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Review Article

An ethno-botanical review of seeds of *Cucumis sativa* (*Maghz-e-tukhme khiyarain*) from Unani Medicine and its Pharmacological Updates

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ABSTRACT

Cucumis sativus Linn. (Cucurbitaceae) commonly called cucumber, kheera; is mentioned in Unani texts as khiyarain. It is widely cultivated as a vegetable crop throughout India due to its nutritional as well as therapeutic value. Its seeds known in USM as *Maghz-e-tukhm-e-khiyarain* are reported to possess wide therapeutic value as astringent, detergent, diuretic, coolant, analgesic, detergent, anti-inflammatory, anti-pyretic, deobstruent, laxative, calorific, blood purifier. It has been used to manage various health ailments like to quench thirst, urolithiasis, correct imbalanced humors, sanguineous inflammation, remove obstructions, used in cystitis, diabetes, bronchitis, diarrhea, and renal diseases due to its cooling property for the bilious diseases (*Musakkin-i-safra*) as well as hyperacidity in sanguine diseases (*Muskkain-i-hiddat-i-dam*).

This wide therapeutic value is attributed to the rich secondary metabolites and phytoconstituents present in it, which act synergistically when used as a whole. It contains cucurbitacin A, B, C and D, ascorbic acid, lactic acid, flavanoid-fisetin, laticiresinol, secoisolariciresinol, pinoresinol, saponin, hypo-xanthine and potassium. The literary evidence of classical literature has also been confirmed by various scientific studies done so far, and it has been proved to possess analgesic, anti-inflammatory, anti-microbial, anti-oxidant, diuretic, hypoglycemic, hepatoprotective, anti-carcinogenic, and have wound healing activities. This study is aimed to provide a brief review of *Cucumis sativus* Linn. As mentioned in Unani texts, ethnobotanical description and provide pharmacological updates. It can be used for further exploration and scientific revalidation of the drug in other pathologies, where it can be used efficiently for mankind.

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INTRODUCTION

Nature has always provided with a beneficial source to the mankind, and thus the plant sources are healing to man since its origin. Traditional system of medicine has always been a treasure of such natural sources which

are economical, and available to every class of the society (Yuan, 2016; Sen and Chakraborty, 2016). But as per the need, synthetic drugs take the front foot due to their active outcome; simultaneously the fascinating

therapeutic outcome leads to the long term adverse effects, and increases the threshold (Karimi, et al., 2015). So, it is much needed to return back to the knowledge of nature, traditional medicines which were well acquainted with the original source of drugs. Active constituent isolated from the plant can show the outcome in seconds due to molecular approach, but the holistic approach of Unani medicine, consider the man as a whole. Therefore since beginning, they emphasize holistic approach and the use of crude drugs or their extracts in compound formulations.

Present study is aimed to provide a detailed review on the Unani description of *Cucumis sativus*, its ethno-botanical description and provides the pharmacological updates.

Plant nomenclature

The term, 'cucumis' is derived from Greek word 'kykyon' and 'sativus' means 'that is sown'. Cucumis in Latin means cucumber, which is the English common name of this genus. So, it is commonly known as Cucumber. In the Mediterranean era, it was confused with *Cucumis melo* and in some other civilization too, which was corrected later on. The main crop used includes the elongated fruits which are called as sikyos (Greek), cucumis (Latin), qishu' im (Hebrew), gherkins (English) and angarah (Persian). It is also mentioned in the Bible, apart from being included in Galenicals, writings of Egyptians and Romans (Burnhams, 2019).

Taxonomical classification

Kingdom:	Plantae
Class:	Magnoliopsida
Order:	Cucurbitales
Family:	Cucurbitaceae
Genus:	Cucumis
Species:	sativus Linn. (Anonymous, 2009)

Vernaculars

It has been named as Khiyar means qasabartang and also known as khiyarza, qasad and qasa. It's seeds (tukhm) are known as khiyarain, the food.

