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RESEARCH ARTICLE

NATURAL SILENT HEALING PROPERTIES AND PHARMACOLOGICAL ACTIVITY OF MOMORDICA CHARANTIA LINN

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ABSTRACT

Momordica charantia Linn. (*M. charantia*) commonly-known as karela, bitter melon, or bitter guard is tropical and subtropical areas around the world, mainly in Asia, India, China, and Brazil, where it is traditionally used as a medicinal plant, and the fruits of some varieties of *M. charantia* are consumed as food. Ancient days to now a day, it possesses many uses as anti-diabetic, carminative, anthelmintic, anti-malarial, anti-microbial, anti-viral, anti-carcinogenic, contraceptives, immunostimulant, laxative, antioxidant, insecticidal and also indicates in skin treatment (eczema, acne, mycoses, scabies, and hemorrhoid). Herbalism has a long tradition of use outside of conventional medicine. It is becoming more main-stream as improvements in analysis and quality control along with advances in clinical research show the value of herbal medicine in the treating and preventing disease. In this paper, we revealed the medicinal potency and pharmacological activity of *M. charantia*.

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INTRODUCTION

Since ancient times, a variety of plants have been used as medicine and vegetable throughout the world. *M. charantia*, a member of the Cucurbitaceae family, is widely distributed in tropical and subtropical regions of the world (Sorifa, 2018). The Latin name *Momordica* means "to bite" (referring to the jagged edges of the leaf, which appear as if they have been bitten). In Ayurveda, the fruit is considered as tonic, stomachic, stimulant, emetic, antibilious, laxative, and alterative. *M. charantia* has been used in various Asian traditional medicine systems for a long time. Like most bitter-tasting foods, bitter melon stimulates digestion. While this can be helpful in people with sluggish digestion, dyspepsia, and constipation, it can sometimes make heartburn and ulcers worse. The fact that *M. charantia* is also a demulcent and at least mild inflammation modulator, however, means that it rarely does have these negative effects, based on clinical experience and traditional reports (Lopes et al., 2018).

Plant Description: Karela, bitter melon, bitter cucumber, or bitter gourd are some of the names given to *M. charantia*. It belongs to the Cucurbitaceae family. *M. charantia* is a vegetable with many culinary uses, especially in Asia and

Africa, and is widely cultivated in the tropical and subtropical regions of the world, such as India, Malaya, China, Thailand, Japan, Singapore, Vietnam, Amazon, Brazil, China, Colombia, Cuba, Ghana, Haiti, Mexico, Malaya, New Zealand, Nicaragua, Panama, Middle East, Central, and South America (Balde et al., 2019). *M. charantia* is a slender and slightly hairy or hairless plant that can be grown at high altitudes. A description of each part of *M. charantia* is shown in Table 1 (Güdr et al., 2016).

MEDICINAL USES







Medicinal properties of *M. Charantia* include anti-microbial, anti-helminthic, anti-cancerous, anti-mutagenic, anti-tumourous, abortifacient, anti-fertility, anti-diabetic (Table 2) (Zeng et al., 2018). *M. charantia* is rich in nutrients like thiamine, beta-carotene, folate, riboflavin, and minerals like calcium, iron, phosphorus, manganese, potassium, magnesium, zinc, and dietary fiber. Regular use of *M. charantia* juice boosts body stamina and prevents chronic fatigue. The beta-carotene content in bitter gourd helps in controlling eye disorders and enhances eyesight (Urasaki et al., 2017).

- *M. charantia* stimulates a sluggish digestive system and treats dyspepsia
- Scientific studies show that fresh juice of *M. charantia* can lower blood sugar values and keep Insulin under check

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Table 1. Description of *M. charantia*

Part	Description	Image
Stem	Round, well-branched, internodes 5-6 cm, thin, corrugated and has unbranched tendrils in the axillae of the leaf	
Root	It has a primary root that extends to the vertex where the stem is born	
Leaves	Palmately-lobed, alternating, rounded edge with 3-7 lobes deeply separated and with quite small marginal points. They are distributed individually in petioles 1.5-5 cm long and have no stipules. When they are crushed, they give off a rather unpleasant smell (Emreet et al., 2017)	
Flowers	Solitary, pubescent, and with 5 yellow petals and 5 central stamens. The male flowers have thinner stems and larger petals than the female flowers and, while the male flower sepals are oval-elliptical, those of the female flowers are narrow and oblong-lanceolate (Poolperm et al., 2017)	
Fruit	Pendular discoid with ovoid shape, 2-10 cm in length, covered with broken or continuous longitudinal ridges and warts. The young fruit is white or emerald green that turns orange when ripe, and its white pulp becomes scarlet during ripening	
Seed	8-15 mm long, rectangular squares, corrugated on the margin, sculpted on both sides, but covered with a white pulp when green and red when ripe (Bai et al., 2018)	

