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Impact of Natural Flavonoids: Review on Seeds of *Momordica charantia* Linn

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ABSTRACT

In the current review on *Momordica charantia* (Karela) an effort has been made regarding the medicinal properties of *Momordica charantia* seeds. Several medicinal properties of karela are present in the leaves, flowers, fruits and seeds. A wide range of secondary metabolites such as flavonoids, alkaloids, phenols, saponins, tannins, di-terpenoids have been isolated from the *Momordica charantia* seeds. Particular attention is given to its antimicrobial, anthelmintic antidiabetic, thrombolytic, antioxidant, analgesic, anti-diarrhoeal properties, so that its potential uses can be better evaluated.

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INTRODUCTION

World Health Organization defines herbal medicine as a variety of health practices, approaches, knowledge, and beliefs that include manual techniques, physical activity, spiritual therapies, and drugs derived from plants, animals, and minerals that are used singly or in combination to promote health and prevent disease. Herbal medicine is herbs, herbal materials, herbal preparations, and finished herbal products.[1-2]

One of the most important medicinal plants is *Momordica charantia L,* which is also known as bitter melon or karela and is a member of the Cucurbitaceae family. Momordica, which describes the ragged, seemingly-bite-shaped leaf margins, is Latin for "to bite." The entire plant, including the fruit, is bitter. The fruit has an oblong shape and resembles a little cucumber. The fruit is emerald green while young, but turns orange-yellow as it ripens. The presence of the black specks indicates that the karela is not brand new. On the other hand, it's acceptable if you discover red seeds inside. The presence of red seeds indicates a mature karela.[3-7]

These plant's leaves are simple membranous, with leaves ranging in size from 3.8 to 10 cm by 3.2 to 8 cm. The male flower is up to 2.8 cm long, with yellow petals that are 1.3–2.5 cm long, five corolla, and three stamens. And the female bloom has a little bract. Calyx and corolla are located below the peduncle's midpoint. The fruit of the female bloom is likewise yellow. Tendrils is elongated, straight, and hairless. This plant produces spherical, slender, and compressed, 8-15mm long, rectangular squares with a corrugated edge and sculpted surfaces, but covered in white pulp when green and scarlet when mature.[8-10]

It has been used for millennia in Ayurvedic and Chinese medicine for its effects on diabetes, inflammation, bacteria, cancer, and obesity. One of Karela's most well-known pharmaceutical functions is blood sugar regulation, which makes it a well-liked all-natural remedy for diabetes. The fruit's constituent charantin has been demonstrated to reduce blood sugar levels by boosting insulin production and reducing insulin resistance. Additionally, polypeptide-p and vicine, two bioactive substances that have been discovered to have anti-diabetic properties in both human and animal research, are present in karela.

Asthma, colitis, and rheumatoid arthritis are just a few examples of the many inflammatory illnesses that Karela helps to treat. It is also well known for its anti-inflammatory qualities. *In vitro* and *in vivo* studies have demonstrated the powerful anti-inflammatory properties of

momordicin, cucurbitacin B, and eleostearic acid, among other plant substances.[11] A potential therapeutic for infectious disorders is karela, which has also been discovered to have antibacterial and antiviral activity. *Escherichia coli*, *Staphylococcus aureus*, and the *herpes simplex* virus have all been demonstrated to be inhibited in studies to proliferate when karela extracts are used. Karela also has anti-cancer and anti-obesity properties, which could be used medicinally.

Biological source

Momordica charantia is a member of the family Cucurbitaceae, genus Momordica, and species *M. charantia*, respectively.[12] Almost sixty species of *momordica*, a little shrub or perennial climber, are found in tropical and subtropical countries[13] According to Volpato et al it is an edible plant that is grown in a variety of cultures throughout tropical and subtropical Asia, India.[14] They are extremely bitter fruits that are extensively used in cooking as well as a natural cure for treating various human illnesses, particularly diabetes.[15] Traditional medicine uses a variety of plant parts, including fruits, foliage, seeds, stems, and roots, to cure conditions like anemia, arthritis, infertility, kidney stones, stomach aches, and worms.[16]

Taxonomy[17]

