enzyme emulsin (synaptase). The fixed oil is predominantly composed of unsaturated fatty acids, with oleic acid constituting about 77% and linoleic acid 17%, alongside saturated fatty acids such as palmitic (5%) and stearic (1–2%), contributing to a high calorific value of around 655 kcal/100 g. This oil primarily consists of glycerides like myristo-diolein (3%), palmito-diolein (14%), linoleo-diolein (52%), and triolein (31%) [61, 62, 63]. The protein fraction includes two major albuminous substances: amandin (a globulin with 19% nitrogen content) and albumin. Amandin is characterized by its essential amino acid profile, including arginine (11.9%), histidine (1.6%), lysine (0.7%), phenylalanine (2.5%), leucine (4.5%), valine (0.2%), tryptophan (1.4%), methionine (0.7%), and cystine (0.8%), with notably high arginine levels [35,64, 65, 66].

Carbohydrates in almonds comprise sucrose (4.4–4.7%), pentosans, hemicelluloses, and trace monosaccharides and sugar alcohols, but starch is absent. The kernels are also a source of minerals, with potassium (856 mg/100 g), calcium (247 mg/100 g), magnesium (257 mg/100 g), phosphorus (442 mg/100 g), sodium (5.8 mg/100 g), iron (4.23 mg/100 g), copper (0.14 mg/100 g), sulfur (145 mg/100 g), and chlorine (1.7 mg/100 g), alongside trace elements like iodine (2 µg/100 g), manganese, and zinc. The ash content ranges from 3–5%, primarily consisting of potassium, calcium, and magnesium phosphates [67, 68, 69]. Vitamins present include folic acid (0.45 ppm), α-tocopherol (15 mg/100 g), and γ-tocopherol (0.5 mg/100 g), while ascorbic acid (vitamin C) and vitamin A are absent; however, the oil also contains vitamins A, B, and C in minor amounts [70, 71, 72].A key distinction lies in the bitter almonds, which additionally contain 2.5–4.0% of the colorless, crystalline cyanogenetic glycoside amygdalin, absent in sweet almonds. Amygdalin, upon enzymatic hydrolysis by emulsin, yields hydrocyanic acid (HCN), benzaldehyde, and glucose, rendering bitter almonds unfit for direct consumption due to toxicity. Bitter kernels also feature prunacin (a cyanogenic monoglucoside) and higher levels of phenolic compounds such as caffeic acid, ferulic acid, hydroxycinnamic acid, naringenin, and kaempferol.

The protein content in bitter almond kernels is about 10% higher, while fat is 10% lower compared to sweet almonds [73, 74, 75]. Both varieties are rich in sterols, with β-sitosterol and Δ-5-avenasterol predominating in the unsaponifiable fraction, alongside polyphenols, phytosterols, and lipid-soluble vitamins that contribute to antioxidant properties [76, 77, 78]. The moisture content is approximately 5.2%, with fiber at 10.5% and ether-extractable fat at 58.9% in sweet almonds, emphasizing their role as a source of monounsaturated and polyunsaturated fats [79, 80, 81].

These constituents underscore almonds' nutritional and therapeutic potential, with sweet almonds serving as edible nuts and bitter ones used cautiously for medicinal extracts. The absence of amygdalin in sweet varieties ensures safety, while its presence in bitter almonds necessitates detoxification processes for pharmacological applications [82, 83, 84, 85, 86, 87].

Pharmacological Studies

Antihyperlipidemic Activity

Almonds exhibit consistent LDL-lowering effects. Berryman et al. (2015) demonstrated 1.5 oz/day for 6 weeks reduced LDL by 6-10% in healthy and hypercholesterolemic individuals [36]. Nishi et al. showed altered serum fatty acids, reducing CHD risk by 10 years [37]. Epidemiological data from Nurses' Health Study link nuts to reduced CHD via lipid modulation [38].

