



Review Article

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A REVIEW ON PHARMACOLOGICAL AND PHYTOCHEMICAL PROFILE OF KHATMI (*ALTHAEA OFFICINALIS* LINN.): AN IMPORTANT MUCILAGINOUS PLANT AND ITS UTILIZATION IN UNANI SYSTEM OF MEDICINE

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ABSTRACT

Traditional medicines / drugs are helpful for management of life style disorders and chronic and acute diseases. Khatmi (*Althea officinalis* Linn.) is a one of the commonly used drugs that has potential for management of many diseases. The meaning of Khatmi (Marshmallow) is Kaseer-al-manafe (Multi actions) in Unani literature. Roots, flowers and seeds of Khatmi are used as a medicament. According to Unani texts the main actions of Khatmi are demulcent, expectorant, defragment, concoctive, astringent, detergent and repellent. It is also used as part of many traditional recipes. Analgesic, emollient, antitussive and diuretic activity are the most ethnobotanical and traditional medicine considerations; also used in Unani medicine for the treatment of the different inflammatory conditions e.g., metritis (Warne reham), enteritis (Warne amaa), mastitis (Warne pistan), arthritis (Waja ul mafasil) etc. Alkaloids, terpenoids, tannins, Flavonoids, Polysaccharides, Phytosterols, Fatty acids, Mucilages, Hydroxybenzoic acid etc. are its main Chemical constituents. The whole plant parts yields mucilage in decoction and infusions, which is very useful in case of several ailments of mucous membranes. The scientifically proven / reported pharmacological activities are antitussive, antimicrobial, immunomodulatory, UV exposure protective, anti-inflammatory, immune stimulating, antioxidant, antifungal, hepatoprotective, ulcer protective etc. These all findings reveal immense utility of Khatmi and scope for developing as a potent therapeutic tool particularly in contemporary lifestyle and also in immune susceptible diseases which is an emerging concern.

Keywords: Khatmi, *Althea officinalis* Linn. Marshmallow, Immunomodulatory.

INTRODUCTION

The genus *Althaea* belongs to the family Malvaceae, the most important species of the genus is *Althaea officinalis* L., *Althaea officinalis* (Khatmi) commonly known as Marshmallow is very common medicinal plant used in Unani medicine. It is a perennial plant; it is native to western Asia, Europe and United States of America. Root, flowers and seeds are specially used in Unani medicine¹. The Khatmi is a perennial herb / plant of height 60-180 cm, which has obovoid leaves, rosy flowers and mericarps each containing a seed. The whole plant constitutes the drug. Stem is erect and 60-90 cm in length². Marshy fields and tidal zones are best for its cultivation. Its propagation occurs through the seeds³. All the parts contain mucilage. According to Ibn al-Baytar (1197-1248 AD), it is a type of wild Khubbazi (*Malva sylvestris* Linn.). Its flowers are similar to Rose.⁴ Parenchymatous cells contains schizogenous mucilage canals, that is why seeds become mucilaginous when soaked in water.⁵ French use its mucilage in lozenges and poultices. The whole plant yields sufficient quantity of colourless and tasteless mucilage in decoction, which is very useful in case of irritation of mucous membranes.²

A. officinalis possessed emollient, expectorant, demulcent, soothing, cleansing, laxative, analgesic, astringent, haemostatic, concoctive, diuretic, emmenagogue and various other pharmacological effects. *A. officinalis* has been used in Unani medicine for the treatment of the various inflammatory conditions

e.g., metritis (Warne reham), enteritis (Warne amaa), mastitis (Warne pistan), arthritis (Waja ul mafasil). It is widely used traditionally for the treatment of irritation of oral and pharyngeal mucosa and associated dry cough, mild gastritis, skin burns and for insect bites. It is also used in catarrh of the mouth and throat, gastrointestinal tract and urinary tract complaints, as well as for inflammation, ulcers, abscesses, burns, constipation and diarrhoea etc.^{1,6,7}

Historical background

Its benefits are being accepted since thousands of years.⁸ First of all Khatmi was described by Pedanius Dioscorides (40-90 AD)⁹. He described that Khatmi is a type of Malukhiya barri that is Khubbazi (Common Mallow/*Malva sylvestris* Linn.).¹⁰ It is widely used traditionally in Unani and Ayurvedic medicine since many years.¹¹ The ancient Greek physician Gaius Plinius Secundus (23/24-79 AD), called Pliny the Elder extolled the plant as a 'Cure-all'. Theophrastus (372-286 BC) reported that Marshmallow root was taken in sweet wine for cough.¹²

Greeks and Latins used this plant mainly for its healing properties. Theophrastus has also defined about its flowers. The Arab physicians described Khatmi as a supportive and emollient drug for various diseases; they used its leaves as a poultice and for fomentations. After mixing with oil its flowers and leaves are used for burns and to the parts bitten by venomous reptiles.⁸

Scientific classification

Kingdom: Plantae
 Sub kingdom: Tracheobionta
 Super division: Spermatophyta
 Division: Magnoliophyta
 Class: Magnoliopsida
 Subclass: Dilleniidae
 Super order: Malvales
 Order: Malvales
 Family: Malvaceae
 Sub family: Malvoideae
 Tribe: Malveae
 Genus: *Althea*
 Species: *Althea officinalis*
 Botanical name: *Althea officinalis* Linn.^{6,13}

Vernacular name

There are various vernacular names of Khatmi. In Unani, it is called as Altiya,⁴ Khatmi, Albayi, Khubbazishajri, Kaseer al Munfa't¹⁴ and in Urdu and Arabic called as Khatmi and Kaseer-al-munfaah.^{2,15} According to Hakim Azam Khan (1815-1902 AD) in Persian language the Khatmi was known as Tukhame khatmi, Hamshat, Haaz, Khairu.¹⁴ In English it is called as Marsh Mallow, White mallow, Bull's eye, Bread and Cheese^{4,14} and in Hindi also called as Gulkhairi, khaira, khaira kajhor.^{8,16,17}