Domain: Eukaryota

Kingdom: Plantae

Phylum: Spermatophyta

Subphylum: Angiospermae

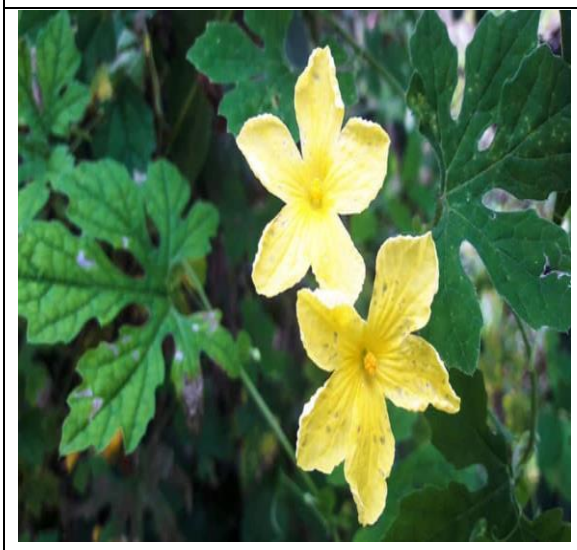
Class: Dicotyledonae

Order: Violales

Family: Cucurbitaceae

Genus: Momordica

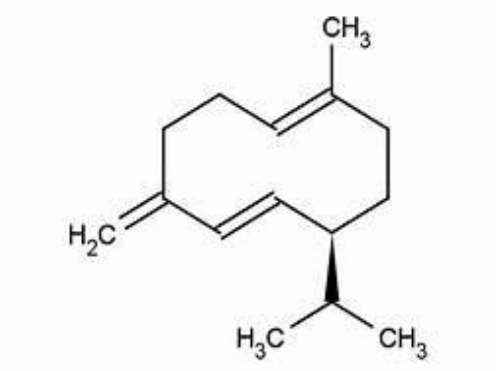
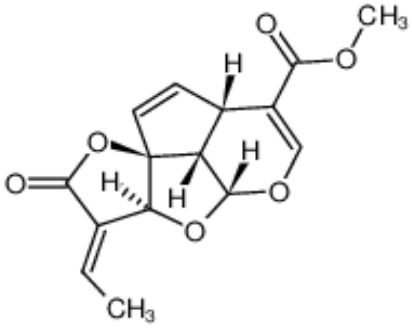
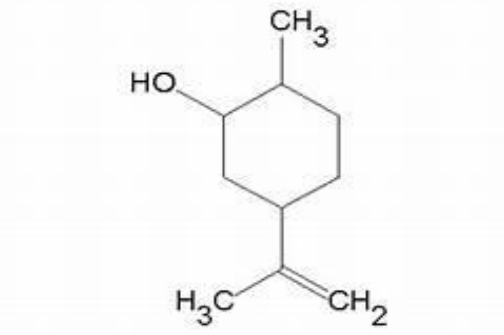
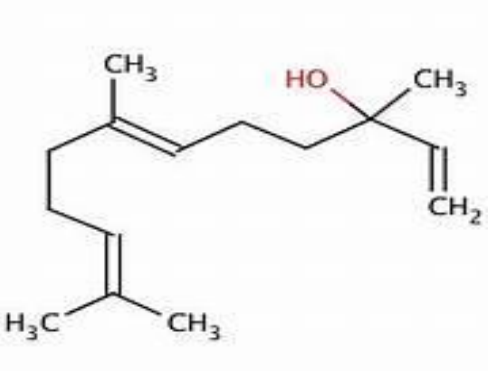
Species: *Momordica charantia L*

