



REVIEW OF LEEMU(CITRUS LIMON) WITH UNANI PERSPECTIVE AND MODERN PHARMACOLOGY

Unani Medicine

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ABSTRACT

Lemon is well known for its nutritional and medicinal properties. It is a shrub approx. 5 meter long with fragrant flowers. The wild stock is the native of the North-West regions of India ascending to 4000 ft. The natives used in medicine are of two varieties—Godaria limbu, thick rinded, the Kagaji limbu has a thin rind. It is found in North India, Mediterranean and foot of Himalaya, cultivated in Southern Europe. Lemon or its products are being part of the daily human intake in one or the other forms all over the world. Fresh citrus fruits act as rich source of dietary fibre and hence are recognized as important components in human healthy life. Some important aspects of citrus lemon Linn. including its distribution, Unani concept, pharmacological actions, medicinal uses, adverse effects and correctives have been discussed in this review paper.

KEYWORDS

Lemon, Citrus, Unani, leemu etc.

INTRODUCTION

Lemon (*leemu*) is an important medicinal plant of the Rutaceae family that originated in tropical and subtropical Southeast Asia. It has a distinctive berry with its internal parts divided into segments. Lemon (*Citrus limon*) is a hybrid of the plant genus citrus, as well as the common name of the popular edible fruit of this small tree. Major medicinal property of lemon includes anti cancerous activity, prevent kidney stones, bring down fever, balance pH. Lemon is also useful in treating asthma, cough, biliousness, cold, heartburn, liver complaints, fever, diphtheria and rheumatism. Lemon helps in the production of WBC and antibodies in blood which attacks microorganism and prevent the infections. Lemon acts as an antioxidant by deactivating the free radicals and prevents diseases like stroke, cardiovascular diseases and cancer. It also lowers blood pressure and increases the level of HDL. As lemon is anticarcinogenic, it lowers the rates of colon, prostate and breast cancers.¹

METHODOLOGY:

To accomplish this review both classical unani literature and contemporary modern literature was thoroughly reviewed. Unani classical texts like *khazainul advia*, *kitabul mukhtarat fil tibb*, *jame ul mufradat*, *maghzanul mufradat*, *kitabul advia*, *Kamil us sana*, *Al Qanoon fit tibb* were extensively reviewed for terms like leemu, Qalambak, fisamoon, limon hamiz etc; for their properties, uses, substitutes, dosage and other characteristics. Also books like *Al Qanoon*, *Dakhirae Khwarzam shahi*, *Al Hawi*, *Firodusul Hikmath*, *Al Akseer* were referred to find the uses of lemon in various diseases in different dosage forms like *shar bath leemu*, *sat-e limu*, *Aabe leemu*, *Shikanjabeen etc.*

Contemporary modern literature was similarly reviewed in varied scientific databases like pubmed, orchid, google scholar, SCOPUS, Crossref, CAS Abstracts, Publons, CiteFactor, Open J-Gate, ROAD, Indian Citation Index (ICI), Indian Journals Index (IJINDEX), Internet Archive, IP Indexing, Scientific Indexing Services, Index Copernicus, Science Central, Revistas Medicas Portuguesas, EBSCO, NEWJOUR, ResearchGATE, DocStoc, PdfCast, getCITED, Sky Drive, Citebase etc were searched using key words like citrus limon, lemon, citron for their morphology, ethano botanical description, habitat, chemical constituents, chemical properties, scientific studies in different diseases etc. all the findings were then put in a logical sequence to complete the comprehensive review of this drug.

BOTANICAL CLASSIFICATION:

- Kingdom – Plantae, Angiosperms, Eudicots, Rosids
- Order – Sapindales
- Family – Rutaceae
- Genus – Citrus
- Species – *C. limon*
- Binomial name - *Citrus limon*²

VERNACULARS:

Arabic: Laimon hamidh,³ Lemu, Qalambak⁴

Bengali: Bara Nebu, Gora Nibu¹
English: Indian Lemon, Lemon, Citron, Lime⁵
Greek: Fisamoon⁶
Gujrati: MotuLimbuz⁷
Hindi: PahariNibu, Bara Nibu, limbe,^{1,7}
Kannada: Byopura, Bijori
Malyalam: Ganapalinarkam
Sanskrit: Matulunga, Jamvira
Tamil: Periya-Yelumichai
Telugu: Madiphalamu, Peddanimma
Urdu: Limu, Neebu¹