Habit and Habitat

Genus *Althea* is widest spread. They are distributed throughout the world and growing from the Mediterranean region to Central Asia.¹⁸ *Althea officinalis* is native to part of Europe to North Africa, Southern and Eastern England, Denmark through Central, Siberia and Western Asia; especially tropical regions and the United States of America. Occupationally the plant is cultivated in Belgium, France, Germany, and Yugoslavia.^{19,20} In India the herb has been successfully cultivated in Manali at 2000 mt. altitude and in the gardens of Kulu valley of Himachal Pradesh,¹⁶ Delhi, Kashmir, Punjab, Uttar Pradesh, Madhya Pradesh, Deccan¹⁶ and Rajasthan. Commonly they grow in loamy soil and sunny condition. In south India it is grow not only as ornamental plant but also used for the medicinal purpose. In sandy soils, the mucilage in the root is higher than in clayey soils. The mucilage is excessive amount in autumn and winter and decreased in spring and summer; increase in moisture reduces the mucilage.¹⁶ Different parts of the plant are mainly imported from Persia.⁸

Botanical description

Seeds

Carpals are large and pubescent and are known as Tukhm-e-Khatmi.⁸ Seeds are small to moderate size, approximately 6 mm, brownish-black in colour and reniform in shape.⁵ The dark black seed is better.¹⁴ Seeds are solitary in each carpel. Each carpel has one seed. Seeds are thick and blackish brown with a mucilaginous insipid taste. Collection of seeds is made, when they become mature, before falling on the ground. Shade dried seeds are stored in cool and dry place. Seeds are moderately hard having rough external surface. Outer periphery of seed is approximately 0.5-0.6 cm. Weight of one seed is approx. 11.1 mg. (100 seeds = 1.11 gm.).¹⁶ The seeds are hairy at margins.⁵ (Figure 1)



Figure 1: *Althea officinalis* Linn. Seeds

Leaves

The leaves attached by a short petiole, ovate, or ovoid, simple, slightly lobed, annular with scarcely chordate base, 2 to 3 inches long and about 1 1/4 inch broad, entire or three to five lobed, unequal toothed at the margin. Stipules are linear-subulate. They are soft and velvety on both sides, due to a dense covering of stellate hairs.¹⁹

Flowers

The pale pink, reddish pink, and rarely, white flowers bloom in August or September. The flowers are peduncle, 2.5-5.0 cm across, rosy, in axillary clusters, bracteoles are linear-lanceolate, five sepals, five heart shaped petals and numerous stamens united into a tube with kidney-shaped and one-celled anthers. Anthers are sub-globose. Ovary is numerous-celled with one ovule in each sepal. Carpals are large, pubescent and many in number, seed one in each carpel,^{17,18,21} flat, round 5-8 mm fruit breaks up into the mericarps, which are downy on the outside and have fine, branched and radiating ribs. Small to moderate size seeds are approximately 6 mm, solitary, ascending, generally brownish-black and kidney shaped, covered with hair at margins and somewhat compressed. It becomes mucilaginous when soaked in water.^{5,17}

Root

Roots are 0.2 to 3 cm in diameter.⁵ The root seldom occurs as an entire piece or long segments.²² The root is greyish white in colour and have brown bark. It is externally whitish or pale yellow to pale brown, longitudinally furrowed, spirally twisted and covered with hair like bast fibres. Internally it is yellowish, mucilaginous and sweetish in taste. The unpeeled roots of *Althea officinalis* are sometimes adulterated with belladonna. The mucilage content is highest in the roots. In sandy soils the mucilage is more in the roots than the roots grown in clayey soils.¹⁶ Khatmi has white and thick roots.³ Plant is 1-2 m. in height. Leaves are round in shape; flowers are white or sky-blue in colour and seeds are black.⁹ (Figure 2)



Figure 2: *Althea officinalis* Linn. Roots

Unani description

The meaning of Khatmi is Kaseer-al-manafe (multi actions) in Unani.²³ Plant of Khatmi is of seven types, on the basis of colour of flowers.¹⁴ Its height is 2.5-3 metre. Leaves rounded, rough, resemblance to Khubbazi leaves but somewhat large in size. The flowers rounded, nodular, apex is broad and lower is longitudinal in shape. It is known as Gul-e-Musafar.^{14,24} Khatmi with bluish flowers is known as Khairu.²⁴ The colour of the flower is bluish white or blue or whitish red, it is found as number of bunches, after falling of flower fruit is formed. Khatmi with white flowers is the best in quality.¹⁴

Fruits contain numerous seed which are white in unripe condition, after ripening they becomes black in colour; these seeds are flat, somewhat thick. According to Unani System of medicine the Black seeds of Khatmi are the best.²⁵ normally the seeds are blackish brown in colour, taste-less and mucilaginous.²⁶ Seeds looks like a Qurs (tablet). Seeds are more demulcent and less dessicant.²⁷ The flower and fruit appear in spring season. Root of this plant is known as Resha-e-Khatmi and a seed known as Tukhme Khatmi.¹³ Its height 3-7 inches, colour is yellowish white. Soaking of root and seed in water they become mucilaginous. Concentration of mucilage is much more in root compare to seed. Potency of the root (Resha-e-Khatmi) up to 1 year, seeds up to 3 year and flowers up to 1 week.^{7,14, 25} It is described that roots, flowers and seeds of Khatmi have same potency.²³

Hasase mustamela (Parts used)