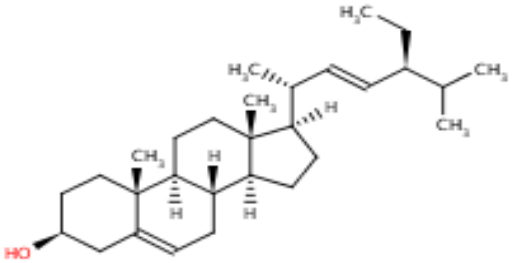
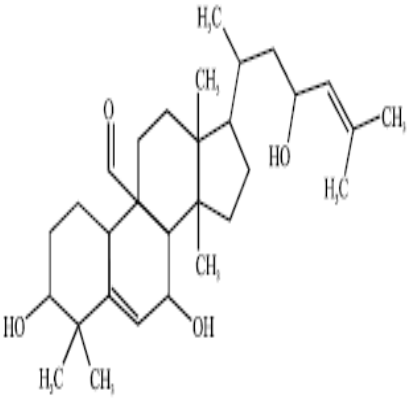
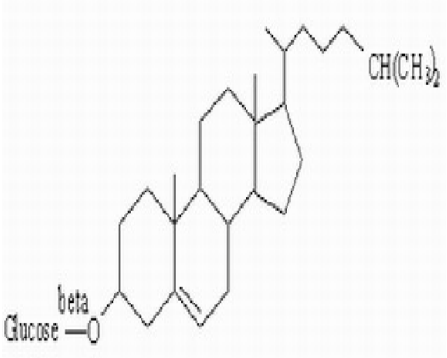
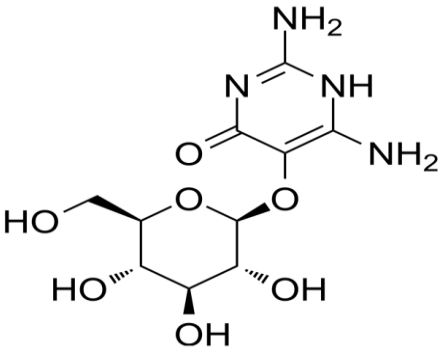
	
Bitter Gourd Fruit	Bitter Gourd Seeds
	
Bitter Gourd Flowers	Bitter Gourd Leaves

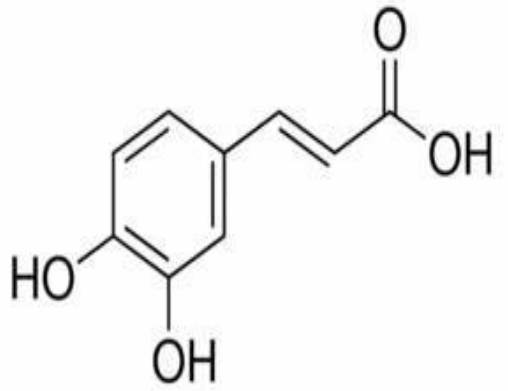
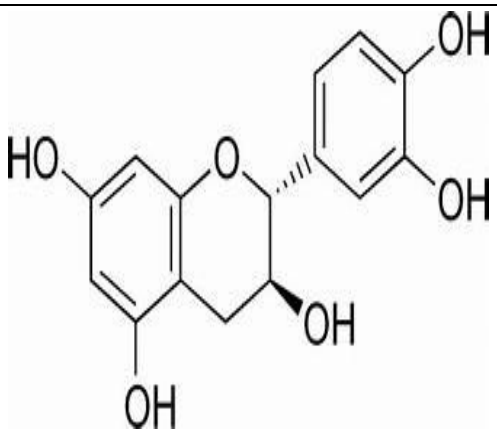
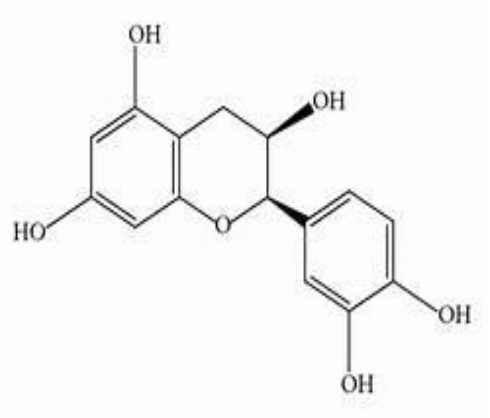
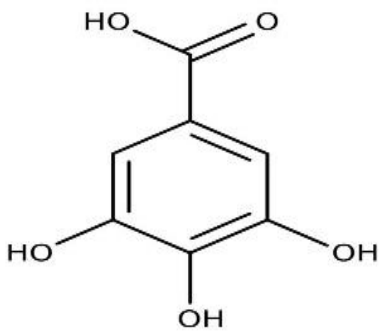
Geographical Source

