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REVIEW ON *CUCUMIS MELO*: ETHNOBOTANY AND UNANI MEDCINE

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ABSTRACT

Cucumis melo which is commonly known as musk melon belongs to the family Cucurbitaceae and it is known as kharbuzah in Unani medicine. It is an annual climbing or creeping herb with angular, scabrous stem, simple soft hairy orbicular-reniform leaves and bears tendrils, by which it is readily trained over trellises. The aim of this review is to explore information available in Unani medicine and ethnobotanical literatures. Musk melons are extensively cultivated throughout India particularly in the hot and dry North-Western areas. Propagation is done by seeds and vegetative method. Main parts used are pulp, root, seeds and seed oil. It is having diuretic, emmenagogue, cooling, demulcent, aphrodisiac, galactagogue and astringent properties. Fruit has been used for several centuries to treat kidney disorders such as kidney and bladder stones, painful and burning micturition, ulcers in the urinary tract, suppression of urine and to treat cough, bilious diseases, hot inflammation of the liver, liver and bile obstruction, eczema, etc. The oil from seeds is said to be very nourishing and contains linoleic acid (60-70%), lecithin, cephalin and cerebroside isolated from seed oil. The seeds of melon contain multiflorenol, isomultiflorenol, 24-methylenecycloartenol, α- and β-amyrin, teraxerol, lupeol, euphol, 24-methyl-25(27)-dehydrocycloartanol, 24-methylene-24-dihydrolanosterol, 24-methylene-24-dihydroparkeol, tirucallol and cycloartenol. Its antimicrobial, antioxidant, anti-hyperlipidemic, anti-inflammatory, analgesic, diuretic, thyroid stimulatory, anthelmintic, nephroprotective and cytotoxic activity have been proved by research studies.

KEYWORDS: *Cucumis melo*, Musk melon, nephroprotective, Unani.

INTRODUCTION

Cucumis melo Linn. belongs to the family Cucurbitaceae. It is an annual climbing or creeping herb with angular, scabrous stem, simple soft hairy orbicular-reniform leaves and bears tendrils, by which it is readily trained over trellises. Flowers are unisexual and yellow. *Cucumis melo* is extensively cultivated for its fruits, eaten as a vegetable in many tropical countries. Sometimes it is naturalized in open scrub forests.[1-3]

The many varieties of melon show great diversity in foliage and still more in the size and shape of the fruit, which in some kinds is as small as an olive and in others it is as large as the gourd; some are globular, others egg-shaped, spindle-shaped or serpent like, the outer skin smooth or netted, ribbed or furrowed and variously coloured. The flesh is white, green, or orange when ripe, scented or scentless, sweet or insipid; some are bitter and even nauseous.[2,4]

Cucumis melo is known as Kharbuzah in Unnai medicine. It has been used for several centuries to treat kidney disorders such as kidney and bladder stones, painful and burning micturition, ulcers in the urinary tract, suppression of urine and to cure cough, bilious diseases, hot inflammation of the liver, liver and bile obstruction, eczema, etc.[1,5-8]

PLANT TAXONOMY

Kingdom	-	Plantae Plants
Division	-	Magnoliophyta
Class	-	Magnoliopsida
Order	-	Cucurbitales
Family	-	Cucurbitaceae
Genus	-	Cucumis
Species	-	*Cucumis melo* Linn
Synonyms	-	*Cucumis callosus* (Rottl.) Cogn., *Cucumis trigonus* Roxb.

VERNACULAR NAMES

Afghanistan - Sardapaliz, Sirdapaliz; *Arabic* - Battigh, Dummeiri, Kauun; *Bengal* - Kakri, Kakur, Kharmuj, Phuti; *Bombay* - Chibuda, Kakadi, Kharabuja; *Burma* – Takhva; *Chinese* - Kan, Kua, Tien Kua; *Danish* – Melon; *Dutch* – Meloen; *English* - Melon, Sweet Melon;

French- Melon; *German* – Melone; *Gujarat* - Chibdu, Shakarateti, Tarbucha; *Hindi* - Kakri, Kharbuja, Khurbuj, Tuti; *Italian* - Pepone, Popone; *Japan* - Mukuwauri, Tenkwa; *Malaya* - Tien Kua, Tien Kwa; *Persian* - Kharbuzeh; *Russian* – Melon; *Sanskrit* - Amritavha, Ervaru, Kalinga, Kharbuja, Madhupaka, Shadbhuja; *Spanish* - Melon, Melon muscatel; *Sudan* – Tagesrarit; *Swedish* – Melon; *Tamil* - Kakarikkai, Vellarikkai; *Urdu* – Kharbuzah.[1-3, 9-11]