The Seed, flowers and roots are used for medicinal purposes.^{14, 25}

Mizaj (Temperament)

Seed

The temperament of seed is moderate towards coldness and moistness.^{5,14,25} According to Ibne sina (Avicenna-980-1037 AD) -moderate towards hotness.^{14,26}, another opinion is Har 1⁰, Yabis 1⁰ (Hot 1⁰, Dry 1⁰).²¹

Gule khatmi (flower)

According to Galen (129-200/216 AD) the temperament of flower is cold & moist (Barid Ratab) and temperament of Resha-e-khatmi (root) is Barid Yabis (cold & dry).²⁶

Pharmacological actions mentioned in Unani medicine

Plant is Mulayyin (laxative), Munzij (concoctive), Qabiz (Astringent), Jali (Detergent), Murakhhi (relaxant), Mohallil (resolvent).^{14,25}

Seed (Khatmi)

Mugharri (stickiness producer),¹⁰ Mulattif (Demulcent), Munaffith-i-Balgham (Expectorant),^{14,25} Musakkin (sedative), Mufattit-i-Hassah (Lithotryptic),^{4,14,27} Musakkin wa Mulayyin-i-Waram (Resolvent),^{14,25} Mukhrij-i-loabe-i-dahan (saliva stimulant),²⁵ Musakkin-i-Atash (Thrust quenching)²⁴ Mohallil (resolvent), Mulayyin (laxative), Rade' (repellent), Murakhhi (relaxant), Munzij (concoctive),^{10,14,25} Mulaayin-e-sadar (ease for expectoration), Mudir-e-bol wa haiz (diuretic and emmenagogue), Mudammil (cicatrisation).²¹

Flower (Gule khatmi)

Mohallil (Resolvent), Munzij (concoctive),²⁵ Mufarreh wa muqawwi-e-Qalb (exhilarant and cardiogenic).⁷

Roots (Resha-e-khatmi)

Mugharri (stickiness producer), Murakhhi (relaxant),²¹ Muzliqe Ama (Lubricant), Musakkin (Analgesic),²⁴ Mohallil (Resolvent), Mufatteh sudad (deobstruent), Daf-e-Peechis (antidysentery),^{5,25} Habis-ud-Dam (hemostyptic).¹⁴

Uses as per Unani literature

Seed

Dhat al-riya (Pneumonia), Dhat al-janb (Pleurisy),²⁶ Nazla (Coryza), Zukam, (Catarrh), Sual-i-har (Dry cough), Waja al-Sadar (Chest pain),²⁸ Nafs-ud-dam (haemoptysis), Waja-ul mafasil (polyarthritis).^{14,25} Suzash-i-Bawl (Burning micturition),^{9,26} Waram-i-Khanazeer (Lymphadenopathy), Baheq (Pityriasis), Waram-i-Harr (Inflammation)^{14,25}

Flower (Gule khatmi)

Warme mafasil (Arthritis), Irq-un-Nasa (sciatica), Ra'sha (tremor), Warm sulb (chronic inflammation).^{14,25} Tamaddud-i-Asab (Distension of Nerves),²⁹ Ushr-al-Bawl (Dysuria).²³

Roots (Resha-e-khatmi)

Warme Ama (Enteritis), Suddae Ama (Intestinal obstruction), Zaheer (dysentery), Ishaal Safravi, Nafs-ud-dam (haemoptysis)^{14,25} Hurqat-al-Bol (Burning micturition), Hurqat-ul-Ama (Irritation of Intestine).²⁹ Quruh wa Sudad-i-Ama (Ulcer and Obstacle of intestine), Ishal-i-Safrawi (Bilious Diarrhoea), Muslih Amraz-i-Maqa'd (corrective of anal diseases), Sailan-i-Khoon-i-Meda (Haemorrhage of Stomach), Qulanlj (Colic),^{14,25}

Mazarrat (Adverse effects)

It may give adverse effect to Meda (stomach), Riya (lung).^{14,25,26}

Muslehat (Correctives)

The correctives of Khatmi are Usara Zarishk (extract of *Berberis aristata* DC.) for stomach, Shahad (honey) and Sonf (*Foeniculum vulgare* Mill.)^{14,21,25}

Badal (substitute)

The Badal of Khatmi are Khubbazi (*Malva sylvestris* Linn), Nilofer (*Nymphaea nauchali*), Samagh-e-Arabi (Gum *Acacia arabica*), Tabasheer (*Bambusa bambos*).^{14,21,25}

Miqdare Khurak (Dose)

5-10 gm²¹

Murakkabat (Compound formulations)

Qairooti bazarkatan,¹⁵ Lauq-e-Nazli,³⁰ Laoq Khashkhash, Sharbat Zoofa, Sharbat Fariyad Ras,⁵ Qurs-e-Zat-ul-Janb, Qairooti-e-Arad-e-Baqila, Qairooti-e-Mamool, Zimad-e-Waram Kulya Qavi,³¹ Dawa-ul-misk Motadil Jawahar Wali, Itrifal, Khameera Abresham Sada, Muqavvi Dimagh, Khameera Gaozaban Sada, Khamera Gaozaban Ambari, Khamera Gaozaban Ambari J adwar Ood Saleeb Wala, Khamera Gaozaban Ambari Jawahar Wala, Khameera Marwareed Banuskha-e-Kalan, Khameera Murakkab, Khameera Nazli Jawahar Wala,³¹ Laoq-e-Sapistan,^{15, 21} Laoq Sapistan Khyar Shambari, Majoon Muqavvi-wa- Mumsik, Mufarreh Azam, Marham Dakhilyun, Arq Amber, Arq Ma-ul-Laham Makoh Kasni Wala, Sharbat-e-Aijaz, Sharbat Nazla, Laoq Khyar Shambar, Kundri, Sadri, Marham-e-Dakhilyun Murakkab.³¹

