



A Review on Clinical and Preclinical Pharmacological Studies in Muskmelon Fruit

N Meghashree*, Satish S

Srinivas college of Pharmacy, Valachil, Farangipete Post, Mangalore, Karnataka, India-574143.

*Corresponding author's E-mail: meghaashree002@gmail.com

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ABSTRACT

Muskmelons are extensively cultivated throughout India particularly in the hot and dry North-Western are as belongs to family Cucurbitaceae. Muskmelon, also referred to as 'sweet melon,' got its name from its strong musky smell. It is a yellow-coloured fruit with tempting sweetness and a pleasant aroma. Generally, muskmelon fruit is eaten fresh or made salad or as a dessert. Seed kernels are used in soups and stews as a thickening, emulsifying, fat binding and flavouring agent. Muskmelon has rich calories, carbohydrate, protein, dietary fibre, sodium, vitamin A, folic acid, niacin, Vitamin C it is also nutrient enriched with good quantities of calcium, magnesium, potassium and carotenoids, does not have fat, cholesterol or saturated fat and have high content of polyphenol antioxidants which enhance the immune function and cardiovascular system. Polyphenols regulates nitric oxide that assists in prevention of heart attacks and also strengthens blood vessels. It can be used for weight loss purposes. During summer, it prevents dehydration of body and replenishes water content and electrolytes in the body. Musk melon is scientifically proven for its useful medicinal values such as Analgesic and Anti-inflammatory Activity, Anti-oxidant and Anti-Vitiligo Effect, Anti-ulcer activity, Anti-cancer activity, Hepato-protective activity, Diuretic effect, Anti-diabetic activity, Antibacterial activity, Antifungal activity. In this review, the effort has been made to focus on the pharmacological activities of the Muskmelon.

Keywords: *Cucumis melo*, Cucurbitaceae, Fruit, Muskmelon, Pharmacological action, Phytochemical constituents.

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INTRODUCTION

The word 'Musk' is derived from Persian literature which means "Perfume" and other word "melon" is fresh from the Latin Melo meaning "apple-shaped melon".¹ *Cucumis melo* originated in Asia and diverse wild and primitive melons are found on that continent, particularly in India². Musk melon fruits vary in size, shape and rind. The outer skin may be smooth, netted, ribbed, furrowed, yellow-brown, green, flesh yellow or pink. Ripe Musk melon fruit is nearly round, yellowish green, and rough textured. An immature Musk melon is green with a smooth rind, and may have shallow grooves depending on the cultivar. The fruits are many seeded.³

Muskmelons are relatively low in calories, fats, sodium and good source of potassium and it is recommended dietary allowance for vitamin A and vitamin C. In muskmelons there are many phytochemicals that have a potential health benefit. Three such compound found in Musk melons are Cucurbitacin-β, lithium and zinc which is helpful in prevention of cancer, fighting against depression, ulcer, dandruff, and stimulating the immune system.⁴

Phytochemical Constituents

Sulphur compounds (mostly thioesters) are responsible for the characteristic aroma of the fruits. Fruits contain ferulic, caffeic and chlorogenic acids. Fruit stalk contains cucurbitacin B and E. Fruit has urease, peptidase, protease and Vitamin A, B, C. Methyl-2-methylbutanoate-(2)-3 hexanal, 2hexanal and ethyl-2 methyl propane were identified as the primary odorants of musk melon. The green notes of musk melon are because of 2- and 3-hexenal, 1, 8-cineol and-1, 5 octadien-3-one.

Methanolic extract of *C. melo* fruit contains a saponin (C₄₀H₆₄O₁₆, mp, 15859°C) which is identified as stigmasta-7-16-25(26) triene-3-O-β-D-glucopyranosyl (15)-O-β-Dxylofuranoside. Presence of curcumin and leptodermin is also reported in the fruits. Myristic acid, phosphates, gelatine, lysine, citrulline, histidine, tryptophane, cystine were isolated from seed oil. The seeds of melon contain multiflorenol, isomultiflorenol, 24-methylenecycloartenol, α- and β amyryn, teraxerol, lupeol, euphol, 24-methyl-25(27)-dehydrocycloartanol, 24-methylene-24dihydrolanosterol, 24-methylene-24-dihydroparkeol, tirucallol and cycloartenol.⁵