Arabic: Khiyaar, Qathadh, Bazarul qissa, Qasa ul himar, Bazr ul Qasad; *Bengali:* Kakur, Karikuda, Shashaa; *Chinese:* Huang kua; *English:* Cucumber, Snake cucumber; *French:* Concombre; *German:* Gurke; *Gujrati:* Kakadi; *Hindi:* Kheera, Khira, Kakri; *Kashmiri:* La' aer, *Khurasani:* Khiyar badrang; *Kannada:* Saute; *Malayalam:* Kammkadi, Vellarika; *Marathi:* Kakdi, Kheera, Valnka; *Persian:* Khayar, Khayarain, Khiyarza, Khiyaraj, Khiyar khar, Baadru, badrugh, Karanjak; *Punjabi:* Kakri; *Sanskrit:* Sakusa, Kandalu, Karkati;

Spanish: pepino; *Tamil:* Kakkarikay, Vellarikkai; *Telugu:* Dosakaya; *Urdu:* Kheera, Kakri (Nadkarni, 2011).

C. sativus (Kheera) and *C. melo* (Kharbooza)

- There is morphological similarity found in the seeds of *C. sativus* (Maghz tukhm-e-khiyarain) and *C. melo* (Maghz tukhm-e-kharpaza).
- Main plant can be distinguished on the basis of leaves, as *C. sativus* bears broader leaves than *C. melo*. The stem of *C. sativus* is big and broad in size, coiled, covered with thin hairs as compared to *C. melo*; new thin soft stems of *C. sativus* have fine hairs.
- Seeds of *C. melo* are known as khiyarza in Persian and shakhaaz in Tibrezi. These are white and heavy, best quality of their seeds is obtained from fully ripened *C. melo*.
- *C. sativus* is more indigestible in comparison to *C. melo*, it is attributed to the variation in temperament also in Unani texts as *C. sativus* temperament is cold in last of second degree whereas temperament of *C. melo* is cold in mid of second degree.
- Pulp of cucumber is easily digestible, in comparison to *C. melo*.

Habit and Habitat

It is a climber that grows in moist, sandy soil under full sunlight exposure in humid climate. Good quality of the plant needs soil, rich in organic matter and slightly alkaline. It was thought to be originated 3000 years ago in the Indian sub-continent up to 1200 m altitude, then spread towards China. It grows and cultivated in both tropical and subtropical regions, warm temperate climates throughout the world and is very important economically (Anonymous, 2006).

Morphological description of *C. sativus*

Cucumis sativus Linn. from Cucurbitaceae/ Guard family is a vegetable crop, cultivated widely for its commercial and therapeutic value. It is an annual, climbing vine, grows up to 2m high with the plant climbs through the coiled tendrils on nearby plants and trees or is found to be scattered on the ground (Anonymous, 2006; Nadkarni, 2011).

Stem: Prostrate stem, angular, white pubescent which encircles thin un-branched axillary tendrils of about 30 cm long around for the support.

Stipules: Absent but have stiff hairs.

Leaves: They are simple, pubescent, basally cordate, acute apically with 3-7 palmate lobes seems orbicular

7-20 cm long and broad with serrated margins. Arranged alternately on 10-16 (-20) cm long petioles. They are acute with pentagon shape forming large form canopy with the fruit.

Flowers: Pubescent, pentamerous with 0.5-1 cm long white, long, narrow, acute sepals. They get fused with the ovary and form hypanthodium. The petals are 2cm long, 5-parted with oblong to lanceolate lobes, narrow, yellow, fused less than half of its length, campanulate. They have 3 staminodes, a pubescent, ellipsoid, unilocular ovary 2-5cm long, with a short style and 3 stigmas.

The staminate yellow colored flowers are solitary, yellow, pentamerous, axillary, monoecious or 3-7 on pubescent pedicels (0.5-2cm long), having three stamens (two celled -two anthers and one celled-one anther).

The pistillate flower are solitary or paired on pedicle which are shorter than staminate before the fruit development, and elongate up-to 5cm after fruit growth.

The flowers bloom around July to September in which staminate flower bloom first.