ETHNO BOTANICAL DESCRIPTION:

Lemons are oval citrus fruits with smooth porous skin. Some fruits have a pointed tip on the bottom of the fruit while other lemons are rounded at the base.² Stamens 25-40. Fruit 6-10 cm in diameter, elliptical or oblong in shape, frequently necked or somewhat collared, with a nipple-shaped (mamillate) extremity. It has a leathery rind and abundant acid pulp. A tree in Kumaon bears 20-60 fruits per annum and a fruit contains about 8-15 seeds.⁵

Lemon grows on small, thorny trees which reach a height of 10 to 20 feet. Leaves 55-110 x 30-4 mm, ovate-elliptic, crenate, apex obtuse. Leaf perfectly jointed to the petiole; petiole narrowly winged, they are arranged alternately on the stem and are dark in colour.^{2,5} The lemon has a white, fragrant flower with five petals. This particular flower comes from a lemon cultivar called 'Pink Lemonade'. The leaves of this cultivar are variegated and the fruit is striped.²

Lemon seeds nestle within the pulp near the centre of each fruit. Their numbers and size vary according to variety, but most are hard, wrinkled, white, elliptical or oval and measure about 3/8 inch long¹



Figure 1: *Citrus limon*

HABITAT AND DISTRIBUTION:

The lemon is both a small evergreen tree which is native to Asia as well as tree's oval yellow fruit. Throughout the world, the fruit can be used for culinary and non-culinary purposes. Primarily it is used for its juice through the pulp and zest is also used mainly in cooking and baking. The top producers of lemon include India, Mexico, Argentina, Brazil, Spain, Republic of China, United States, Turkey, Iran and Italy.² Citrus limon has been reported from the outer valleys of Kumaon (Uttarakhand); outer valleys of Sikkim; Damra in Garo hills; Khasia hills; in Pachmari hills (M.P); in Satpura hills and in Western Ghats, Brandis. It is cultivated throughout the Himalayan region from 1500-2500 m in the Himalayan states of India like ; Jammu & Kashmir, Himachal Pradesh, Sikkim, Darjeeling, Assam and Meghalaya. It flowers from March to May and fruits from November to January. Some time it is found as an escape near cultivated fields. It can also be grown in other parts of the country.⁵

MACROSCOPIC CHARACTERISTICS:

- Colour- Yellow
- Size- 5-8 cm in diameter
- Shape- Ovoid or globose¹
-

MICROSCOPIC CHARACTERISTICS:

- Exocarp -contains tubular parenchymal cells.
- Mesocarp- colourless, contains meristematic polygonal cells.
- Endocarp- contains compactly arranged parenchymal cells.¹

MAHIYAT (UNANI MORPHOLOGY): Lemons are shrubs of average height. Leaves are green in colour, oblong with rounded contour. Flowers are small, white, and beautiful with fragrance. Fruits are round; peel is green in colour, after ripening peel becomes yellowish. Lemons are of various types but *limu kaghzi* is the best, it has thin peel but more juicy.^{4,8}

PARTS USED:

Seeds, Peel, Fruit⁹, Lemon oil, Leaves, Expressed juice of the ripe fruit¹⁰.

MIZAJ (TEMPERAMENT): *Aabe- leemu- Barid Yabis, Tukhme leemu- Harr Yabis*^{8,11}

MUZIR (ADVERSE EFFECTS): *Sardmizaj, Aasab*⁹

MUSLEH (CORRECTIVES): *Shakarsafaid, Shahedkhalis*

BADAL (SUBSTITUTE): *Naranj*⁹

MIQDAR KHURAK (DOSAGE): *Aabe- limu- 6 masha, Post watukhmelimu- 1 masha*¹¹

AF'AL: AABE-LEEMU (ACTIONS ACCORDING TO UNANI MEDICINE)