HABITAT

Cucumis melo is extensively cultivated in gardens as well as in the sandy basins of rivers. Its centre of origin is supposed to be Africa. It is mentioned in some books as native of South Asia, which has come from the foot of the Himalayas to Cape Comorin, where it grows wild but it's cultivated in the temperate and warm region of the whole world.[4] Domestication of musk melon may have occurred independently in India, especially North and central India. Many forms of melons varying in size, skin, pulp-colour and taste are cultivated in North and Central India.[2,3,9,12,13]

CULTIVATION, PROPAGATION AND COLLECTION

Musk melons are extensively cultivated throughout India particularly in the hot and dry North-Western areas. Musk melons are grown with magnetically treated water showed higher yields, higher sugar contents and better colour than those grown with ordinary water. Propagation is done by seeds and vegetative method and an alternative method is through tissue culture.[2,3,10,12,14]

PLANT DESCRIPTION

This is an annual climbing herb with angular and scabrous stem.[1-3] Leaves are about 7.5 cm, orbicular-reniform in outline, 5 angled or lobed, scabrous on both surfaces and also often with soft hairs, lobes neither deep nor acute and 5 cm long petiole.[1-3, 14] Fruits are spherical ovoid elongate or contorted, glabrous or somewhat hairy, neither spinous nor tuberculate[1] and 5 cm long and 4 cm in diameter, yellow with age with green stripes when young. Seeds are obovoid and rounded at apex. Give fruits in August and September.[2] Flowers are small, yellow, unisexual flowers contain bells shaped corollas, male flowers borne in small clusters and female solitary. Male flowers have three stamens, whereas the female flowers have the ovary and three cells. In central India flowering is between July and August.[2-4, 14]

PARTS USED

Fruit pulp, root, seeds and seed oil.[1,2,6-8]

CHEMICAL CONSTITUENTS

Meloside A, meloside L and their caffeoyl ester have been isolated from leaves. A-carotene, β-carotene, C-carotene and three more carotenes are also isolated.[9, 15] Sulphur compounds (mostly thioesters) are responsible for the characteristic aroma of the fruits. 3-Methylpropanenitrile originating from 2-methyl-thiothyglucosinolate through the action of myrosinase thioglucoside glucohydrolase is a glucosinolate. The existence of myrosinase activity in fruit is because of 3- methylpropanenitrile. This activity seems to increase with the maturation of the fruit. Also, maximum activity of the l-amino cyclopropane-l-carboxylate oxidase was observed in the enzyme extracted from ripe melon fruits to which bicarbonate/ CO_2 have been added.[1,3,12]

Fruits contain ferulic, caffeic and chlorogenic acids. Fruit stalk contains cucurbitacin B and E.[9] Fruit has urease, peptedase, protease and Vitamin A, B, C.[16] Volatile compounds of cucumber and musk melon were analysed and methyl-2-methylbutaoate-(2)-3 hexanal, 2-hexanal, and ethyl-2 methyl propane were identified as the primary odorants. Ethyl 3-propanate and 3-(methyl thio) propyl acetate have been considered to be of importance of aroma profile of the fruits. The green notes of musk melon are because of -2- and -3-hexenal, 1,8-cineol and -1, 5-octadien-3-one.[3,12]

Methanolic extract of *Cucumis melo* fruit contains a saponin (C40H64O16, mp, 158-59˚) which is identified as stigmasta-7-16-25(26) triene-3-O-β-D-glucopyranosyl (15)-O-β-D-xylofuranoside. Presence of curcumin and leptodermin is also reported in the fruits.[12] Linoleic acid (60-70%), lecithin, cephalin and cerebroside isolated from seed oil. The seeds of melon contain multiflorenol, isomultiflorenol, 24-methylenecycloartenol, α- and β-amyrin, teraxerol, lupeol, euphol, 24-methyl-25(27)-dehydrocycloartanol, 24-methylene-24-dihydrolanosterol, 24-methylene-24-dihydroparkeol, tirucallol and cycloartenol.[15]