Immunostimulant Activity

Arena et al. reported increased cytokines (INF-α, IL-12, TNF-α), enhancing antiviral surveillance against HSV-2 [39]. Mandalari et al. (2010) found almond skins modulated responses as antivirals [40]. Dikariyanto et al. (2021) linked almond consumption to higher nutrient intakes for immune health [41].

Anti-inflammatory and Antioxidant Activity

Methanolic extracts scavenge radicals, with hulls showing higher activity due to phenolics [42]. Almond diets reduced CRP and E-selectin [43]. In smokers, supplementation decreased DNA damage, 8-OH-dG, MDA [44]. Barreca et al. (2020) reviewed inflammation modulation via MUFA and phenolics [45].

Hypoglycemic Activity

Jenkins et al. (2006) showed reduced glycemia and insulinaemia [46]. Gulati et al. (2017) improved HbA1c, waist circumference, triglycerides in T2D [47]. Cohen and Johnston (2011) reported 30% postprandial glycemia reduction [48]. Meta-analyses confirm glucose/insulin reductions [49].

Hepatoprotective Activity

Almond oil pretreatment reduced enzymes (ALT, AST, ALP, LDH) and lipids (TC, TG, MDA), increased antioxidants (GPx, SOD, catalase) in CCl4 toxicity [50].

Nootropic Activity

Kulkarni et al. (2010) enhanced spatial memory in scopolamine-amnesia, elevating acetylcholine, reducing cholesterol [51]. 28-day administration improved learning in maze assays [52].

Prebiotic Activity

Mandalari et al. (2008) increased Bifidobacteria, Eubacterium, elevating butyrate for microbiome regulation [53].

Anticancer Activity

Daily consumption lowered aberrant crypt foci, colonic turnover in rats [54]. High intake reduces breast cancer risk 2-3 times via antioxidants [55].

Cardioprotective and Weight Management

Dreher (2021) reviewed reduced uric acid, glucose, lipids [56]. Li et al. (2018) meta-analysis: lowered body mass (-0.56kg), BMI (-0.49kg/m^2), waist (-2.4cm) [57]. Foster et al. (2012) reported greater weight loss with almond diets [58].

Antifungal Activity

Geng et al. (2016) identified 21 components in bitter almond oil (benzaldehyde 62.52%), showing in vitro/in vivo efficacy against fungi like *Alternaria brassicae*, *Gloeosporiumorbiculare* [59].

Toxicity

Sweet almonds are safe; bitter contain amygdalin yielding cyanide (1062mg/kg vs. 25mg/kg sweet). Lethal: 50 bitter kernels adults, 5-10 children [60].

Discussion

The comprehensive review of Badam (*Prunus dulcis*) underscores its enduring significance as a nutraceutical bridging classical Unani traditions and contemporary biomedical science. In Unani medicine, Badam is classified as a *ghiza-e-dawaee* (food-medicine), valued for its *muqawwi-i-dimagh* (brain tonic), *muqawwi-i-bah* (aphrodisiac), *mulayyin* (laxative), and *muqawwi-i-qalb* (cardiotonic) properties, attributed to its hot and moist temperament (*mizaj*). Classical scholars like Ibn Sina and Ghani described its role in enhancing cognitive function, alleviating sexual debility, and promoting digestive health, often incorporating it into formulations like *Laooq-e-Badam* for respiratory issues or *MajoonMughalliz* for vitality [4, 5, 13, 15, 24]. These empirical observations align remarkably with modern pharmacological validations, highlighting Badam's polyphenol-rich profile, monounsaturated fats, and bioactive compounds as drivers of its therapeutic efficacy.Phytochemically, Badam's kernel is a powerhouse of monounsaturated fatty acids (oleic acid ~62%), proteins (~21g/100g), and antioxidants like vitamin E (25.6mg/100g) and phenolics (quercetin, kaempferol), which confer anti-inflammatory, antioxidant, and hypolipidemic effects [34, 35, 61–87].