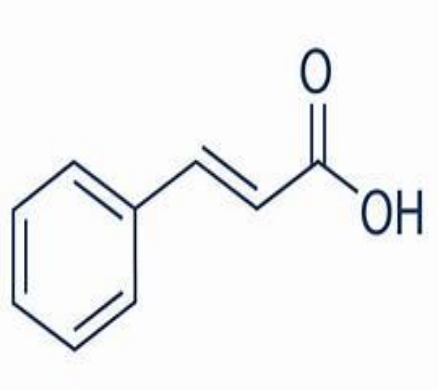
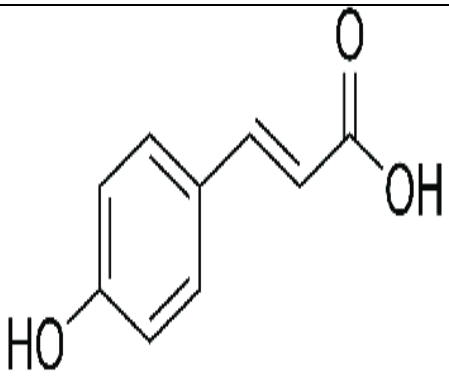
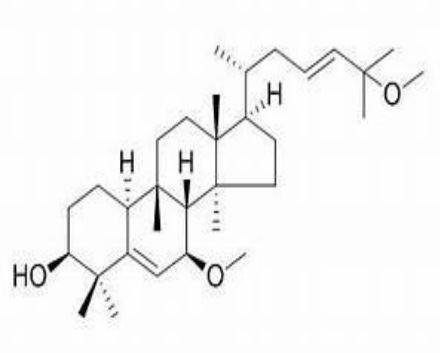
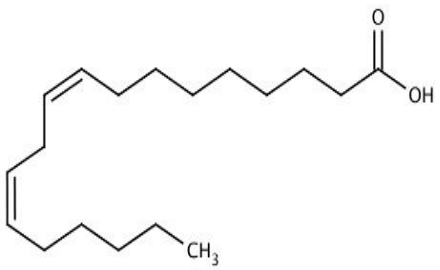
It grows well in the Caribbean, Amazon, East Africa, and Tropical Asia. It is cultivated all over the world for both culinary and therapeutic uses. Developing countries like Brazil, China, Colombia, Cuba, Ghana, Haiti, India, Mexico, New Zealand, Nicaragua, Panama, and Peru are among those where this is the case.[17]

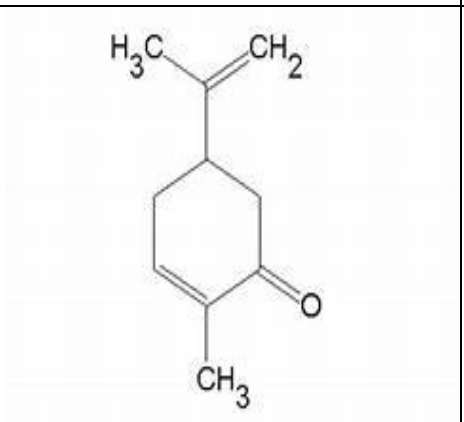
Chemical constituents

Compound name	Compound structure	Part of plant
Germacrene		Fruits[18]
Plumericin		Leaf and Stem[19]
t- Dihydrocarveol		Fruits[20]
t- Nerolidol		Fruits[20]

Stigmasterol glucoside		Fruits[18-23]
Momordicin		Leaf, Stem and Seeds[24-26]
Charantin		Leaf, Stem and Flowers[24-26]
Vicine		Seeds[27-28]

Caffeic acid		Leaf, Stem and Seeds[25-30]
Catechin		Leaf, Stem and Seeds[31]
Epicatechin		Leaf, Stem and Seeds[31]
Gallic acid		Leaf, Stem and Seeds[31]

Cinnamic acid		Leaf and Stem[32]
P-Coumaric acid		Leaf, Stem and Seeds[25]
Karavilagenin A		Leaf and Stem[32-35]
Lenoleic acid		Seeds[36-38]

Oleic acid		Seeds[36-38]
Stearic acid		Seeds[36-38]
Anethole		Seeds[39]
Carvone		Seeds[39]