In *Cucumis melo* seeds, Codisterol, 25(27)-dehydroporiferasterol, avenasterol, clerosterol, isofucosterol, stigmasterol, campesterol, sitosterol, 25(27)-dehydrochondrillasterol, 24β-ethyl-25-(27)-dehydrolathosterol, 24ξ-methyllathosterol, spinasterol and 22-dihydrospinasterol were identified.[15] Cucurbit seeds are promising substitutes for various nuts in milk beverages. This is supported by evidence on the high enzyme activities of urease, lipase, lipoxygenase, trypsin inhibitors and low activity of β-amylase in musk melon. The seeds contain triterpenoid glucoside.[3,12,17] The protein content of seed meal 49.93%. The

seed contain myristic acid, phosphates, galactane, lysine, citrulline, histidine, tryptophane, cystine.[16]

UNANI PERSPECTIVE

Temperament (*Mizaj*)

Cold[2] and moist[2][5, 7, 18] Hot[1] and moist[2][6, 8, 19-21]

Adverse Effects (*Muzir Asrat*)

The fruits may cause allergy, congestion of eyes in plethoric people, headache, bilious fever, diarrhea and indigestion.[1,21,22] Also produce adverse effects on spleen and spleenic disorders and is not suitable for old persons and cold temperament people.[8,21] Its excess use causes adverse effect on stomach and intestine.[20]

Corrective (*Musleh*)

Following drugs have been recommended to be used along with Kharbuza to avoid its adverse effects which act as correctives. They are *Shahad* (honey),[8,21] *Banafsha* (*Viola odorata*),[8,20] *Zarish* (*Berberis vulgaris*),[20] *Sounf* (*Foeniculum vulgare*),[20] Salt and Sugar.[21]

Substitute (*Badal*)

The following drugs are mentioned in the Unani text as substitutes for Kharbuza. They are *Tukhm-e-Kheyareen* (*Cucumis sativus*),[20,21] *Badam shereen* (*Prunus amygdalus*)[20] and *Chilgoza* (*Pinus gerardiana*).[20]

Formulations (*Murakkabat*)

Banadiq-e-Buzoor,[19] Habb-e-Nafs-ud-Dam Silli,[24] Halwa-e-Salab,[24] Jawarish-e-Zaruni,[6] Jawarish-e-Zarroni Ambari,[24] Labube-e-Barid,[6] Majoon-e-Hajral Yahud,[6] Majoon-e-Kaknaj,[24] Majoon-e-Muravvahul Arvah,[6] Majoon-e-Salab,[23] Muffareh Barid Sada,[23] Qurs-e-Kafoor,[6] Qurs-e-Sartan,[6] Qurs-e-Sartan-Kafoori,[24] Sharbat Bazuri Barid,[19] Sharbat-e-Mudir,[6] Sharbat Bazuri Motadil,[6] Tiryaq-e-Masana.[23]

Therapeutic Dose (*Miqdar-e-Khurak*)

The therapeutic doses mentioned by various authors are as 7 – 15 g,[8] 7 – 12 g,[20] and 5 – 7 g.[21]

Pharmacological actions of Kharbuza

Lachrymatory (*Dhalka*),[1] diaphoretic (*Moarriq*),[1] detergent (*Jali*),[6-8,18,19] cooling (*Mubarrid*),[1-3,13,17] Diuretic (*Mudir-e-Baul*),[1-8,13,17-21] emmenagogue (*Mudir-e-Haiz*),[19, 21] liver deobstruant (*Mufatteh-e-Jigar*),[5,8,19,20] lithotriptic (*Mufattit-e-Hisat*),[5,6,14,19,21] nutritive (*Mughazzi*),[1,3,10,11,13] laxative (*Mulayyan*),[1,3,5,8] concoctive (Munzij),[8] demulcent (*Mulattif*),[9,10,13] strengthen the heart, brain and body (*Muqawwi-e-Qalb, Dimagh wa Badan*),[1,3,14] aphrodisiac (*Muqawwi-e-Bah*),[1,3,8,14] emetic (*Muqee*),[4,9,12,16] cleansing the kidney and bladder (*Musaffi-e-Kulliya wa Masana*),[5,8,20] urinary tract and uterus analgesic (*Musakkin-e-Majarebole wa Reham*),[8] purgative (*Mushil*),[4,9,13] fattening (*Musammin-e-Badan*),[1] appetizer (*Mushtahi*),[3,4,14,16] galactagogue (*Muwallid-e-Laban*),[1,3,6,20] flatulence (*Muwallid-e-Riya*)[20] and astringent (*Qabis*).[1,3]