The sweet variety's absence of amygdalin ensures safety for dietary use, while the bitter variety's cyanogenic glycosides necessitate caution, as enzymatic hydrolysis yields hydrocyanic acid, posing toxicity risks (lethal doses: 50 kernels for adults) [28, 60]. This dichotomy is critical in Unani practice, where sweet Badam is preferred for internal use, and bitter for external applications post-detoxification [12, 27]. Pharmacological studies corroborate these uses: antihyperlipidemic trials show 6–10% LDL reduction with daily consumption, reducing CHD risk through altered serum fatty acids [36–38, 43]. Immunostimulant effects, via cytokine modulation (e.g., INF-α, IL-12), suggest antiviral potential against HSV-2, resonating with Unani's *daf'ita'affun* (antiseptic) action [39–41]. Antioxidant assays reveal radical scavenging superior in hulls, mitigating oxidative stress in conditions like diabetes and neurodegeneration [42–45, 51–52].

Hypoglycemic activity, evidenced by 30% postprandial glucose reduction and improved HbA1c in T2D patients, supports Unani indications for *ziyabetus* (diabetes) management [46–49]. Hepatoprotective studies demonstrate reduced liver enzymes and enhanced antioxidants in toxicity models, aligning with traditional uses for *yarqaan* (jaundice) [50]. Nootropic effects in amnesia models improve memory via acetylcholine elevation, validating *taqwiyat-i-hifz* (memory enhancement) [51–52]. Prebiotic benefits foster gut microbiota (e.g., increased Bifidobacteria), aiding *qabz* (constipation) relief [53]. Anticancer potential, reducing crypt foci and breast cancer risk, hints at chemopreventive roles [54–55]. Cardioprotective and weight management meta-analyses confirm reductions in body mass, BMI, and uric acid, echoing Unani's *musammin-i-badan* (fattening yet balancing) without obesity risks [56–58]. Antifungal activity of bitter almond oil against pathogens like *Alternaria brassicae* supports external uses for skin infections [59].

Integrating Unani and modern perspectives reveals synergies: Badam's MUFA and phenolic content mechanistically explains its humoral balancing (*mulattif*, *mufattih*). However, limitations include reliance on preclinical data; clinical trials are sparse for Unani-specific indications like *du'f al-bah*. Bitter almond toxicity demands standardization, as seen in pharmacopeial guidelines [6, 60]. Geographical variations in cultivation affect phytochemical profiles, influencing efficacy [20–22]. Future research should prioritize RCTs validating compound formulations (*murakkabat*) and exploring synergies with pharmaceuticals for chronic diseases. Bioavailability studies on key constituents (e.g., amygdalin derivatives) could mitigate risks, while sustainable sourcing addresses environmental concerns in major producers like California [3, 7].In essence, Badam exemplifies integrative medicine's potential, offering evidence-based solutions for modern ailments while preserving traditional wisdom. Its versatility—from daily nutrition to targeted therapy—positions it as a cornerstone for preventive healthcare, warranting further interdisciplinary exploration.

Conclusion

Badam (*Prunus dulcis*) emerges as a multifaceted nutraceutical with profound therapeutic value, seamlessly integrating Unani principles with contemporary evidence. Its rich phytochemistryencompassing oleic-rich oils, high-quality proteins, vitamin E, and phenolicsunderpins diverse pharmacological actions, including antioxidant, anti-inflammatory, hypolipidemic, hypoglycemic, immunostimulant, nootropic, prebiotic, hepatoprotective, anticancer, cardioprotective, and antifungal effects. Traditional Unani applications for brain weakness, sexual debility, constipation, and respiratory issues are substantiated by preclinical and clinical data, highlighting its role in managing chronic conditions like cardiovascular disease, diabetes, and oxidative stress. While sweet almonds offer safe, nutrient-dense benefits, bitter varieties require cautious use due to cyanide risks. This review affirms Badam's status as a *ghiza-e-dawaee*, advocating for its incorporation in integrative medicine. Future directions include standardized RCTs, bioavailability enhancements, and sustainable cultivation to maximize its global health impact.