Action and uses according to ethnobotanical and other literature pharmacological actions

Emollient, demulcent, analgesic, Suppurative, expectorant Soothing, Laxative,^{3,32} Analgesic,² Antitussive, antilithic and diuretic,³³ Concoctive, resolvent and cicatrizing.²¹

Pharmaceutical uses

Dry coughs,^{2,3,34,35} catarrh, asthma and pleurisy,^{3,35} lumbago, otitis, mastitis, irritation of intestines and urinary bladder,² cosmetic industry, mouthwash preparations used in odontology, soothing effect to mucous membranes, Irritable bowel syndrome,³⁵ bronchitis, pneumonia, Renal calculus, arthritis and scrofula.²¹

The roots contain mucilage is used as excipient in making of absorbent pills and pastilles, and also used in ointment, skin preparation and paper manufacture.^{16, 36} Powdered roots are used in poultice and lozenges as demulcent.^{19,36}

Chemical constituents

Flavonoids

Leaves, roots and flowers contains ypolaetin-8-glucoside, Isoquercitrin, kaempferol.¹¹

Polysaccharides

Seeds, leaves and flowers contains hemicelluloses, which is composed of D- xylose, 4-O-methyl-D-glucuronic acid and traces of D-galactose, L-arabinose,^{37,38} Pectins.³⁹

Phytosterols

Leaves, flowers and seeds contain β -Sitosterol and Stigmasterol.³⁸

Fatty acids

The fatty acid fractions of seeds were found dominating in linoleic and petroselinic acid.^{16,38}

Saturated fatty acids

Flowers and seeds contain stearic acid, Palmitic acid, Lauric acid, Myristic acid.³⁸

Fatty oil

In seeds (15.30%)- Oleic acid- 30.80%, linoleic acid- 52.90%, linolenic- 2.50%, palmitic- 9.70%, stearic- 9.70%.¹⁶

Unsaturated fatty acids

In seeds Linoleic acid.³⁸

Mucilages: (found in Seeds Leaves, flowers and roots)

Mucilage, β -asparagine.² Mixture of colloiddally soluble polysaccharides, particularly galacturonicrhmannans, arabinogalactans, arabans, glucans, acidic heteropolysaccharide.³⁹ *Althaea officinalis* contained pectin's 11%, starch 25-35%, mono-, and di-saccharide, saccharose 10%, mucilage 5%.¹¹ Mucilage polysaccharides contents reached 5-11.6%. They were consisted of the mixture of colloiddally soluble polysaccharides, particularly of acid arabinanogalactans, galacturonicrhmannans, arabans and glucans acidic heteropolysaccharide. Mucilage is present in root¹¹.

Roots

Root contains excessive amount of mucilage.⁸ It is composed of galacturonic acid, galactose, glucose, sucrose, xylose, rhamnose. The roots contain galacturorhammans, arabinans, glucans, arabinogalactans, asparagine, betaine, lecithin, phytosterol, starch

pectin, Sugar, trace of fatty oil, tannin^{8,16,17,40} L-arabinan, coumarins (scopoletin)¹⁶ hypolaetin-8-o- β -D-glucoside, isoscutellarein-4-methyl ether-8-O- β -D-glucoside-2-SO₃K,^{16,41} polysaccharide althaea mucilage-O, asparaginene, 3-4 dihydroxy benzyl octa decan, 5- β and 13- β dihydroxy nonacosanyl godolite, tillerozide, campherole, chlorogenic acid, caffeic acid, oxalate.^{5,42}

Coumarins

Root and seeds contain Scopoletin, p- coumaric acid.²

Acids

Seeds, leaves and flowers contains Caffeic, Pcoumaric acid, ferulic acid, p-hydroxybenzoic acid, salicylic acid, p-hydroxyphenyl acetic, acid, vanillic acid.¹¹

Hydroxycinnamic acid

Seeds, leaves and flowers contains Caffeic acid, ferulic acid.³⁸

Hydroxybenzoic acid (Seeds, flowers and roots)

Salicylic acid, p-hydroxybenzoic acid, Vanillic acid, syringic and p-hydroxy phenyl acetic acids.³⁹ It also contains tannins, asparagine and many amino acids.¹¹ Valiei *et al* extracted many compounds from extracts of flower and root of *Althaea officinalis*, these included: undecyne, nonanoic acid methyl ester (nonanoic acid), phenol, 2,6-bis (1,1-dimethylethyl)-4-methyl, tetradecanoic acid methyl ester (tetradecanoic acid), pentadecanoic acid methyl ester (pentadecanoic acid), 9-hexadecenoic acid methyl ester (9-hexadecenoic acid), cyclopropaneoctanoic acid 2-hexyl methyl ester (cyclopropaneoctanoic acid, 2-hexyl), heptadecanoic acid methyl ester (heptadecanoic acid), hexadecanoic acid methyl ester (hexadecanoic acid), octadecyne-5,7,10-octadecadienoic acid methyl ester (7,10-octadecadienoic acid), 9,12-octadecadienoic acid (ω -6) methyl ester (9,12-octadecadienoic acid), 8,11-octadecadienoic acid, methyl ester (8,11-octadecadienoic acid), 9,12,15-octadecatrienoic acid (ω -3) methyl ester (9,12,15-octadecatrienoic acid), naphthalene, decahydro-2,6- dimethyl, octadecanoic acid methyl ester (octadecanoic acid), 10-nonadecenoic acid methyl ester (10-nonadecenoic acid), methyl ester (cyclopropaneoctanoic acid, 2-octyl), cyclopropaneoctanoic acid, 2-octyl, dihydroionone, 3-heptadecen-5-yne, tetracosan, heneicosanoic acid methyl ester (heneicosanoic acid), pentacosane, heneicosane, methyl 2- octylcyclopropene-1-heptanoate, eicosanoic acid, methyl ester (eicosanoic acid) , tricosane, tricosanoic acid methyl ester (tricosanoic acid), heptacosane, docosanoic acid methyl ester (docosanoic acid), tetracosanoic acid methyl ester (tetracosanoic acid), octacosane, squalene, nonacosane , γ -sitosterol.⁴³