Pollination: Entmophilous (honey bees)

Fruits: Pepo, a botanical berry with no internal divisions and hard outer rind. They are indehiscent yellow to greenish colored glabrous cylindrical berries. It varies widely in length from 5-100cm in length and weight ranges from 50 g to 4kg with many seeds. One plant can yield up to 25 fruit (Anonymous, 2006).

Seeds (Tukhm Khiyarain)

Macroscopical characters: They are smooth, glossy, creamish, white compressed of 0.7- 1.0 cm x 0.3 -0.4 cm size, sweet in taste, emarginated and elliptical with pointed ends. The seed coat is hard but breaks upon little pressure, get detached straight embryo with 2 elliptical off white, smooth, leathery textured cotyledons. A gram of seed includes 33-40 seeds (Anonymous, 2006).

Microscopical characters: The seeds are coated by whitish cream outer layer of round to oval shaped stone cells, lignified and striated. It is followed by a narrow zone of endosperm containing cellulose having thin aleuronic granules. The cotyledon shows leaf like structure with single layered epidermis, palisade layer, oval to polygonal compact spongy parenchyma and mesophyll.

Cut section of the two cotyledons inside, shows 2-3 layered straight cells in the epidermal layer with sclereids, it is followed by closely packed sclerenchymatous layer with numerous thick walled

cells. The inner layer have large oval to polygonal parenchymatous cells, small sized thin sclerenchymatous cells. The inner and lower epidermis is single layered. The cotyledonary cells are covered by thick cuticle, thin walled mesophyll cells arranged radially, elongated to square, parenchymatous, with numerous aleurone grains and oil globules.

Its powder is creamish yellow and oily, shows stone cells, mesophyll cells, oil globules, aleurone grains (Anonymous, 2006).



Seeds of *C. sativus* (Maghz tukhm khiyarain)

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Part used: Seed and Fruit (Anonymous, 2006 and Nadkarni, 2011).

C. sativus fruits vary in softness, seeds, color and length. Some are white, soft and delicate whereas others are up to one hand (1.125ft) length, with more pulp and less seeds. Cucumber of small size are considered as good having thin seeds which are filled with thick-milk like

fluid. The small, light, and easily digest is the best. Medium size, hard and worm eaten, old are the worst. Seeds of *C. sativus* (Khiyarain) are mentioned to be of two types One called as *Misri* (Egyptian): greenish with striation and long and other as *Shami* (Syrian): Soft, easily digestible.

Temperament (Mizaj)

Unani text in reference of single drugs most often mentions a variation in the degree of temperament. This is also observed in *C. sativus*.

Cold, moist (Anonymous, 2006; Anonymous, 2007; Baitar, 1985; Asbi, 2007)

Cold and moist (Khan, 2012)

Cold and moist

Cold moist

Gilaniin Najmul Ghani mentioned, that its temperament is different from *C. melo*, as other authors assigned Kakri with cold and moist (Khan, 2012).

It is beneficial for the hot temperamental people and people suffering from liver disorder. Even in small amount it provides freshness (Ghafqi). It is beneficial in diarrhea, drowsiness, weakness, imbalance in consciousness (Isa bin masoya) (Baitar, 1985; Khan, 2012).

Therapeutic dose

17.5–35 gm (Ghani, 2012), 2-3 gm (Anonymous, 2006); Some authors have mentioned it on the basis of maturity like in mature form (*Kamil*) 9gm-12gm and Immature form (*Naqis*) 4-6 gm (Hakim, 2002).

Pharmacological profile

Astringent, detergent, diuretic, coolant, analgesic, detergent, anti-inflammatory, anti-pyretic, deobstruent, laxative, calorific, blood purifier, emmenagogue, musakkin fawaq, muffateh and muqatfeh. It has been used to manage various health ailments like to quench thirst, urolithiasis, correct imbalance humors, sanguinous inflammation, remove obstructions, used in cystitis, diabetes, bronchitis, diarrhoea and renal diseases due to its coolant property for bilious diseases (*Musakkin-i-safra*) as well as hyperacidity in sanguine diseases (*Muskain-i-hiddat-i-dam*) (Aasbi, 2007; Ghani, 2012).