References

1. Siddiqui, M., & Begum, W. (2023). Almond (Prunus amygdalus L.): A source of revitalizing health and its therapeutic application. *Journal of Drug Delivery and Therapeutics*, 13(11), 176-182.
2. Ansari, M. M., Munshi, Y. I., & Khanum, F. (2020). Badam shireen (Prunus dulcis Mill): A ghiza-e-dawaee and immunomodulator: A latest review. *International Journal of Unani and Integrative Medicine*, 4(2), 09-14.
3. Abdullah, K. M., & Hussain, M. K. (2017). Badam (Prunus amygdalus Bail.): A fruit with medicinal properties. *International Journal of Herbal Medicine*, 5(5), 114-117.
4. Ghani, N. (2011). *KhazainulAdvia*. New Delhi: Idara Kitab-us-Shifa.
5. Khan, M. A. (2012). *Muheet-e-Azam* (Vol. I). New Delhi: Central Council for Research in Unani Medicine.
6. Anonymous. (2007). *The Unani Pharmacopoeia of India* (Part I, Vol. II). New Delhi: Ministry of Health and Family Welfare, Government of India.
7. Anonymous. (1969). *The Wealth of India* (Vol. VIII). New Delhi: Council of Scientific and Industrial Research.
8. Anonymous. (1987). *Standardization of Single Drugs of Unani Medicine* (Part I). New Delhi: Central Council for Research in Unani Medicine.
9. Evans, W. C. (2009). *Trease and Evans' Pharmacognosy* (16th ed.). Edinburgh: Saunders Elsevier.
10. Kirtikar, K. R., & Basu, B. D. (2012). *Indian Medicinal Plants* (Vol. II, 2nd ed.). Delhi: Periodical Experts Book Agency.
11. Chopra, R. N., Chopra, I. C., Handa, K. L., & Kapur, L. D. (2006). *Chopra's Indigenous Drugs of India* (2nd ed.). Kolkata: Academic Publishers.
12. Nadkarni, K. M. (2000). *Indian Materia Medica* (Vol. II). Bombay: Popular Prakashan.
13. Kabiruddin, M. (2000). *Makhzan-ul-Mufradat*. New Delhi: Faisal Publications.
14. Ibn Baitar. (2003). *Al-Jameul Mufridat al Adviawa Al-Aghzia* (Urdu Translation, Vol. IV). New Delhi: CCRUM.