Physicochemical evaluation

Total ash %: 6.78, Loss in weight on drying at 110⁰ C: 6.90²¹

Successive extractive values%

Petroleum ether (60-80⁰): 9.30, Benzene: 6.68, Chloroform: 0.39, Acetone: 3.97, Alcohol: 4.90, Distilled water: 10.90.²¹

Aerial Parts

On HPLC analysis and chemical composition from Iraq the flavonoid fraction of the aerial parts of the plant showed the presence of Quercetin, Rutin, apigenin, isorhamnetin, scopoletin, coumarins and Kaempferol.⁴⁴

There is also Polyprenols from the aerial part of the plant *Althaea officinalis* L. The polyprenols from leaves were polyprenol homologs with 9-13 isoprene units where undecaprenol dominated.⁴⁵

Reported Pharmacological activity

Wound healing properties

Robab Valizadeh *et al.* revealed the wound healing properties of *Althea officinalis* flower mucilage in rabbit full thickness wound in the form of ointment in a eucerin base with different concentrations (5%, 10%, and 15%). AFM 15% ointments were found to reduce wound healing time without any significant difference with the phenytoin 1% ointment.⁴⁶

Antitussive activity

Sutovska *et al.* revealed the antitussive activity of polysaccharide obtained from the flower and plant of *Althaea officinalis* in cough induced cats of both sexes. The results revealed that the tested polysaccharide exhibited statistically significant cough suppressing activity due to the presence of higher proportion of uronic acid, which was noticeably higher than that of the non-narcotic drug used in clinical practice.⁴⁷ Another study of Sutovska M *et al.*, revealed the Antitussive Activity of *Althaea officinalis* L. polysaccharides rhamnogalacturonan. Result showed that rhamnogalacturonan isolated from *Althaea officinalis* mucilage possesses very high cough suppressive effect in guinea pig a test system which is shortened in conditions of experimentally induced airways allergic inflammation.⁴⁸

Another review showed that *Althaea officinalis* L. in combination with other plant extracts in different forms of drug could be a good choice for cough, sore throat, and other respiratory ailments.⁴⁹ The root extract of *Althaea officinalis* L. also exerted antitussive effect especially in case of irritated and inflamed buccal tissue and cough.⁵⁰ Fink *et al.*, revealed root extract of *Althaea officinalis* L. can be used for the treatment of irritative cough.⁵¹ Mahboubi *et al.*, also revealed effective treatment of acute cough.⁵²

Rouhi and Ganji *et al.* in a double-blind clinical study used *Althaea officinalis* in hypertensive patients who had been developed cough during taking of angiotensin converting enzyme inhibitors. The patients have taken *Althaea officinalis* (40 mg) thrice a day as 20 drops for four weeks. The Mean scores of the severity of the cough in the group which have been treated by *Althaea officinalis* had a significant change from the score of 2/66 + 0.958 (to) 1/23 + 1.006. Eight patients in the *Althaea officinalis* group indicated almost complete cough elimination.⁵³ Root extract of marshmallow and isolated mucilage polysaccharide were tested for antitussive action in unanaesthetised cats of both sexes at orally (50 to 100 mg/kg body weight), in a cough induced by mechanical stimulation, in a comparison with the cough-suppressing effects of *Althaea* syrup (1000 mg/kg), dropropizine (100 mg/kg), prenoxidazine (30 mg/kg), and codeine (10 mg/kg). Both the extract and isolated polysaccharide significantly reduced the severity and the episode of cough efforts from laryngopharyngeal and tracheobronchial areas. The extract of root was less effective than the isolated polysaccharide. The antitussive activity was found to be lesser than that of codeine, but superior than those of prenoxidazine and dropropizine.⁵⁴

A study was carried out with polysaccharides isolated from roots of marshmallow on laryngopharyngeal and tracheobronchial stimulated cough in un-anaesthetized cat and correlated the cough suppressant activity with changes in the lateral pressure of trachea.

The results of the experiments illustrated that administration of the polysaccharide at a dose of 80 and 100 mg/kg significantly diminished the number of cough efforts both from laryngopharyngeal and tracheobronchial areas of the respiratory system.⁵⁴ The polysaccharide of *Althaea officinalis* was found to

show effect on a number of parameters of cough response i.e. number of efforts, intensity of cough attack in expiration and inspiration, cough frequency and intensity of utmost efforts in expiration and inspiration.

The German commission E approves the use of root and leaf for irritation of oral and pharyngeal mucosa and associated dry cough.⁵⁵ In another study, the mucociliary transport was reported to be inhibited in an isolated, ciliated epithelium of the frog oesophagus by a cold macerate of the *Althaea officinalis* plant root.⁵⁶ The drug *Althaea officinalis* is known to have demulcent and antitussive effects.⁵⁷