Therapeutic uses

It quench thirst, provide relief in productive and nonproductive cough, used in gastritis, pyrexia, lung abscess, cerebral and orbital edema, urinary tract infection, renal colic (Baitar, 1985; Khan, 2012), biliary diarrhea, burning micturition, dysuria, celiac disease,

skin health, dysentery, anti-helminthic. It relives inflammation of liver, irregular bowels, infection, spleen calorific infection, headache, reproductive tract infection, arthralgia, appetizer, syphilis, phrenitis, palpitation, urticaria (Maghribi, 2007).

Adverse effect (Muzir): It can be harmful to the nerves and stomach due to the prolonged gastric emptying time, as it is difficult to digest. It also causes some side effects when used in same temperament people like that of cold temperament (Khan, 2012; Hakim, 2002). Its toxicity may cause the putrefaction in humors. It is also reported to cause side effects to spleen, detrimental to spleen.

Correctives (Musleh): Honey (Asl) (Khan, 2012), *Cuminum cyminum* (Kamoon/cumin seeds), *Foeniculum vulgare* (Badiyaan), *Zingiber officinalis* (Zanjabeel) (Haleem, 2009), Jawarish-e-ood, Sikanjabeen.

Substitute (Badal): Tukhm e kakdi.

Unani compound formulations: *Jawarish zarooni sada*, *Sharbate bazoori*, *Banadiq ul buzoor*, *Qurs zarishk*, *Qurs sartan*, *Qurs kafoor*, *Laboob barid*, *Laoq badaam*, *Laoq nazla* etc. (Daljeet, 1974; Siddika *et al.*, 2016).

Phytochemical constituents

Sitosterol, stigmosta-7,22,25 -trien -3 β -ol, β Ethyl-31-norl -ansota -8, 25(27)-dien -3 β -ol; 24 β -Ethyl-25(27)-dehydrolophenol; multiflorenol; isomuliflorenol; α - and β amyryns; taraxerol; lupeol; cycloartenol; stigma sterol, campesterol, sitosterol 25(27)-dehydrochondrillastrol; spinasterol; 24- β -ethyl -25(27) Dehydrolothasterol; 24 β -ethyl-25(27) dehydrolothasterol; 24E, methyllothasterol and 22 dihydrospinosterol (Anonymous, 2006).

Scientific studies

Thrombolytic and analgesic activity: Methanolic crude extract of *C. sativus* reported to possess moderate thrombolytic activity (45.15%) while analgesic activity was found to be effective in comparison to aspirin and Pentazocine, it efficiently reduced the pain sensation (Siddika *et al.*, 2016).

Antioxidant activity: Aqueous extract of *Cucumis sativus* showed antioxidant activity which was evaluated in isolated rat hepatocytes against cumene hydroperoxide (CHP) induced-cytotoxicity and ROS formation (Siddika *et al.*, 2016).

Anti-ulcer activity: Ethanol extract of cucumber showed significant ulcer protective effect in *Wistar* albino rat model (Pradhan *et al.*, 2013).

Anti-inflammatory activity: *Cucumis sativus* L. showed anti-inflammatory activity in animal models and there was no dose dependent side effect as conventional drug (Heidari *et al.*, 2012; Pradhan *et al.*, 2013 and Agatemor *et al.*, 2015).

Cosmetic use: Dermal application of *C. sativus*, prepared by homogenization of the fruit and expressing the juice, delayed the onset and decreased the incidence of tumors in a tumor promotion assay using DMBA and croton oil in mice. This study also depicts unusual mortality rate (Anderson, 2012).

Carminative and antacid properties: Carbon dioxide evolution method and Rosette Rice test were used for the different doses of *C. sativus* extracts; it demonstrated significant results for carminative properties and antacid effect. The study indicated neutralization of acid and resistance against alteration in pH (Sharma *et al.*, 2012).