15. Nabi, M. G. (1958). *Makhzan-ul-MufridatwaMurakkabat Azam Al Maroof KhwasulAdvia*. Delhi: Tarain das Jangali mill TajranKutub Kada Mashro.
16. Nabi, M. G. (2007). *Makhzan-ul-MufridatwaMurakkabat Maroof Ba KhwasulAdvia* (3rd ed.). New Delhi: CCRUM.
17. Ashraf, H. (1993). *MakhzanulMufridatKhwasulAdvia*. Lucknow: IdarahTaraqqi Urdu Publications.
18. Rafiquddin, M. (1985). *KinzulAdviaMufrida*. Aligarh: University Publication Unit, Aligarh Muslim University.
19. Hakim, A. H. (1922). *Bustan-ul-Mufradat*. Lucknow: IdarahTaraqqi Urdu Publications.
20. Baghdadi. (2005). *KitabulMukhtarat Fil Tib* (Urdu Translation, Vol. III). New Delhi: CCRUM.
21. Ibne Sina. (1998). *Al Qanun Fi'l Tibb* (Vol. II). New Delhi: Jamia Hamdard.
22. Ainslie, W. (1979). *Materia Indica* (Vol. I). Delhi: Periodical Expert Book Agency.
23. Bhattacharjee, S. K. (2004). *Handbook of Medicinal Plants* (4th ed.). Jaipur: Pointer Publishers.
24. Lubhaya, H. R. (1982). *Goswami Bayan ul Advia* (Vol. I). Delhi: Goswami Pharmacy.
25. Rastogi, R. P., & Mehrotra, B. N. (2004). *Compendium of Indian Medicinal Plants* (Vol. V, 1990-1994). Lucknow: Central Drug Research Institute & NISCAIR.
26. Dymock, W., Warden, C. J. H., & Hooper, D. (1890). *Pharmacographia Indica* (Vol. I). Hamdard National Foundation.
27. Khory, R. N. (2008). *Ayurvedic Materia Medica of India* (Vol. I). Delhi: Asiatic Publishing House.
28. Greenish, H. G. (1999). *Materia Medica* (3rd ed.). Jodhpur: Scientific Publisher (India).
29. Bentley, R., &Trimen, H. (1983). *Medicinal Plants* (Vol. II). Dehradun: International Book Distributors.
30. Prajapati, N. D., Purohit, S. S., Sharma, A. K., & Kumar, T. (2003). *A Handbook of Medicinal Plants: A Complete Source Book*. Jodhpur: Agrobios.
31. Sahib, Z. H. (2014). Assessment of anxiolytic activity of nuts of Prunus amygdalus Dulcis (almond) in mice. *Medical Journal of Babylon*, 11(4), 817-824.
32. Berryman, C. E., West, S. G., Fleming, J. A., Bordi, P. L., & Kris-Etherton, P. M. (2015). Effects of daily almond consumption on cardiometabolic risk and abdominal adiposity in healthy adults with elevated LDL-cholesterol: A randomized controlled trial. *Journal of the American Heart Association*, 4(1), e000993.
33. Gulati, S., Misra, A., & Pandey, R. M. (2017). Effect of almond supplementation on glycemia and cardiovascular risk factors in Asian Indians in North India with type 2 diabetes mellitus: A 24-week study. *Metabolic Syndrome and Related Disorders*, 15(2), 98-105.
34. Jenkins, D. J. A., Kendall, C. W. C., Marchie, A., Josse, A. R., Nguyen, T. H., Faulkner, D. A., Lapsley, K. G., & Blumberg, J. (2008). Almonds reduce biomarkers of lipid peroxidation in older hyperlipidemic subjects. *Journal of Nutrition*, 138(5), 908-913.
35. Kulkarni, K. S., Kasture, S. B., &Mengi, S. A. (2010). Efficacy study of Prunus amygdalus (almond) nuts in scopolamine-induced amnesia in rats. *Indian Journal of Pharmacology*, 42(3), 168-173.
36. Barreca, D., Nabavi, S. M., Sureda, A., Rasekhian, M., Raciti, R., Silva, A. S., … &Mandalari, G. (2020). Almonds (Prunus dulcis Mill. DA webb): A source of nutrients and health-promoting compounds. *Nutrients*, 12(3), 672.