Anti-inflammatory, Antiulcer, Antiplatelet activities

Rouba Hage-Sleiman *et al.*, examined anti-inflammatory, anti-ulcer and anti-platelet activity of aqueous extract of *Althaea officinalis* flower. Anti-inflammatory activity was tested against acute and chronic inflammation induced by carrageenan and formalin, respectively. Antiulcer activity was evaluated using ethanol-induced gastric ulcer. Antiplatelet activity was investigated *in vitro* using the adenosine 5'-diphosphate (ADP)-induced platelet aggregation bioassay. The 50 mg/kg body weight dose resulted in significant increase in serum HDL cholesterol level with no effects on stool cholesterol and triacylglycerol. Increasing the dose to 500 mg/kg body weight caused a significant decrease in stool water content. No adverse effect on liver enzymes was observed. Significant anti-inflammatory (acute and chronic inflammation) and antiulcerogenic activities were observed at all used doses (50, 100 and 250 mg/kg body). Time-dependent inhibition of platelet aggregation was demonstrated at 500 µg/ml concentration.⁵⁸ Bonaterra *et al.*, revealed Anti-inflammatory and Anti-oxidative Effects of Phytohusil and Root Extract of *Althaea officinalis* L. on Macrophages *in vitro*.⁵⁹ A single intra-articular injection (20 µl) of Mucilages (from *Althaea officinalis* roots and *Linum usitatissimum* seeds) showed anti-arthritis effect in the rat.⁶⁰

Anti-inflammatory activity

The aqueous extract of *Althaea officinalis* flower grown in Lebanon in the rat model demonstrated significant anti-inflammatory (acute and chronic inflammation) and antiulcerogenic activities were observed at all used doses (50, 100 and 250 mg/kg body). Time-dependent inhibition of platelet aggregation was demonstrated at 500 µg/ml concentration with no visible adverse effect.⁵⁸ An *in vitro* study of Aqueous roots extracts of *Althaea officinalis* stimulated phagocytosis and the release of oxygen radicals and leukotrienes from human neutrophils. The aqueous extract also releases of cytokines, interleukin-6 and tumour necrosis factor from human monocytes, thereby exhibiting anti-inflammatory and immune stimulant activity.⁶¹ The study was investigated as protective effects of extracts of *Zingiber officinale* and *Althaea officinalis* on pyloric ligation-induced gastric ulcer in rats (5 groups). A standard treatment group receiving famotidine (20 mg/kg), and two treatment groups receiving *Z. officinale* extract (100 mg/kg) and *A. officinalis* extract (100 mg/kg). Treatments were given orally for 14 days. The result shows *Z. officinale* and *A. officinalis* can protect against pyloric ligation induced ulcer.⁶²

Antioxidant activity

Parisa Sadighara *et al.*, examined three colours of petals of *Althaea officinalis* flowers, i.e., pink, reddish pink, and white for total antioxidant activity and flavonoids content. The reddish pink flowers of *A. officinalis* have more antioxidant activity and the power of antioxidant activity was reddish pink > pink > white.⁶³

Niko Benbassat *et al.*, revealed the antioxidant activity of aqueous and hydro alcoholic extracts of *A. officinalis* root by applying

ABTS⁺ (2,2'-azino-bis (3-ethylbenzothiazoline-6- sulphonic acid), hypochlorous acid scavenging assay and iron-induced lipid per oxidation. The results showed that the extract prepared with water as extraction solvent did not possess antioxidant activity, whereas the extracts obtained using ethanol: water as extraction agent showed well pronounced antioxidant activity. In particular, the extracts obtained at low concentration of ethanol in the mixed solvent (50:50 and 70:30, v/v) showed higher scavenging activity for ABTS⁺ radicals and hypochlorite ions than the extract obtained with the higher ethanol concentration (90:10 v/v). These results correlated very well with phenolic and flavonoid content of the extracts. The extracts did not show cytotoxic effect on human BV-173 leukemic cells but may have immunomodulating effects due to their antioxidant properties.⁶⁴ Zaghlool *et al.* study revealed Gastro-Protective and Anti-Oxidant Potential of *Althaea officinalis* on Pyloric Ligation/Indomethacin-Induced Ulceration in Rats.⁶⁵

Ethanol/water of (1:1) extract of the dried entire plant of *Althaea officinalis*, at a concentration of 5.0 mcg/ml, produced weak activity vs superoxide anion when estimated by the neotetrazolium method.⁶⁶ Tabarsa M *et al.* evaluate gum from *A. officinalis* flower which is a Rhamnan-rich polysaccharide. The gum displayed negatively charged carboxyl groups and high antioxidant activity⁶⁷

Immunomodulatory activity of *Althaea officinalis*

Modaresi M. *et al.*, determined immunomodulatory activity of hydroalcoholic extract of root of *Althaea* by observing electrophoresis pattern of blood protein. According to the result the β -globulin concentration was not affected by treatments. Albumin concentration was reduced and the ratio of albumin to globulin was decreased. Gama globulin concentration and α -1 globulin concentration increased significantly.⁶⁸ According to European medicines agency evaluation of medicines for human use an extract (extraction medium 45% 1,3-butylene glycol solution) was found to inhibit intracellular calcium mobilisation in normal human melanocytes activated by endothelin-1, and to powerfully inhibit endothelin-1-induced proliferation of melanocytes. The extract of marshmallow root can reduce the physiological activity of endothelin-1 on normal human being melanocytes following UVB irradiation.⁶⁹ Scopoletin of marshmallow produced double action on tumoral lymphocytes cells exhibiting both a cytostatic and a cytotoxic effect, and moreover exert apoptosis. Due to the interaction with kinase C (PKC) protein the proliferation of normal T lymphocytes was found. It shows that Scopoletin may be a potential anti tumoral compound.⁷⁰ *Althaea-mucilage* O, an acidic polysaccharide isolated from marshmallow root, has been demonstrated to have an anti-complement activity on normal human serum in concentrations of 100-1000 μ g/ml.⁷¹

Ebringerova *et al.* studied the structure / function relationship of two acidic heteroxylan types, the arabino-(glucurono) xylan from corn cobs (AGX) and 4-O-methylglucuronoxylans (GXs) from beechwood and three medicinal herbs *Rudbeckia*, *Althaea* and *Mahonia*. Immunomodulatory activity of the GX sample of *A. officinalis* was also evaluated. The effect of the molecular mass of AGX, as well as the content and distribution of the 4-O-methylglucuronic acid (MeGA) side chains in GXs on the immunological activity of these xylans was characterized by their biological response in the mitogenic and comitogenic thymocytes *in vitro* tests. The xylans from the plants *A. officinalis* (AltGX) have a regular distribution of MeGA units. It was concluded that not only the primary structure but also, the whole complex of chemical and physicochemical properties and supramolecular structural features may be contributing in the expression of the immunological activity⁷².