Dafi-i- qay'al-haml, Dafi-i- qaywamitli (Antiemetic and antinausea), *Hadim* (Digestive), *Muqawwi-i- mi'da* (Stomachic), *Mushtahi* (Appetizer), *Mubarridwamufarrih* (Refrigerant and exhilarant), *Muqtaiwamulattifakhlateghaliza, Dafi-i- tip* (Antipyretic), *Dafi-ihiddatesafra, Dafi-i- samoom* (Antidote), *Musakkin* (Sedative), *Dafi-i- attish* (Antithirst), *Jali* (Detergent)^{9,8}

ISTE'MAL: AABE- LEEMU (USES ACCORDING TO UNANI MEDICINE)

- Can be used in nausea and vomiting in pregnancy.
- As *aabe-leemu* is *dafi-i-hiddate safra khun* can be used in nausea and vomiting.^{9,12}
- It can be used in gastritis.
- It can be used as appetizer.
- As it is *muqawwi-i- mi'da* can be used in *amraz-i- mi'da*.¹³
- It is useful in decreasing thirst.⁸
- It can be used as cardiotoxic.
- Due to its *mubarrid, muffarrih* and *dafi-i-safra* properties it can be used in seasonal fever.⁹
- It is very effective in headache.
- It is useful as a blood purifier.⁸
- As it possess *muqtai* and *jali* properties it can be used externally in *bahaq* and *kalaf*^{9,12}

ACTIONS: (ACTIONS ACCORDING TO CONVENTIONAL MEDICINE)

Fruit - Antiemetic, Antianemic¹⁴, Analgesic¹⁵, Antisclerotic, Antipyretic, Antiseptic^{3,15} Demulcent¹⁴

Pulp -Antidiarrheal, Diuretic¹⁴, Intestinal mucosa protector¹⁵, Local hemostatic¹⁴, vascular stimulant and protectant¹⁵, Vitaminic¹⁴

Peel -Antiseptic¹⁴, Carminative^{14, 16}, Diuretic^{14, 15}, Eupaptic¹⁴, Vascular stimulant and protector¹⁵, Vitaminic¹⁴

Lemon juice -Antiemetic¹⁰, Diuretic³, Antiscorbutic^{3,10,16}, Astringent, Febrifuge Gingivitis, Stomatitis³, Laxative and prevention of common cold^{3, 15}, Antioxidant^{3, 17}, Analgesic^{3, 15}, Antisclerotic¹⁵, Emollient and moisturizer properties, Antiallergic, Antiviral¹⁵, Anti-inflammatory^{3,15, 17}, Antidiabetic³, Antimicrobial¹⁸, Antiproliferative, antimutagenic, and anticancer activity^{15,19}

USES: (ACCORDING TO CONVENTIONAL MEDICINE)

- Lemon juice with water relieves vomiting and dyspepsia^{1,10,16}
- Juice of half a lemon in a little water relieves heartburn.¹⁰
- A glass of plain lemonade without sugar before breakfast and at bed time is an excellent stomach and bowel cleanser, having a laxative effect.
- Lime or lemon eaten daily is a remedy of enlargement of spleen.
- It is an excellent antidote.¹⁰
- Lemon essential oil obtained from citrus limon promotes clarity of thoughts, and gives freshness to the mind. It releases tension and makes mind peaceful.²⁰
- Lemon is also an important ingredient in natural cosmetics that reduces wrinkles in the face, as it supports and refreshes the skin.
- D-limonene supports the normal functioning of immune system.
- Lemon acts as an antiseptic agent by preventing the growth of pathogenic bacteria.
- Lemon helps in the production of WBC and antibodies in blood which attacks microorganism and prevent the infections.²⁰
- Juice of the fruit in doses of 4-6 drachms is useful refrigerant drink in small pox, measles, scarlatina and other forms of fever where there is very hot dry skin and much thirst.
- Hot lemon juice is useful in colds and mild forms of influenza.
- Lime juice is most useful in dysentery with sloughing of the mucous membrane.
- Diluted lime juice is useful in cholera and in cases of typhoid fever as a mild germicide.¹⁰
- Lime juice added to strong black coffee without milk relieves malarial attacks.^{10,20}
- Lemon juice is used in the treatment of leprosy and white spots.²¹
- Lemonade or ale made up of lemons in their natural state are valuable for those suffering from gout, rheumatism, lumbago, sciatica, neuralgia etc as they diminish the acidity of the blood, the citric acid being converted into alkaline carbonate in the blood.^{10,20}
- Haemorrhage form the lungs, stomach, bowels, uterus, kidney and other internal organs.
- Fresh lemon juice is useful in cataract.¹⁰
- Curative as well as preventive in scurvy.^{1,10}
- Lemon acts as an antioxidant by deactivating the free radicals and prevents diseases like stroke, cardiovascular diseases and cancer.²⁰
- Lime juice is helpful in hysterical palpitation of the heart.¹⁰
- It also lowers blood pressure and increases the level of HDL.^{20,22}
- As lemon is anticarcinogenic, it lowers the rates of colon, prostate and breast cancers.²⁰