Therapeutic uses of Kharbuza

Ophthalmia (*Amraz-e-Ain*),[1-3,12] liver disorders (*Amraz-e-Jigar*),[1,3,5,8] kidney disorders (*Amraz-e-Kuliya*),[1,3,8,14] chronic and bilious fevers (*Khuna wa safravi humma*),[1,3,5,8,19] cough due to heat (*Garm Khansi*),[5] painful and burning micturition (*Hirquat-ul-Baul*),[1,3,5,8,20] burning sensation of the oesophagus (*Hirquat-ul-Mari*),[1,20] kidney and bladder stones (*Hisat-e-Kuliya wa Masana*),[5-7,19,20] ascites (*Istisqa*),[1,3,6] burning sensation (Jalan),[2,3] insanity (*Janoon*),[1,3,9] improving complexion (*Mumallisat-e-jild*),[20] chronic and acute eczema (*Muzmin wa Haad Naar-e-Farsi*),[1,9,10,13] suppression of urine (*Quilat-e-Baul*),[1,10,13,19] liver and bile obstruction (*Tasuddud-e-Kabid wa Safra*),[13] biliousness (*Safravi Amraaz*),[1,20] vitiligo (*Bars*),[5,8,18] gonorrhoea (*Suzak*),[19,20] fatigue (*Thakawat*),[1] thirst (*Uttas*),[1,3,5,8] chest pain (*Wajaus Sadar*),[5,8,20] inflammation and ulcers in the urinary tract (*Warm wa Qurooh-e-Majar-e-Bole*),[6,9,19] hot inflammation of the liver (*Warm-e-Jigar Har*),[5, 20] bronchitis (*Warm-e-Shobatyn*),[1,3,14] dryness of the throat and tongue (*Yaboosat-e-Halaq wa Lisaan*),[5,8] jaundice (*Yarqan*),[6] sexual tonic and semen producing (*Zau-e-Baah wa Muzayyad-e-Mani*),[20] general debility (*Zauf-e-Amoomi*)[3,14] and dyspepsia (*Zauf-e-Hazm*).[1,3,13,14]

RESEARCH STUDIES ON *CUCUMIS MELO*

Phytochemical studies

Terpenoid profile of *Cucumis melo* (L). was elucidated using high performance thin layer chromatography (HPTLC). The Rf value of the different compounds present in the extract was found to 0.06, 0.21 and 0.93 of peak 1, 2 and 3 respectively. Among them, peak 1 was

found to be terpenoid compounds. *C. melo* fruit extract showed the presence of terpenoids and it was confirmed from the chromatogram after derivatization.[25]

The morphological, microscopic, physicochemical and chromatographic studies were carried out by Fahamiya et al (2012) developed quality control parameters for *Cucumis melo* Linn.[26] Sasi Kumar (2014) identified ten compounds in ethanolic extract of *Cucumis melo*, 5-hydroxy -6,7,8-trimethoxy-2,3-dimethyl-4H-chromen-4-one (21.04%) was the major proportion.[27] The effect of freeze-drying on the antioxidant compounds and antioxidant activity tests showed that there were no significant ($p < 0.05$) differences found between the fresh and freeze-dried fruit of muskmelon in the amounts of total phenolic compounds (TPC) and change observed in the ascorbic acid content.[28]

The methanolic extract of the seeds of *Cucumis melo* L. var. reticulatus (Cucurbitaceae) afforded three new chromone derivatives; 5,7-dihydroxy-2-[2-(4-hydroxyphenyl) ethyl] chromone, 5,7-dihydroxy-2-[2-(3,4-dihydroxyphenyl)ethyl] chromone and 7-glucosyloxy-5-hydroxy-2-[2-(4-hydroxyphenyl)ethyl] chromone, together with three known compounds; beta-amyrin, beta-sitosterol and beta-sitosterol-3-O-beta-glucopyranoside.[29]