Hepatoprotective activity

Ali Mohd *et al.*, revealed the hepatoprotective activity of ethanolic extract of *Althaea officinalis* against carbon tetrachloride induced hepatotoxicity in rats. The serum biochemical analysis showed significant protective effect from hepatic damage in CCl₄ induced hepatotoxicity model.⁷³

UV Protecting property / Radio protective activity

Alison Curnow *et al.*, explained the phytochemicals derived from *Althaea officinalis* root and *Astragalus membranaceus* as potential natural components of UV protecting dermatological formulations with no significant reduction in DNA damage was observed when total ultraviolet irradiation (including UVB) was employed, indicating that the extracted phytochemicals predominantly protected against indirect UVA-induced oxidative stress.⁷⁴

Study was evaluated against exposure to UV radiation Hydroponically grown root *Althaea officinalis* extracts were found to significantly reduce UVA-induced DNA damage in cultured human lung and skin fibroblasts, study indicates that *Althaea* root extracts may be a possible constituent for dermatological formulations.⁷⁴

Bronchodilatory and B-adrenergic effects

Behrang Alani *et al.* examined the Bronchodilatory and β -Adrenergic effects of methanolic and aqueous extracts of *Althaea* root on isolated tracheobronchial smooth rat muscle. Result represented the Epinephrine (5 μ m) alone and root methanolic and aqueous extract concentrations (0.6-14.6 μ g/ml) reduced tracheobronchial smooth muscle contractions induced using KCl (60 mM) in a dose dependent manner. Propranolol inhibited the antispasmodic effect of epinephrine on tracheobronchial smooth muscle contractions, but could not reduce the antispasmodic effect of the root extract concentrations.⁷⁵

Effect on Thyroid Hormones

Farshid Roshangar *et al.*, revealed effect of Marshmallow's root extract on Thyroid Hormones concentration in Broilers. Results showed that the concentration of T3 hormone was decreased significantly ($p < 0.05$) whereas the concentration of T4 hormone was not affected by treatments.⁴²

Antimicrobial Activity

Shiv shanker gautam *et al.*, revealed antimicrobial efficacy of *Althaea officinalis* Linn. Seed extracts and essential oil against respiratory tract pathogens, against five bacteria and one fungus. The maximum inhibition was noted by essential oil against *Streptococcus pyogenes* (21.3 \pm 0.28 mm) and *Haemophilus influenza* (19.0 \pm 0.50 mm) at 200 mg/ml. The minimum inhibitory concentration value for methanol extract was 3.12-12.5 mg/ml. The antifungal activity noted highest with 41.28% by essential oil and 36.27% inhibition by aqueous extract represented by dosage-response curve.⁷⁶ There is also reported action against diaper (napkin) dermatitis.⁷⁷

Amjed Haseeb Khamees *et al.*, revealed antibacterial effect of aqueous and methanol extracts of *Althaea officinalis* L. on gastrointestinal pathogens. Both extracts were produced comparable zone of inhibition against *Salmonella typhimurium* with p value < 0.001 . In addition, Methanol extract have higher activity than gentamicin against *K. pneumoniae* at all concentrations with inhibition zone ranged from (15.3 mm) to (21.2 \pm 0.3 mm) mm. However, the inhibition zones were noted against *E. coli* (23.5 \pm 0.2 mm), *K. pneumoniae* (21.2 \pm 0.3 mm) and *Shigella dysenteriae* (18.7 \pm 0.5 mm) and all reading showed comparable effect when compared with the results that have been given by ciprofloxacin p value < 0.001 .⁷⁸

Jafari-Sales *et al.* showed antibacterial activity that minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of ethanolic extracts of *Malva neglecta* and *Althaea officinalis* L. against antibiotic-resistant strains of *Staphylococcus aureus* were 6.5/13 mgml⁻¹ and 3.2/6.5 mgml⁻¹.⁷⁹

Haghgoo *et al.*, showed; the root extract of *A. officinalis* exhibited antibacterial effects on *L. acidophilus* and *S. mutans* but this effect was less than those of penicillin and CHX mouthwash. The antibacterial property increased with an increase in the concentration of the extract.⁸⁰

The *in vitro* antibacterial activity of hexane extracts of flower and root of *Althaea officinalis* were evaluated by the disc diffusion method (DDM) using Mueller Hinton agar for bacteria. Vallie *et al.* demonstrated the antimicrobial activity of the hexane extracts of the samples against some Gram-positive and Gram-negative bacteria.⁸¹

A marshmallow root methanolic extract prepared by exhaustive extraction has been shown to possess an inhibiting activity able to reduce significantly the periodontal pathogens resident in the oral cavity (*Porphyromonas gingivalis*, *Prevotella* spp., *Veillonella parvula*, *Actinomyces odontolyticus*, *Fusobacterium nucleatum*, *Eikenella corrodens*, *Peptostreptococcus* spp.). Antimicrobial activity against *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Proteus vulgaris* has been documented for chloroform and methanolic extracts of marshmallow roots.¹¹