CONSTITUENTS AND THEIR ACTIONS:

Hesperidin (3',5,7-trihydroxy-4'-methoxy-flavanone 7-rhamno glycoside) and diosmin (3',5,7-trihydroxy-4'-methoxyflavone 7-rutinoside) are flavonoid glycosides and are known to lower hepatotoxicity induced by carbon tetrachloride (CCl4) & lipopolysaccharides (LPS), minimize oxidation stress caused by nicotine, reduce blood sugar and cholesterol, and inhibit carcinogenesis of the bladder. In addition, the concentration of hesperidin is used to determine the purity of a citrus juice. Bergapten and limettin are coumarin compounds widely distributed among higher plants, especially in Rutaceae and Apiaceae.²³

ACTIVE INGREDIENTS:

Flower: Purine alkaloids (caffeine, theobromine, theophylline, paraxanthine).

Peel: Essential oil [(+)-limonene, canfen, citral, citronelal, felandren, pinene, terpinol], coumarins (bergamotin, limetin), citroflavonoids (neohesperidosides, rutinoides), Vitamin C, carotenoids, mucilage, calcium oxalate.

Pulp: Pectin, sugars, organic acids (ascorbic, citric, malic), citroflavonoids.¹⁴

Vitamin C: An important constituent of lemon

Vitamin C (ascorbic acid) is a simple low-molecular weight carbohydrate with an ene-diol structure that has made it a ubiquitous and essential water-soluble electron donor in nature. It is usually considered the major antioxidant in lemon. Lemon juice provides an important source of vitamin c for human nutrition. Vitamin C plays a key role in the formation of collagen, the main protein of connective tissue, whose adequate synthesis is essential for proper resistance and strength of tendons, ligaments, skin, and other connective tissues. Moreover, severe ascorbate deficiency causes scurvy whose symptoms result from impaired collagen synthesis. The current recommendation of daily intake of vitamin C is 90 mg/day for men and 75 mg/day for women.²⁴

Beneficial effects of vitamin C intake:

Vitamin C plays an important role in a number of metabolic functions including the activation of the B vitamin, folic acid, the conversion of cholesterol to bile acids and the conversion of the amino acid, tryptophan, to the neurotransmitter, serotonin. It is an antioxidant that protects body from free radical damage. It is used as therapeutic agent in many diseases and disorders. Vitamin C protects the immune system, reduces the severity of allergic reactions and helps to fight off infections.

Some important beneficial effects given in the subheading

1. Vitamin C and Common Cold

Apart from the well accepted role of vitamin C in the prevention of scurvy, the most widely known health beneficial effect of ascorbic acid is in the prevention and relief of common cold.²⁵

2. Vitamin c and Cancer

High intakes of vitamin C have been associated with decreased risk of certain cancers, particularly cancers of the pharynx, oral cavity, esophagus, lung, and stomach.²⁶

3. Vitamin C and iron

Ascorbic acid is known to enhance the availability and absorption of iron from non-heme iron sources. Its supplementation is found to facilitate the dietary absorption of iron. The reduction of iron by ascorbic acid has been suggested to increase dietary absorption of non-heme iron

4. Vitamin C and infertility

Vitamin C has been used in the management of male infertility on empirical grounds, particularly in the presence of non-specific seminal infections.

5. Vitamin C and atherosclerosis

There are several publications on the role of vitamin C in lipid metabolism and atherogenesis with diverse observations.