Antihyperlipidemic activity : The consumption of 500 mg of *C. sativus* seed extract daily showed significant reduction of serum total cholesterol, LDL-C, and TG as well as significant increase of serum HDL-C in adult hyperlipidemic patients (Soltani *et al.*, 2015).

Antibacterial and cytotoxic activity: *C. sativus* phosphate buffer solution (PBS) extracts has been found to possess more antibacterial and cytotoxic activity as compared to the aqueous extracts. Same PBS extracts were assayed against 2 cancer cell lines, the p53 deficient human non-small cell lung carcinoma cell line (H1299) and the estrogen dependent human breast adenocarcinoma cell line (MCF-7). The PBS pulp and peel showed activity against H1299 with IC50 of 42.0 and 52.0 mg/mL, respectively while the peels and pulp of PBS extracts exhibits anti-bacterial activity against gram positive (*S. Aureus*) and gram negative (*K. Pneumonia*) (Foong *et al.*, 2017).

Anti-hyperglycemic activity: *C. sativus* is reported to be effective after a prolonged treatment in animal model, as it involves a different process of glucose metabolism, such as by decreasing plasma glucagon (Amalia *et al.*, 2014). Prolonged treatment with its hydro alcoholic extract, it exhibited 22.5-33.8 % improvement while the butanolic extract demonstrated 26.6- 45.0 %. It was found to be effective in decreasing blood glucose level and also control the loss of body weight in diabetic rats in comparison to control (Minaiyan *et al.*, 2011).

Anti-ulcerative effect: The aqueous extract of *C. sativus* L. was screened for its efficacy in experimentally induced bowel disease. It was found to possess significant pharmacological activity against ulcerative colitis (Patil *et al.*, 2012).

Wound healing effect: Aqueous extracts of *C. sativus* found to be significantly effective for wound healing. Herbal paste preparation from the drug has shown significant ($P < 0.05$) enhancement on maturation, wound contraction and epithelialization (Patil *et al.*, 2011).

CONCLUSION

Present study provides an insight of the detailed Unani description of *Cucumis sativus* with main emphasis on its seeds which are reported to possess wide therapeutic index, various scientific exploration of its activity also reconfirms the claims of Unani medicine. Still, there is an ample scope for future researchers to explore more out of it. This study will provide a baseline to study on seeds of *Cucumis sativus*.

REFERENCES

- Agatemor MU, Nwodo OF, Anosike CA. Anti-inflammatory Activity of *Cucumis sativus* L. British Journal of Pharmacological Research. 2015. 8(2):1-8.
- Al Maghrabi Asbi. *Kitab Al fateh* (Urdu translation by Hk. Abdul Bari. New Delhi: Dept. of AYUSH. Ministry of Health and Family Welfare, India, 2007.
- Amalia F, Surialaga S, Rachmayati S. Effect of *Cucumis sativus* L. on Glucose Absorption through Intestinal Mucosal Membrane of Wistar Rat Models. Althea Medical Journal. 2014. 1(1):30-4.
- Andersen F.A. *Cucumis sativus* (Cucumber) - Derived Ingredients as Used in Cosmetics; Cosmetic Ingredient Review 1101 17th Street, NW, Suite 412.. Washington, DC 20036-4702. 2012.
- Anonymous. Indian Medicinal Plants. Indian Council of Medical Research. New Delhi, India: 210-221, 2009.
- Anonymous. Standardization of Single Drugs of Unani medicine. Part1, 3, 4. New Delhi 61-65. CCRUM, Dept. of AYUSH. Ministry of Health and Family Welfare, Govt. of India, New Delhi. 105,122, 2006.
- Anonymous. The Unani pharmacopeia of India, Part1, Vol. 4, New Delhi. Government of India. Dept. of AYUSH. Ministry of Health and Family Welfare, Rakmo Press Pvt Ltd. New Delhi, India, 2007.
- Baitar I., *Al-Jameul Mufridat al Adviawa Al-Aghzia* (Urdu Translation). Vol.1. New Delhi: CCRUM. Ministry of Health and Family Welfare, Govt. of India: 248-252, 1985.
- Burnham RJ. CLIMBERS. Censusing Lianas in Mesic Biomes of Eastern Regions. University of

Michigan. <http://climbers.lsa.umich.edu> [accessed on Jan 2021].