A new phenolic glycoside (*E*)-4-hydroxycinnamyl alcohol 4-*O*-(2′-*O*-β-D-apiofuranosyl) (1″→2′)-β-D-glucopyranoside was isolated and identified from *Cucumis melo* seeds together with benzyl*O*-β-D-glucopyranoside, 3,29-*O*-dibenzoylmultiflor-8-en-3α,7β,29-triol and 3-*O*-*p*-amino-benzoyl-29-*O*-benzoylmultiflor-8-en-3α,7β,29-triol.[30]

21 cucurbitane-type triterpenoids, including nine new compounds and 12 known compounds were isolated and identified from the stems of *Cucumis melo*. Two known compounds, cucurbitacin B and cucurbitacin A showed significant cytotoxic activity against the proliferation of A549/ATCC and BEL7402 cells in vitro. Of the new compounds, only compound 7 was weakly cytotoxic.[31]

The seeds contained high percentages of lipids (35.36%) and proteins (29.90%). Hexane-extracted oil had acid, peroxide, iodine and saponification values of 1.51, 3.95, 89.5 and 226.73, respectively. Gas chromatographic analysis of the oil revealed the presence of twenty-five fatty acids varying from C_4 to C_{24} with the exception of C_5, C_7, C_{11} and C_{19}. Linoleic, oleic, palmitic and stearic acids were the principal fatty acids and had a relatively

high percentage of unsaturated fatty acids. Seed proteins were rich in arginine, aspartic and glutamic acids while limiting amino acids were methionine and lysine.[32]

Partial purification and characterization of three alpha-galactosidases, including a novel alkaline alpha-galactosidase (form I) from melon (*Cucumis melo*) fruit tissue was carried out by Gao and Schaffer (1999).[33] The form I enzyme showed preferred activity with raffinose and significant activity with stachyose. Other unique characteristic of this enzyme is weak product inhibition by galactose.

From the seeds of Cucurbitaceae fourteen dihydroxy triterpenes and their derivatives and one oxo-sterol were characterized. They are 7-oxodihydrokarounidiol-3-benzoate, isokarounidiol-3-p-methoxybenzoate, karounidiol-3-benzoate, karounidiol, isokarounidiol, 5-dehydrokarounidiol, 7-oxodihydrokaroudnidiol, bryonolol, 3-epibryonolol, loranthol, betulin, 29-hydroxylupeol, erythrodiol, (23Z)-cycloart-23-ene-3beta,25-diol and 7-oxositosterol among which the first two were the new naturally occurring compounds. Karounidiol and 7-oxodihydrokarounidiol were detected in all of the investigated seed materials.[34]

Cucumisin (EC 3.4.21.25) isolated from prince melon fruit is a plant serine protease. Its milk-clotting activity was compared with plant cysteine proteases such as papain (EC 3.4.22.2) and ficain (EC 3.4.22.3). Cucumisin was more stable than papain under the condition of pH 7.1, 37ºC for 24 h. The milk-clotting activity of cucumisin was same to that of papain and was half value of that of ficain.[35]

Two squash family trypsin inhibitors, CMeTI-A and CMeTI-B, were isolated from the melon (*Cucumis melo*) seeds, by ion exchange chromatography, gel filtration, affinity chromatography and high-performance liquid chromatography and their amino acid sequences were determined. All inhibitors contain 29 amino acid residues including 6 half-cystine residues.[36]

Triterpene alcohols in the seeds of two *Cucumis* species of cucurbitaceae. Isomultiflorenol was the major component accompanied by its Δ17-isomer, multiflorenol, in the triterpene alcohol fractions of the unsaponifiable.[37]

Pharmacological studies

Antimicrobial activity

The aqueous, heptane, petroleum ether and acetone extract of the whole plant of *Cucumis melo L*., *Pergularia daemia Frosk.* (Asclepiadaceae) was screened for the antibacterial and antifungal activity by Hemantkumar (2015).[38] Highest zone of inhibition was shown by whole plant and fruit extract of *Cucumis melo L.* with aqueous and acetone with *C. albicans* and E. coli 08 and 12 mm respectively. Very poor response was observed with acetone and aqueous extract in other bacterial and fungal stains. Highest zone of inhibition was shown by whole extract of *Pergularia daemia* with heptane with *E. coli* and C. *albicans*, 16 and 21 mm respectively.