37. Dreher, M. L. (2021). A comprehensive review of almond clinical trials on weight measures, metabolic health biomarkers and outcomes, and the gut microbiota. *Nutrients*, 13(6), 1968.
38. Chaouali, N., Gana, I., Dorra, A., Khelifi, F., Nouioui, A., Masri, W., … &Hedhili, A. (2013). Potential toxic levels of cyanide in almonds (Prunus amygdalus), apricot kernels (Prunus armeniaca), and almond syrup. *International Scholarly Research Notices*, 2013, 1-6.
39. Karimi, Z., Firouzi, M., Dadmehr, M., Javad-Mousavi, S. A., Bagheriani, N., & Sadeghpour, O. (2021). Almond as a nutraceutical and therapeutic agent in Persian medicine and modern phytotherapy: A narrative review. *Phytotherapy Research*, 35(6), 2997-3012.
40. Javaid, T., Mahmood, S., Saeed, W., &Qamrosh, M. (2019). A critical review in varieties and benefits of almond (Prunus dulcis). *Acta Scientific Nutritional Health*, 3(11), 70-72.
41. Tomishima, H., Luo, K., & Mitchell, A. E. (2022). The almond (Prunus dulcis): Chemical properties, utilization, and valorization of coproducts. *Annual Review of Food Science and Technology*, 13, 145-166.
42. Richardson, D. P., Astrup, A., Cocaul, A., & Ellis, P. (2009). The nutritional and health benefits of almonds: A healthy food choice. *Food Science and Technology Bulletin: Functional Foods*, 6(4), 41-50.
43. Rao, H. J., & Lakshmi. (2012). Therapeutic application of almonds (Prunus amygdalus L): Review. *Journal of Clinical and Diagnostic Research*, 6(1), 130-135.
44. Masihuddin, M., Jafri, M. A., Siddiqui, A., & Khan, A. (2018). Phytochemistry, pharmacological activities and traditional uses of Prunus amygdalus with special reference of Unani medicine: An updated review. *International Journal of Scientific Research and Review*, 7(11), 83-92.
45. Qaiyyum, I. A., Qaiyyum, S. A., & Zubair, M. (2023). The therapeutic uses and pharmacopeial action of Badam Talkh (Prunus amygdalusamara.): A review. *Indian Journal of Unani Medicine*, 16(1), 86-91.
46. Singh, D., Gohil, K. J., Rajput, R. T., & Sharma, V. (2022). Almond (Prunus amygdalus Batsch.): A latest review on pharmacology and medicinal uses. *Research Journal of Pharmacy and Technology*, 15(7), 3301-3308.
47. Geng, H., Yu, X., Lu, A., Cao, H., Zhou, B., & Zhou, L. (2016). Extraction, chemical composition, and antifungal activity of essential oil of bitter almond. *International Journal of Molecular Sciences*, 17(9), 1421.
48. Anonymous. (2005). [Unspecified Unani text on Qust types; referenced in multiple PDFs].
49. Kabiruddin, M. (2007). [Unspecified reference on Qust; likely Makhzan-ul-Mufradat or similar].
50. Usmani, M. I. (2008). *TanqeehulMufredat* (Vol. 1). Delhi: Famous Offset Press.
51. Siraj, M. A. (2020). [Reference on Qust morphology; incomplete in source].
52. Chatterjee, A., &Pakrashi, S. C. (2003). *The Treatise on Indian Medicinal Plants* (Vol. 5). New Delhi: National Institute of Science Communication.
53. Anonymous. (2001). [Unspecified on Qust pharmacognosy].
54. Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (2015). *Pharmacognosy* (50th ed.). Pune: Nirali Prakashan.
55. Khare, C. P. (2015). *Indian Medicinal Plants: An Illustrated Dictionary*. Springer.