6. Vitamin C and immunity

Vitamin C affects several components of the human immune system. Vitamin C appears to play a role in a number of neutrophil functions including increased chemotaxis, increased particulate ingestion, enhanced lysozyme-mediated non-oxidative killing, protection against the toxic effects of superoxide anion radical, inhibition of the halide-peroxide-myeloperoxidase system without a pronounced bactericidal effect, and stimulation of the hexose monophosphate shunt.²⁵

Pharmacological activity of lemon:

1. Vasodilator:

Hesperidin extracted from C. limon can improve endothelium dependent vasodilation during hypertension¹⁵

2. Antihypercholesterolemic

C.limon had a significant effect on the levels of cholesterol and triglycerides, suggesting that the prolonged consumption of its juice

might offer significant protection from hypercholesterolemia.^{15,27}

3. Anxiolytic effect

A recent study evaluated the effects of lemon on the behavior of rats, using three different doses (0.2, 0.4, and 0.6 ml/kg), considered low, moderate, and high doses, respectively. The results suggest that C. limon at moderate dose has an anxiolytic effect.¹⁵

4. Antibacterial activity

The antibacterial activity of crude extracts (aqueous and ethanolic) of citrus limonum fruits against four wound isolates staphylococcus sp, pseudomonas sp, escherichia coli and klebsiella sp. showed that they exerted antibacterial activity.^{3,19,27}

5. Scurvy

Lime is so famous as a cure for scurvy, since its cause is deficiency of vitamin-C and lime is blessed with this vitamin.

6. Skin care

Lime juice and its oil are very beneficial for skin when consumed orally or applied externally. It rejuvenates the skin, keeps it shining, protects it from infections and reduces body odour. Flavonoids, both of which are class-1 anti oxidants, anti biotic and disinfectants. When applied externally on skin, its acids scrub out the dead cells, cures dandruff, rashes, bruises etc.

7. Digestive

Lime has an irresistible scent which waters the mouth and thus aid primary digestion. Then the acids in it do the rest. While they break down of the macro molecules of the food, the flavonoids, the compounds found in the fragrant oils extracted from lime, stimulate the digestive system and increase secretion of digestive juices, bile and acids and also stimulate the peristaltic motions.^{1,2}

8. Laxative

Primarily, the ample of acids present in lime helps clear the excretory system by washing and cleaning off the tracts. Then the roughage in it is also helpful in easing constipation. But it is mainly due to high acids. An overdose of lime juice with salt also acts as an excellent purgative without any side effects, thereby giving relief in constipation²

9. Anticancerous properties

Studies have supported the citrus limonoids show anticancer activity, compounds that protect cells from damage which is the formation of cancer cells.^{1,19,27}

10. Antioxidant

Citrus limon essential oil showed strong antioxidant activity in mice. Furthermore, it also possessed scavenger activity in all *in vitro* tests. Essential oil of citrus limon leaves reduced the lipid peroxidation and nitrite content as well as increase the glutathione reduced (GSH) levels and enzymatic antioxidant activities (super-oxide dismutase, catalase and glutathione peroxidase) in mice hippocampus; which implies that a neuroprotective effect could be achieved using citrus limon essential oil as antioxidant treatment.^{3,27}

11. Peptic ulcer

In addition to vitamin-C, lime contains special compounds called flavonoids (limonoids such as limonin glucoside) which have antioxidant, anti carcinogenic, anti biotic and detoxifying properties which help healing of peptic and oral ulcers.^{1,2}

12. Respiratory disorders

The oil, containing flavonoids and certain oils, extracted from lime is extensively used in anti congestive medicines such as balms, vaporizers, inhalers etc. due to presence of kaempferol. Scratching the peel of a lime and inhaling it gives immediate relief in congestion and nausea.

13. Eye care

Its anti oxidant properties protect eyes from aging and macular degeneration. Flavonoids help protect them from infections.²

14. Gout

It is caused by accumulation of free radicals and toxins, primarily uric acid in the body. Limes helps in removal of these, as it is a reservoir of anti oxidants & detoxifiers (vitamin C & flavonoids).

15. Effect on body weight:

A glass of warm water with a full-lime juice in it is an excellent weight reducer, brilliant refresher and anti oxidant drink. The citric acid present in lime is an excellent fat burner.