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-oxodihydrokarounidiol, bryonolol, 3-epibryonolol, loranthol, betulin, 29-hydroxy lupeol, erythrodiol, (23Z)-cycloart-23-ene-3beta,25-diol and 7-



oxosterol among which the first two were the new naturally occurring compounds. Karounidiol and 7-oxodihydrokarounidiol were detected in all of the investigated seed materials.⁶

Ethanol extract of *Cucumis melo* fruit contain polyphenolic and flavonoids contents were found to be 56.5 ± 2.49 mg GAE/g of dry extract and 0.43 ± 0.09 mg QE/g of dry extract, respectively. Whereas the tannins content was 48.30 ± 0.9 mg ETA/g of dry extract. Melon pulp extract exhibited a good reducing potential with an EC50 of 4.23 ± 0.08 mg/ml and high hydroxyl radical scavenging activity with IC50 of 1.83 ± 0.09 mg/ml.⁹

Vernacular Names

Hindi- Karbhooja, English- Muskmelon, Kannada- Kekkarike hannu, Tamil- Tumatti kai, Sanskrit- Madhupala, Marathi- Chibunda, Tulu-Chippad.

Traditional Uses

Muskmelon acts as purgative. It is used in dysuria, regulate the kidney functions, reduced blood pressure, dyspepsia, flatulence, leprosy, fever, jaundice, diabetes, obesity, cough, bronchitis, ascites, anaemia, constipation, other abdominal disorders, amentia and menorrhagia. The fruit is used as cooling agent, cleansing agent or moisturizer for the skin. It acts as demulcent and stomachic. The seeds have antitussive, febrifuge and vermifuge properties. Fruit pulp is employed as a lotion for chronic and acute eczema.⁷

PHARMACOLOGICAL ACTIVITY *Cucumis Melo*

Pre-clinical studies

Analgesic and Anti-Inflammatory Activities

Methanolic extraction of *Cucumis melo* seed was screened for its analgesic activity using tail flick and tail immersion models in doses 100, 200, 300mg kg⁻¹ orally and it has proven for its analgesic activity which was due to its antioxidant effect. Carrageenin induces accumulation of leukocytes in the pleural cavity, as well as the enhancement of LTB4 levels in pleural exudates after inflammatory stimulus. Migration of neutrophils to the affected area constitutes an important pro-inflammatory factor, as they liberate toxic oxygen radicals in the extracellular medium. *Cucumis melo* inhibited the leukocyte influx and diminished LTB4 levels, thereby producing anti-inflammatory effect in group of Wister rats in doses 100,200,300mg kg⁻¹.⁸

Anti-Ulcer Activity

Methanolic extract of *Cucumis melo* was screened for anti-ulcer activity on swiss albino rats using in vivo pyloric ligation, water immersion test and indomethacin induced ulcer models in doses 50. 150. 300 mg kg⁻¹ orally. The mechanism of its gastro-protective activity may be attributed to reduction in vascular permeability, scavenging of free radicals and diminished lipid peroxidation along with strengthening of mucosal barrier.

Presence of phytoconstituents, triterpenoids and sterols are responsible for these actions.⁹

Diuretic Effects

Ethanol seed extract of *Cucumis melo* was screened for diuretic activity on male albino rats using Lipschitz method orally in doses 200 and 500 mg kg⁻¹. It produced diuretic activity individually, and synergistic activity in their combination and thus can be used to produce diuresis during oedema and also to treat hypertension. The diuretic effects of the extracts were evaluated by measuring the Urine volume, Sodium, Potassium, Chloride and Bicarbonate contents. The ethanol seed extract of *Cucumis melo* showed more diuretic effect than standard Furosemide.¹⁰

Hepato-Protective Activity

Methanolic extract of the fruits of *Cucumis melo* was analysed for the hepatoprotective activity against albino rats with liver damage induced by rifampicin-isoniazid showed significant protective action against the hepatotoxicity induced by the drugs used in the treatment of tuberculosis at the doses 100, 250 and 500 mg kg⁻¹ intraperitoneally. The methanolic extract showed significant hepatoprotective activity in 500 mg/kg ip dose. However, treatment of these extract completely protected the liver cells. Hence the hepatoprotective effect of the extract may be due to the presence of one or more phytochemical constituents present in the *Cucumis melo* which scavenged the free radical offering hepatoprotection. Thus, the methanolic extract of the fruits of *Cucumis melo* which are useful in controlling hepatic injury in drug induced hepatotoxicity.¹¹