Daljeet. Unani Dravyagun Darsh. Uttar Pradesh. Ayurvedic and Tibbi Academy, India, Vol.II: 294-295. 1974.

Foong FH, Mohammad A, Ichwan SJ. Biological Properties of Cucumber (*Cucumis sativus* L.) Extracts. Malaysian Journal of Analytical Sciences. 2015; 19(6):1218-22.

Hakim MA. *Bustan ul mufradat*. Idara Kitabus Shifa, New Delhi, India, 2002.

Haleem MA. *Mufradat-e-Azizi*. CCRUM, New Delhi, India. 2009.

Heidari H, Kamalinejad M, Eskandari MR. Hepatoprotective activity of *Cucumis sativus* against cumene hydroperoxide induced-oxidative stress. Research in Pharmaceutical Sciences. 2012;7(5):936.

Karimi A, Majlesi M, Rafieian-Kopaei M. Herbal versus synthetic drugs; beliefs and facts. Journal of Nephro pharmacology. 2015;4(1):27-30.

Khan MA. *Muheet-e-Azam* (Urdu translation). Vol.1-4. CCRUM, Dept. of AYUSH. Ministry of Health and Family Welfare, Govt. of India, New Delhi, India, 2012.

Minaiyan M, Zolfaghari B, Kamal A. Effect of hydroalcoholic and buthanolic extract of *Cucumis sativus* seeds on blood glucose level of normal and streptozotocin-induced diabetic rats. Iranian journal of Basic Medical Sciences. 2011;14(5):436.

Nadkarni KM. Indian Materia Medica. 3rd Ed. Vol. 1. Bombay. Popular Book Depot, Dhootapa peshwar Prakashan Ltd. Panve. 2011.

Patil MV, Kandhare AD, Bhise SD. Effect of aqueous extract of *Cucumis sativus* Linn. Fruit in ulcerative colitis in laboratory animals. Asian Pacific Journal of Tropical Biomedicine. 2012;2(2):S962-9.

Patil MV, Kandhare AD, Bhise SD. Pharmacological evaluation of ameliorative effect of aqueous extract of *Cucumis sativus* L. fruit formulation on wound healing in Wistar rats. Chronicles of Young Scientists. 2011;2(4):207.

Pradhan D, Biswasroy P, Singh G, Suri KA. Anti-ulcerogenic activity of Ethanolic Extract of *Cucumis sativus* L. against NSAID (Aspirin) induced Gastric Ulcer in Wistar albino rats. International Journal of Herbal Medicine. 2013;1(3):115-9.

Sen S, Chakraborty R. Revival, modernization and integration of Indian traditional herbal medicine in

clinical practice: Importance, challenges and future. Journal of Traditional Complementary Medicine. 2016;7(2):234-244..

Sharma S, Dwivedi J, Paliwal S. Evaluation of antacid and carminative properties of *Cucumis sativus* under simulated conditions. Scholars Research Library Der Pharmacia Lettre. 2012;4(1):234-9.

Siddika M, Hasnat R, Bahar E. Thrombolytic (in vitro) and analgesic (in vivo) effect of methanolic extract of *Cucumis sativus*. The Pharma Innovation. 2016; 3 (12, Part A):01-07.

Soltani R, Hashemi M, Farazmand A, Asghari G, Heshmat-Gahdarjani K, Kharazmkia A, Ghanadian SM. Evaluation of the Effects of *Cucumis sativus* Seed Extract on Serum Lipids in Adult Hyperlipidemic Patients: A Randomized Double-Blind Placebo-Controlled Clinical Trial. Journal of Food Science. 2017;82(1):214-8.

Yuan H, Ma Q, Ye L, Piao G. The Traditional Medicine and Modern Medicine from Natural Products. Molecules. 2016;21(5):559.