16. Urinary Disorders:

The high potassium content of limes is very effective in removal of the toxic substances and the precipitates deposited in kidneys, urinary bladder and its disinfectant properties help cure infections in the urinary system. It also stops prostrate growth and clears blockage of urine due to deposition of calcium in the urinary tract.^{1,2}

CITRIC ACID (*Sate-limu*)

Citric acid is a six-carbon tricarboxylic acid, found naturally in citrus fruits, pineapples, pears and crystallised as calcium citrate. It is an important chemical used in medicines, flavouring extracts, food and candies, and the manufacture of ink and dyes. It was first isolated from lemon juice. It is used in the food and beverage industry for various purposes, as pharmaceuticals and for other industrial uses.²³

MAHIYAT:

It is obtained from lemon, less soluble in alcohol, and not soluble in ether but soluble in cold and hot water.⁴

METHOD OF PREPARATION OF SATE-LIMU:

After squeezing lemon, collect lemon extract and dried it over heat, *sate-limu* is formed.²⁹

Miqdar khuraq: 10 grain to 30 grain⁸

AF'AL: *Dafi-i- mitli* (Antinausea), *Mufarrih* (Exhilarant), *Mubarrid* (Refrigerant), *Dafi-i-attish* (Antithirst)⁸

ISTE'MAL: (USES ACCORDING TO UNANI MEDICINE)

1. It is used to reduce temperature in fevers.
2. As it is *mufarrih* it is used to produce *farhat*.
3. It is used with water to relieve thirst.⁸

MACROSCOPIC CHARACTERISTICS:

Color - Colorless

Appearance - White crystalline or translucent crystals

Odour - Odourless

Taste - Strong acidic

Structure - Orthorhombic³⁰

Actions: Antioxidant, Buffering agent, Chelating agent, Flavor enhancer, Preservative³¹

USES: (ACCORDING TO CONVENTIONAL MEDICINE)

1. Citric acid is widely used in pharmaceutical formulations and food products, primarily to adjust the pH of solutions. It has also been used experimentally to adjust the pH of tablet matrices in enteric-coated formulations for colon-specific drug delivery.
2. Citric acid is used in the preparation of effervescent granules and tablets while anhydrous citric acid is widely used in the preparation of effervescent tablets.
3. Citric acid has also been shown to improve the stability of spray-dried insulin powder in inhalation formulations.
4. Citric acid monohydrate is used as a sequestering agent and antioxidant synergist.
5. It is also a component of anticoagulant citrate solutions.
6. Preparations containing citric acid have been used to dissolve renal calculi.³⁰

PHARMACOLOGICAL ACTIVITY:**1. Antioxidant**

Citric acid is used as an excipient in pharmaceutical preparations due to its antioxidant properties.

2. Anticoagulant

It acts as an anticoagulant by chelating calcium in the blood.³²

3. Disinfectant

Citric acid is an excellent, harmless disinfectant against several viruses, including human norovirus. For example, added to norovirus-like particles, citrate precisely binds at the binding pocket on the histoblood group antigens involved in attaching to host ligands, preventing the transmission of these viruses, as well as reducing symptoms in those already infected with noroviruses.

4. Produce preservative

The use of citric acid to reduce microbiological activity, thereby

enhancing the stability of concentrates, is well known for example to orange juice makers, who add the acid to concentrates delivered to customers in the beverage industry. Formulated along with other ingredients, citric acid affords an effective commercial antioxidant, which preserves the aspect (texture and colour) and the organoleptic qualities of several fruits, making them appearing fresh.³¹

5. Helps in retention of calcium and phosphorus

Citric acid supplementation together with a Calcium-rich diet allows an increased retention of calcium and phosphorus in bone.³³

CONCLUSION

Lemon is well known for its nutritional and medicinal value all over the world. It is an important medicine in Unani also. Nowadays people are more concerned about the safety of drug and therefore inclined towards herbal medicine. Further researches should be conducted on lemon and on different actions to evaluate its medicinal properties and also to validate the claims of Unani physicians for its different pharmacological actions

ACKNOWLEDGEMENT

I gratefully acknowledge the Director, National Institute of Unani Medicine for his skillful guidance and support. I would also like to acknowledge the faculty of Post-Graduate Department of Ilmul qabalat wa amraze niswan, for their valuable cooperation and support.

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