Rashidi *et al* also found that 80% ethanolic *Althaea officinalis* extract was active against *Aspergillus niger*, *Aspergillus fumigatus* and *Aspergillus flavus* species. Plant extracts were prepared by maceration method. The effect of anti-fungal extracts was separately assessed using Broth macrodilution. Finally, the minimum inhibitory concentration (MIC) and minimum fungicidal concentrations (MFC) of extracts were determined.⁸² In a study in which the *Althaea officinalis* seed extracts and essential oil were screened for antimicrobial activity against five bacteria and one fungus responsible for dominant, fatal or opportunistic infection of respiratory system. The maximum inhibition was noted by essential oil against *Streptococcus pyogenes* (21.3 ± 0.28 mm) and *Haemophilus influenzae* (19.0 ± 0.50 mm) at 200 mg/ml. The minimum inhibitory concentration values for methanol extract were 3.12-12.5 mg/ml. The antifungal activity noted highest with 41.28% by essential oil and 36.27% inhibition by aqueous extract represented by dosage-response curve.⁴² Polysaccharide mucilage of marshmallow administered (10 mg/kg) intraperitoneally to mice that produced a 2.2 - fold increase in phagocytic activity of macrophages in the carbon-clearance test.⁸³

Baan M. Twaij *et al.*, revealed anti-fungal activity of *Althaea officinalis* L. Tissue Culture extracts the effect of the alcoholic and water extracts of the tissue plant to inhibiting the growth of the pathogenic fungi *Rhizoctonia solani* and *Fusarium oxysporum*. The results showed that the alcoholic extract was significantly higher inhibition compared to the control plant, 100% inhibition of 60 mg / 100 ml, 80 mg / 100 ml on both fungi. The effect of hot water extract was 84.5% and 90% for *Rhizoctonia solani* at 60 mg / 100 ml, 80 mg / 100 ml respectively. 86.1% and 89.7% for *Fusarium oxysporum* at 60-80 mg/100 ml, respectively.⁸⁴

Antifertility properties

Al-Zubaid BA *et al.*, revealed, effect of methanol extract of *Althaea officinalis* flowers on serum oestrogen and ovary in mature female albino rats. Were normal rats administrated orally

with 2 ml methanol extract of *Althaea officinalis* flowers at 500 mg/kg, daily for 14 days. The results showed there was significant reduction ($P < 0.05$) in oestrogen of the treated rats when compared with the control and there were remarkable noted in the histology of ovary of treated group. The results suggest that *Althaea officinalis* Flowers has female anti fertility properties, possibly acting via inhibition of oestrogen secretion.⁸⁵ Tahmouzi *et al.*, also showed new infertility therapy effects of polysaccharides from *Althaea officinalis* leaf with emphasis on characterization, antioxidant and anti-pathogenic activity. The infertility therapy effects of four fractions of AOLPS were in the order AOLPS-3 > AOLPS-4 > AOLPS-1 > AOLPS-2.⁸⁶

Neuroprotective property

Rezaei *et al.*, revealed neuroprotective activity of *Althaea officinalis* L. extract (10 mg/kg) against 6-OHDA-induced hemi-Parkinsonism in rats.²⁰ It is also reported that Hollyhock leaf compress combined with performing routine interventions for breast engorgement can improve breast engorgement.⁸⁷

Toxicity study

This study was conducted to evaluate the effects of marshmallow extract (*Althaea officinalis* L.) administration on blood cells and biochemical parameters of carp liver. A total of 150 carps (*Cyprinus carpio*, initial body mass of 37.7 ± 4.4 g) were fed diets containing 0.0 (control diet), 2.5, 5, and 10 g marshmallow extract for 60 days. On days 30 and 60 of the experiment blood samples were collected and haematological parameters and liver enzyme activities—aspartate aminotransferase (AST), alanine amino transferase (ALT), lactate dehydrogenase (LDH), and alkaline phosphatase (ALP)- were measured. A significant increase was observed in AST, ALT, ALP, and LDH levels in livers of fish fed with extract 10 g, which may be attributed to cytotoxicity.⁸⁸

DISCUSSION

It is widely used traditionally in Unani, Ayurveda and other traditional system of medicine since long back, for the treatment of the irritation of oral, pharyngeal mucosa and associated dry cough, mild gastritis, skin burns and for insect bites.¹¹ Theophrastus (372-286 BC) reported that Marshmallow root was taken in sweet wine for cough.¹² Detailed review suggests that, based upon the capable pharmacological activity of the drug its indication has been detailed in the Unani classical texts. Khatmi is also utilized resolving of hard swelling, dysentery, intestinal Colic, ulcer and obstacle of intestine, bilious diarrhoea, and dysuria. Reported Pharmacological activities on khatmi are antitussive activity, anti-inflammatory activity, antioxidant activity, antimicrobial activity / antibacterial activity, antiulcer activity, hepato-protective study, Bronchodilatory b-adrenergic effects etc. Findings in the reported activity sections validates some of the Unani Medicine indications of the drugs such as antitussive, anti-inflammatory, antiulcer, hepato-protective, expectorant, Resolvent, cicatrization, antidysentery etc. These validations of classical claim and reported pharmacological activity suggest that khatmi possessed very potent pharmacological action and future research work can be directed in further analysing these properties clinically and by *in vivo* / *in vitro* experiments, by following structured scientific method.

CONCLUSION

The present review reveals that there is the tremendous scope of Unani single drugs Khatmi in management of resolvent of hard swelling, dysentery, intestinal Colic, ulcer and obstacle of intestine, bilious diarrhoea, dry cough and dysuria and it can also be utilized as a potent conventional traditional Unani drug due to

its diverse and related beneficial pharmacological activity and suggest that further phytochemical, clinical and advance research should be done on this medicinal plant for the benefit of mankind.

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