Phytochemical Constituents

M. charantia contains significant levels of phenolic and flavonoid components. These include protocatechuic, Gentistic, vanillic, syringic, and p-coumaric acids, as well as t-cinnamic, t-ferulic, gallic, and gentistic acids. In the methanol hydrophilic extraction of *M. charantia* dialysis tubing with 3.5 kDa, quinic acid and rutin were the two flavonoids that were discovered in the highest amounts. The constituents of each phenolic acid were distributed in various tissues in varied ratios.[40] Gallic and benzoic acids, gentilic acid, flavanoic acids, catechin, ascorbic acid, chlorogenic acid, and epicatechin were frequent phenolic acids discovered in *M. charantia* seeds, with amounts ranging from 8.03 to 39.75, 22.06 to 72.46, 16.98 to 31.39, and additional ranges. Actively, the ranges are 4.44 to 15.78 and 16.19 to 44.20 Mg/100-gram dry content. Epicatechin and catechin are the two most valuable flavonoids found in plants. Shotipruk and Budrat discovered that catechu is most high phenolic acid prepared in bitter apple (45.16 mg/gm weight, 72-80% of all about phenolic contents) and that it is regulated by gentisic acid (4-11%), gallic acid (0.25-0.86%), and chlorogenic acid (0-0.16%) acids, among other acids.[41] The extracts of catechu, gallic, chlorogenic, gentisic acid, and elicitation all contain the same phenolic component.[42] Thus, *Momordica charantia* contains more quantity of phenols and flavonoids.

Antidiabetic property

According to Yuguda YM, the reduced molecular weight peptide 25 Kilo Dalton exerted the high antidiabetic action on sodium dodecyl-sulfate polyacrylamide gel electrophoresis study of the hydrolysate of bitter gourd seed protein that contained bromelain. After 21 days of oral administration of bromelain bitter gourd seed protein hydrolysate at dosages of 100 mg/kg, 200 mg/kg, and 400 mg/kg, spontaneously diabetic rats demonstrated a decrease in the blood glucose level, glycated hemoglobin (HbA1c) level, glucose level, and also shows lower level of lipid profile parameters (Chol, HDL, LDL, and TG) in the serum of the diabetic rats. The impact was however dose-dependent. Future research should focus on demonstrating the molecular mechanism of action and validating its bioactivity through human intervention studies for a novel protein hydrolysate source with *in-vivo* antidiabetic activity.[43]

Anthelmintic activity

According to Sen et al. India, *in vitro* anthelmintic activity of methanolic extract of 150 mg/ml of whole fruit, fruit peel, seed, whole fruit juice, and peel juice of *M. charantia* against

Indian adult earthworms (Eisenia foetida) was investigated.[44] Indian researchers Veda Murthy et al. investigated the effects of *M. charantia* seed extract on *Pheretima postuma*, an adult earthworm. The best anthelmintic action was demonstrated by the chloroform extract, which caused paralysis within 3 minutes and death within 8 minutes. *Momordica charantia* seeds have anti-*Pheretima postuma* anthelmintic properties to are inversely proportional to the time taken for paralysis/death of the individual worms. *M. charantia*'s chloroform extract exhibited the strongest anthelmintic activity. Ethanol extract was used against *P. postuma,* then aqueous extract, and finally petroleum ether extract.[45]

Antioxidant activity

According to Winarti L, Kumalasari LO, Ulfa EU et al. DPPH technique was used to assess the radical scavenging activity. A measurement known as the IC-50 represents antioxidant activity. The analysis revealed that the oil from bitter melon seeds contained 0.0118 0.0006% phenol and 0.0127 0.0004% flavonoid. The IC-50 of bitter melon seeds oil was determined by a study on the radical scavenging activity to be 11.31±0.77 mg/ml. The findings of this investigation on radical scavenging activity revealed very little action. Overall, the findings show that the oil from bitter melon seeds is a substance that has modest antioxidant activity.[46]