Anti-Hyperlipidemic Activity

Methanolic extract *Cucumis melo* fruit peel have potent antihyperlipidemic activity against wistar albino rats using high cholesterol diet induced hyperlipidaemia model and which is equipotent activity when compared with Atorvastatin treated group. Histopathological findings add an additional note for protective effect. The active ingredient present in plant may recover the disorders in lipid metabolism noted in hyperlipidaemic state and further work would be necessary to evaluate the active constituents responsible for the activity and mechanisms of these effects. Therefore, it may be a potential therapeutic agent for treating hyperlipidaemia and can be further explored for future studies.¹²

Anti-Cancer Activity

The methanolic extract *Cucumis melo* Linn (MECM) extract used in the study had showed THP-1 cell lines (Human Monocytic Leukaemia), A-549 cell lines (Lung cancer), HeLa cell lines (Cervical carcinoma), and MG-63 cell lines (Human osteosarcoma) were used to assess MECM's in vitro cytotoxic capacity MECM's anticancer activity against different cell lines revealed that it has antiproliferative properties in all human tumour cell lines tested in a dose-dependent manner. It's hard to attribute this to a single



compound. As a result, one or more natural phytochemicals with potentially beneficial medicinal properties could be discovered and extracted from the fruits.¹³

Antibacterial and Antifungal Activity

The n-hexane and methanolic extract of Seeds of *Cucumis melo* L var. *reticulatus* evaluated using the agar plate diffusion assay showed potent antibacterial and moderate anti-fungal activity. The antimicrobial evaluation of the n-hexane and methanolic extracts revealed that the latter had potent antibacterial activity against *Pseudomonas aeruginosa* and moderate activity against *Escherichia coli*, while the n-hexane extract only displayed moderate activity against *Escherichia coli*. None of the tested extracts showed antifungal activity except against *Geotrichum candidum*, where they had moderate activity.¹⁴

Anti-Diabetic Activity

The study on Female db/db mice, a rodent model of type 2 diabetes using oxykinin in the *Cucumis melo* extract (CME) selected for its high in vitro superoxide dismutase (SOD) activity, which is covered by polymeric films of wheat matrix gliadin. The treatment of oxykinin ameliorated the progression and acceleration of diabetic nephropathy in type 2 diabetic rodents. The oxykinin reduced the diabetes-induced oxidative stress and renal mesangial cell injury. Oxykinin might be a novel approach for the prevention of diabetes nephropathy.¹⁵

Anti-Hypothyroidic Activity

According to the study on male wistar albino rats administering administration of 3 test fruit peel extracts (*Mangifera indica*, *Citrullus vulgaris* and *Cucumis melo*) with respect to the possible regulation of tissue lipid peroxidation (LPO), thyroid dysfunctions, lipid and glucose metabolism. Administration of three test peel extracts significantly increased both the thyroid hormones (T3 and T4) with a concomitant decrease in tissue LPO, suggesting their thyroid stimulatory and antiperoxidative role. This thyroid stimulatory nature was also exhibited in propylthiouracil (PTU) induced hypothyroid animals.¹⁶

Clinical studies

Anti-Platelet Activity

The studies were carried out in platelet rich plasma where the blood is obtained from the normal adult individuals. Adenosine isolated from an aqueous *Cucumis melo* extract inhibited human platelet aggregation induced by epinephrine, ADP, collagen, thrombin, sodium arachidonate, prostaglandin endoperoxide analogue U-46619 and PAF-acether. This activity of Musk melon may be helpful in the management of cardiovascular diseases. Identification of active substance as adenosine was indicated by TLC which gave identical R_f value compared to adenosine by the UV spectrum.¹⁷

Anti-Vitiligo Effect

The open study included 149 subjects, aged 18–72, affected by symmetrical vitiligo with long-term, stable or active lesions, involving 10% or less of the skin, 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 micro phototherapy, 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.¹⁸

CONCLUSION

Cucumis melo L. is a worldwide appreciated fruit that offers multiple benefits to human health. However, besides the pulp, its by-products, such as peels and seeds, may also be used in the production of extraction of oils, since they contain phytochemicals of high nutritional and functional capacity. For decades, it has played key roles in the field for its medicinal values as it holds extraordinary promise for the future in management of claimed disease. Since, no side-effects have been reported till date, Musk melon can be looked upon as a unique, affordable, safe and tasty fruit medicine.

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