Sasi Kumar (2014), found that the extract and fractionates of fresh fruits of *Cucumis melo* showed a significant and remarkable activity against all the microorganisms. Based on the antioxidant analysis obtained, it was showed that the extract of *Cucumis melo* fruits exhibits the greatest antioxidant activity through the DPPH radicals scavenging activity.[27]

Antioxidative and cytotoxic activity

A study was conducted to determine the activity of *Cucumis melo* extract and β-carotene in antioxidative and cytotoxic potencies by Wahyu Widowati (2015).[39] The study was done by examining the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging activity assay. *C. melo* extract showed more active anti-cancer both in HeLa (IC50: 23.649 µg/mL) and HepG2 (IC50: 110.403 µg/mL) cancer cells. C. melo extract (IC50: 16,670.404 µg/mL) and β-carotene (IC50: 50,645.994 µg/mL) had low cytotoxicity in NIH3T3 fibroblast. C. melo extract has lower antioxidant activity, but higher cytotoxic potency compared with β-carotene.

Vasundra Devi (2011) found that the *Cucumis melo* possessed Ferric Reducing Antioxidant Power and was found to possess cytotoxic effect against Ehrlich's Ascites Carcinoma cells.[40] The in vitro cytotoxicity of the aqueous extract of *Cucumis melo* against Ehrlich's Ascites Carcinoma cells were done at different concentrations for a period of 3 hours treatment. The aqueous extract of *Cucumis melo* showed cytotoxic effect against the Ehrlich's cancer cells in a dose dependent manner. As the concentration of the extract increased the cytotoxicity also increased.

Dose-dependent cytotoxic activities were exhibited by human prostate carcinoma PC-3 cell line with aqueous fruit extract of *Cucumis melo*. As the dose of the extract is increased, the numbers of viable cells are decreased. This confirms that the anti-cancer and cytotoxic potential of the fruit of C. melo.[41]

Anti-hyperlipidemic activity

Bidkar (2012) found that the treatment with *Cucumis melo* fruit peel (CMFP) methanolic and aqueous extract showed significant (P<0.01) reduction in gain in body weight, serum lipid profile like total cholesterol (TC), triglyceride (TG), low density lipoprotein cholesterol (LDL-C) level, atherogenic index and increased the serum high density lipoprotein cholesterol (HDL-C) levels in 28 days treatment when compared to the hyperlipidemic control group.[42] The fecal excretion of bile acids and sterols were further increased upon treatment with CMFP methanolic and aqueous extract and standard drug. Administration of methanolic extract of CMFP at a dose of 500 mg/kg showed higher antihyperlipidemic activity as compared to other extract treated groups.

Vitiligo

An open observational study to evaluate the efficacy and safety of the investigated product containing phenylalanine, *Cucumis melo* extract and acetyl cysteine, given alone or in combination with 311-nm narrow band microphototherapy, excellent repigmentation (>75%) was achieved by 38-73% of patients, depending on the treatment regimen. Mild to moderate side effects were observed only in patients treated with clobetasol 0.05% ointment. The tested gel formulation showed a good efficacy in improving vitiligo repigmentation. No side effects were observed.[43]

Antioxidant activity

The seed extract was found to have significant scavenging activity 75.59% at 300 µg mL-1 by 1, 1-dipheny1-2-picrylhydrazy1. picrylhydrazyl method and 69.86% at 400 µg mL-1 by Hydrogen peroxide method as compared to standard (ascorbic acid).[44]

A melon (*Cucumis melo* LC.) pulp concentrate (MPC) rich in superoxide dismutase (SOD) activity was tested for its ability to decrease stress protein expressions along the gastrointestinal tract in a swine model. A SOD-rich MPC provided at the dose of 50 IU/kg of food for up to 12 d was effective in lowering the level of stress proteins along the gastrointestinal tract of pigs after weaning.[45]

After 14 days of oral administration of 1250 mg of the melon extract/gliadin or vehicle, animals underwent 30 min of thoracic aortic cross-clamping and 4 h of reperfusion. The melon extract/gliadin blunted the DNA damage, reduced spinal cord apoptosis and attenuated NO release, however, without any effect on lipid peroxidation and organ function. Pre-treatment with the oral melon extract/gliadin may be a therapeutic option to reduce oxidative cell injury affiliated with aortic cross-clamping.[46]

Oxykine is the cantaloupe melon extract rich in vegetal superoxide dismutase covered by polymeric films of wheat matrix gliadin. Study carried out by Naito et al. (2005) showed that the treatment of oxykine ameliorated the progression and acceleration of diabetic nephropathy for rodent model of type 2 diabetes.[47] These results indicated that the oxykine reduced the diabetes-induced oxidative stress and renal mesangial cell injury.