Antimicrobial activity

According to Baidya m, Anbu j et al. antibacterial and antifungal activity of EEPSS (Ethanolic extract of polyherbal seed shells) was investigated against two bacterial species and two fungus strains. At a concentration of 100 l/disc, EEPSS demonstrated a minimum of 24 mm inhibition against Escherichia coli and 22 mm inhibition against Staphylococcus aureus, but no zone of inhibition against fungal strains. At a concentration of 30 µg/disc, the standard drug inhibited *Escherichia coli* by at least 38 mm, *Staphylococcus aureus* by at least 35 mm, *Aspergillus Niger* by at least 20 mm, and *Candida albicans* by at least 26 mm.[47]

The agar well diffusion method was used in this investigation to assess 10 different plant materials for their antibacterial activity against 15 clinical isolates of multidrug resistance *Acinetobacter baumannii*. Betel leaves, watermelon peel, star anise, garlic, bitter gourd pulp, bitter gourd seeds, and vinca rosea leaves are among the plants that were tested. We found that ethanolic betel leaf extract had a positive impact on *A. baumann*ii isolates. The largest zone of inhibition against AQB88 was 35 mm, followed by 31 mm and then 140 mm. The zone of inhibition was 31.33 mm1.799 on average. Only a few types of bacteria were

effectively inhibited by other plant extracts such as vinca rosea leaf, bitter gourd, bitter gourd seeds, watermelon peel, lemon seeds, and garlic.[48]

Momordica charantia seed extracts made from methanolic, ethanolic, hexane, and ethyl acetate, which were effective against *S. aureus, Enterococcus*, and fungi, the aqueous seed extract showed superior antibacterial ability by suppressing the growth of *Fusarium solani* and *Pasteurella multocida*.[49-52] Since seed oil contains the primary components t-nerolidol, c-dihydrocarveol, and germacrene, which has antimicrobial action against *S. aureus, E. coli,* and *C. albicans.*[39,53]

Analgesic activity

According to Biswas AR, Ramaswamy S, Bapna JS et al., unripe *M. charantia* fruits were plucked and shade dried for four weeks at room temperature before the seeds were removed. In a series of extractions with powdered seeds, benzene, methanol, and water were used. The extracts were dried using a flash rotary evaporator. In initial studies with the various preparations, only the methanol extract (yield 9.4 g/100 g of dry seeds) showed a significant analgesic effect.[54]

Anti-diarrhoeal activity

According to Galvez J, Zarzuelo A, Crespo ME, Lorente MD, Ocete M, Jimenez J et al. It was found that the crude methanolic extract of *Momordica charantia* has the potential to have an anti-diarrheal effect. Loperamide is frequently used to treat diarrheal diseases and effectively combats diarrhea brought on by castor oil.[55] Aqueous fraction (400 mg/kg body weight) demonstrated a sizable percentage of diarrhoeal inhibition in the anti-diarrheal activity test. According to reports, the anti-dysenteric and anti-diarrheal activities of a plant extract are caused by the presence of tannins, alkaloids, saponins, flavonoids, and triterpenes.[56] This may be as a result of the extract's ability to boost water absorption by decreasing intestinal motility in the isolated rabbit ileum. Tannins are well known for having a decreasing effect on GI motility.[57]

Thrombolytic activity

According to Das et al.[58] Abedin et al.[59] Hussain et al.[60] fibrin and fibrinogen are routinely disrupted by thrombolytic drugs to lyse clots. In our work, we evaluated the capability for clot lysis of the crude methanolic extract. We discovered that the methanolic extract of *MC*

has concentration-dependent thrombolytic activity, with the lowest activity at 2 mg/ml (14.88%) and highest activity at 10 mg/ml (46.12%). As methanolic extract of *MC* contains significant concentrations of these phytochemicals, they can be the likely cause of the thrombolytic action. Phytochemicals found in medicinal plants, such as saponins, alkaloids, and tannins, are responsible for the thrombolytic activity.[61-62]

CONCLUSION

The seeds of *Momordica charantia* show various pharmacological activities which are reported in various research papers such as anthelmintic, antimicrobial, anti-diabetic, antioxidant, anti-diarrhoeal, analgesic, and thrombolytic activity. The current review concentrated on the impact of phenolic and flavonoid compounds, which exhibit anti-diabetic, anthelmintic, antioxidant, antimicrobial, analgesic, anti-diarrhoeal, thrombolytic activity of *Momordica charantia* seeds. In this review article, we have collected and compiled the details of research information on *Momordica charantia.*

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