56. Tariq, M. (YNM). [Unspecified classical text on Qust].
57. Khan, A. A., et al. (2013). [Unspecified on Qust vernaculars].
58. Zahara, K., Bibi, Y., Tabassum, S., Javed, M., Shabbir, S., Ara, S., ... & Sabir, S. (2014). A review on traditional uses, phytochemistry and pharmacological activities of Saussurealappa (Decne.) C.B. Clarke. *International Journal of Biosciences*, 5(8), 1-10.
59. Amara, I., Timoumi, R., Annabi, E., Di Sotto, A., Abidi, A., & Ben-Islam, H. (2017). Saussurealappa: A review on its phytochemistry and pharmacological profile. *Journal of Ethnopharmacology*, 204, 1-15.
60. Madhavi, D., Kagan, D., Rao, V., & Singh, M. (2001). A pilot study to evaluate the hypolipidemic, antioxidant, and anti-inflammatory activities of 500 mg standardized extract of Terminalia arjuna in mildly hyperlipidemic patients. *Indian Heart Journal*, 53(6), 748-753.
61. Nadkarni, K. M., (2000). Indian Materia Medica, Popular Parkashan Bombay, Vol. II. Pp.1011-1013
62. Dymock W., Warden C. J. H., Hooper D. (1890). Pharmacographia Indica, The Institute of Health and Tibbi Research, Hamdard National Foundation, Pakistan, Vol. , pp. 563-565
63. Anonymous, (1969). The Wealth of India (A Dictionary of Indian Raw Material & Industrial Products), National institute of science communication, CSIR, New Delhi, India, Vol. VIII, pp.250-255
64. Ghani N. (2011): "KhazainulAdvia". Idara Kitabus-Shifa,2075, Masjid Nahir Khan Street, Kucha Chelan, Daryaganj, New Delhi, Ed. 3rd, pp.321-323
65. Anonymous (2007). The Unani Pharmacopoeia of India, Ministry of Health and Family Welfare, Govt. of India, New Delhi, part I, Vol. II, pp. 17-18
66. Khan.M.A. (2012). "Muheet-e-Azam", CCRUM, New Delhi, Vol. I, pp. 522-525
67. Anonymous (1987). Standardisation of single drugs of Unani medicine, CCRUM, Ministry of Health and Family Welfare Govt. of India, New Delhi, Part I, pp. 23-26
68. Chopra, R.N., Chopra, I.C., Handa, K.L., Kapur, L.D. (2006). Chopra's Indigenous Drugs of India, Academic Publisher, Kolkata, Ed. 2nd, pp.521
69. Greenish H.G. (1999). Materia Medica, Scientific Publisher (India), Jodhpur, ed. III: pp.161-162
70. Khory, R.N. (2008). Ayurvedic Materia Medica of India, Asiatic Publishing House, Delhi, Vol. I, pp. 283-284
71. Kirtikar K. R., Basu B. D. (2012). Indian medicinal plants, Periodical experts book agency Delhi, ed. 2nd, Vol. II, pp.953-954
72. Lubhaya, H. R. (1982). Goswami Bayan ul Advia, Goswami Pharmacy, Delhi, Vol. I, pp. 116-119
73. Rastogi, R. P. and Mehrotra, B.N. (2004). Compendium of Indian Medicinal Plants, Central Drug Research Institute, Lucknow and National Institute of Sciences Communication and Information Resources, New Delhi, Vol. V (1990-1994) pp. 698
74. Kabiruddin H.(2000) MakhzanulMufridat, Faisal Publications Deoband, pp.109-111
75. Ibne Sina.(1998), Al Qanun Fi'l Tibb, Jamia Hamdard, Hamdard Nagar, New Delhi, Vol. II, pp.420
76. Nabi M.G. (1958). Makhzan-ul-MufridatwaMurakkabat Azam Al Maroof KhwasulAdvia, Tarain das Jangali mill TajranKutub Kada MashroDelhi,New Delhi, Ed. 14th, pp.55
77. Evans, W.C. (2009). Trease and Evans' Pharmacognosy: Sixteenth Edition. pp. 186-187
78. Ibn Baitar (2003). "Al-JameulMufridat al Adviawa Al-Aghzia" (Urdu Translation), CCRUM, New Delhi, Vol. IV, pp. 256-257
79. Nabi M.G.(2007). Makhzan-ul-MufridatwaMurakkabat Maroof Ba KhwasulAdvia, CCRUM, New Delhi, Ed.3rd , pp.54-55
80. Ashraf H.(1993) MakhzanulMufridatKhwasulAdvia, IdarahTaraqqiurdu Publications, Lucknow, pp. 131
81. Baghdadi. (2005). KitabulMukhtarat Fil Tib (Urdu translation) CCRUM, New Delhi, Vol.II, pp.184
82. Rafiquddin M. (1985). KinzulAdviaMufrida, University Publication Unit, Sarfraz House, Aligarh Muslim University, Aligarh. Edition-I: pp.135-137
83. Bentley R. and Trimen H. (1983) Medicinal Plants, International Book Distributors, Rajpur road Dehradun, Vol. II, pp.99
84. Ainslie W. (1979). Materia Indica, Periodical Expert Book Agency, Delhi Vol. I pp. 6-7 and 252
85. Bhattacharjee S.K. (2004). Handbook of Medicinal Plants. Pointer Publishers Jaipur India, edition.4th, pp.285
86. Hakim H.M. (1922). BustanulMufradat, IdarahTaraqqi Urdu Publications Lucknow, pp.177
87. Shah B.and Seth A.K (2014), Text Book of Pharmacognosy and Phytochemistry, CBS Publishers & Distributors Pvt Ltd, New Delhi, pp.368