The *Cucumis melo* L. extract (CME) inhibited in a dose-dependent manner the production of superoxide anion with a maximal effect at 100 mcg/ml. This inhibitory effect of CME appeared to be closely linked to the SOD activity because it was dramatically decreased after heat inactivation of the SOD activity (HI-CME). When the SOD activity was present in the CME it promoted the IgG1IC-induced production of IL-10 instead of TNF-alpha.[48]

Anti-inflammatory and analgesic activity

As far as anti-inflammatory is concerned, the maximum percentage inhibition by rat paw edema was 61.6% at 300 mg kg-1 observed. Further the extract showed maximum analgesic activity i.e. 70.6% at 300 mg kg-1 by acetic acid induced writhing method and increased the pain threshold significantly after 60 min at 300 mg kg-1 by tail immersion method.[44]

Diuretic and nephroprotective effects

The diuretic effects of the ethanolic seed extracts of *Macrotyloma uniflorum* and *Cucumis melo* in Albino rats were evaluated by measuring the urine volume, Sodium, Potassium, Chloride and Bicarbonate contents. A significant diuretic effect was observed from the experimental animals treated with extracts of *Macrotyloma uniflorum* and *Cucumis melo* individually compared to the control. Further, extract of *Cucumis melo* (400mg/kg) showed more diuretic effect than standard.[49] Pharmacodynamic investigations into the diuretic activity of *Cucumis melo* seed (ether extract) has been done by Singh and Sisodia (1970).[50] Jawarish Zarooni Sada (JZS) is one such polyherbal preparation containing 15 ingredients, mainly described to be diuretic and nephroprotective. Ethanol and water extracts of JZS

(300 mg each) were investigated for diuretic activity by measuring the total urine output over a period of 6 h. Sodium and potassium level in urine sample was also estimated. Nephroprotective activity of JZS against gentamicin-induced nephrotoxicity was investigated by administering JZS along with high dose of gentamicin (40 mg/kg) and elevation of serum urea and serum creatinine was taken as the index of nephrotoxicity. JZS showed significant diuretic and nephroprotective effect.[51]

Gentamicin treated group showed increased levels of blood urea nitrogen and serum creatinine, which were significantly retrieved in group pretreated with methanolic extract of *Cucumis melo* (ME-CM) seed kernel. The level of superoxide dismutase, catalase, glutathione peroxidase and reduced glutathione were increased with decrease in malondialdehyde content in ME-CM pretreated group when compared with gentamicin alone treated group. The histopathological analysis also showed the protective nature of ME-CM in gentamicin-induced renal damage.[52]

Thyroid stimulatory and antiperoxidative activity

Administration of peel extracts *Cucumis melo* (CM) fruits significantly increased both the thyroid hormones (T 3 and T 4) with a concomitant decrease in tissue LPO. In serum lipid profile CM reduced the concentrations of total cholesterol and low-density lipoprotein-cholesterol. The results revealed that the thyroid stimulatory and antiperoxidative role of peel extracts of *Cucumis melo* fruits.[53]

Anthelmintic property

Zinchenko et al. (1955) found anthelmintic pryoperties in *Cucumis melo* seeds.[54]

Inhibits human platelet aggregation

An active fraction was isolated from an aqueous melon extract (*Cucumis melo*) and was shown that it inhibits human platelet aggregation induced by epinephrine, ADP, collagen, thrombin, sodium arachidonate, prostaglandin endoperoxide analogue U-46619 and PAF-acether.[55]

CONCLUSION

Cucumis melo which is known as kharbuzah in Unnai medicine has been used for several centuries to treat different kinds of ailments by Unani physicians. There are large number of phytoconstituents have been discovered. However, very few pharmacological studies have

been carried out to prove its beneficial effects scientifically. Hence, this review will serve as base for further studies to validate the claims mentioned in the Unani medicine and ethnobotanical literatures.

CONFLICT OF INTEREST: None.

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