Property	Active phytochemicals/extract administered	Test system	Mechanism of action/ targeted against an organism
Anti-viral	MAP 30 (Momordica Anti-HIV Protein) in seed and fruit extracts	Viral cell line, H9	Anti-HIV1 (Human Immunodeficiency Virus) activity
	Anti-HIV proteins MAP30	Human lung fibroblasts	Anti-HSV (Herplex Simplex Virus) activity
	Alpha and beta momorcharin(MMC) from seeds, fruits, and leaf extracts	Rabbit reticulocyte lysate	Anti-HIV activity
	Methanol extract	Shrimp	White spot syndrome virus
Anti-malarial	Leaf extract	Rat	Plasmodium falciparum
	Aerial part extract	Rat	Plasmodium vinckepetteri279BY (rodent malarial parasite)
Anti-bacterial	Water, ethanol, and methanol extracts from leaves	Shrimp	Broad-spectrum anti-microbial activity (Basavaraj et al., 2017)
	Leaf extract	Shrimp	Escherichia coli, Salmonella paratyphi and Shigelladysenterae
	Essential oil	Shrimp	Klebsiellapneumoniae, Bacillus megaterium, Bacillus subtilis, Proteus mirabilis, Aspergillusniger, Aspergillusflavus and Escherichia coli
Anti-diabetic	Green fruits	Human	Hypoglycemic activity detected
	Subcutaneously administered p- insulin	Human	A decrease in blood glucose level in IDDM (Insulin-Dependent Diabetes Mellitus) patients
	Fruit powder	Human	Increase in glucose tolerance and fasting glucose levels in NIDDM (Non-Insulin Dependent Diabetes Mellitus) patients
	Seed powder	Human	A decrease in postprandial glucose levels
	Charantin administered orally or intravenously	Rabbit	Fall in blood glucose level
	Chloroform extract Administered intravenously	Alloxan induced rabbit	Fall in blood glucose level
	Pulp juice	Rats	Fall in blood glucose level
Anti-cancerous	Alcoholic fruit extract	Rat (1 hour after feeding glucose to the normal)	Fall in plasma glucose level (Farooqi et al., 2018)
	Fruit and seed extract	Mice	Extract activates natural killer cells in mice
Anti-helminthic	The crude plant extract, MAP 30	Rat	Lymphoid leukemia, lymphoma, squamous carcinoma of tongue, larynx, human bladder carcinoma, Hodgkin's disease
	Plant extract	Rat	Free-living nematodes
Anti-tumour	Lyophilised plant extract	Rat	Caenorhabditiselegans
	Crude extract	Mice	Tumor formation inhibition in CBA/DI tumor cell line
Anti-mutagenic	Green fruits containing acyl-glucosyl-sterols	Mice	80% reduction in the number of micronucleated polychromatic erythrocytes induced by mitomycin C
Abortifacient	Alpha and beta MMC in seeds extract	Mice	Induction of mid-term abortion
Anti-fertility	Ether, benzene and ethanol extracts	Male rat	Anti-spermatogenic activity (Jones et al., 2018)

Table 3. Ethnobotanical uses of *M. charantia* in India

Plant part	Type of extract	Route of administration	Used by a human (male/female)	Ethnobotanical uses
Leaf	Leaves	Oral	Child	Purgative in children
Leaf	Hot water extract	Oral	Adult	Anthelmintic
Leaf	Hot water extract	Oral	Adult	Treatment of leprosy, piles, and jaundice
Leaf and flower	Hot water extract	Oral	Female	Used regularly each month to avoid childbirth (Yoshime <i>et al.</i> , 2016)
Leaf	Juice	Oral	Adult	Leaf juice rubbed on the affected parts for the treatment of ringworm
Leaf	Juice	Oral	Child	5-6 drops of leaf juice extracted from half fried leaves are administered to infants during breastfeeding for a bowel movement
Leaf	Juice	Oral	Child	1 teaspoon leaf juice with few drops of honey administered thrice a day for cough, congestion and chest pain in children (Tuan <i>et al.</i> , 2017)
Root	Hot water extract	Oral	Pregnancy	Used for abortions up to II-trimester (v month) of pregnancy
Root	Paste	oral	Adult	Root paste administered with milk to reduce the scars in smallpox
Fruit	Decoction	Oral	Adult	Treat diabetes
Seeds	Hot water extract	Oral	Adult	Seeds are boiled and the extremely bitter effusion is said to produce instantaneous vomiting
Shoots	Shoots	Oral	Adult	Used to treat pneumonia and leucorrhoea (Sung <i>et al.</i> , 2018)

- *M. charantia* juice can also prevent jaundice by detoxifying, nourishing and strengthening the liver and may be beneficial in the treatment of a hangover
- *M. charantia* is an Immuno-modulator. It might improve immune cell function in people with cancer
- Piles: A popular folk remedy is to mix 3 teaspoonfuls of juice from *M. charantia* leaves with a glassful of buttermilk to be taken every morning for about a month on an empty stomach
- Cholera: Fresh juice of leaves of *M. charantia* is also a useful medicine in the early stages of Cholera and other types of diarrhea (Soo May *et al.*, 2018).

Ethnobotanical Uses: *M. charantia* is very important so far as ethnomedical practices are concerned. Ethnobotanical uses of *M. charantia* in India are enumerated in Table 3 (Mohan *et al.*, 2017).

Pharmacological activity: As *M. charantia* has been used for the treatment of various kinds of diseases since ancient times, it is still widely applied for therapy in Latin America and Asian countries as mentioned above. The following is an overview of its common pharmacological activities (Massimo *et al.*, 2019).

- **Anti-diabetic activity:** *M. charantia* contains bitter chemicals like, charantin, vicine, glycosides, and karavilosides along with polypeptide-p plant insulin, which is hypoglycemic in action and improves blood sugar levels by increasing glucose uptake and glycogen synthesis in the liver, muscles and fat cells. Reports indicate that they also improve insulin release from pancreatic beta cells, and repair or promote new growth of insulin-secreting beta cells.

- P-Insulin, a polypeptide from the fruits and seeds rapidly decreased and normalized the blood sugar level in rats. Bitter melon contains another bioactive compound i.e. lectin that has insulin-like activity. This lectin is a major contributor to the hypoglycemic effect that develops after eating Karela. Charantin extracted by alcohol is a potent hypoglycemic agent composed of mixed steroids which are sometimes used in the treatment of diabetes to lower the blood sugar levels (Deng *et al.*, 2019).
- **Antioxidant activity:** Antioxidant activity of extracted phenolic compounds from *M. charantia* has been reported. Antioxidant properties of *M. charantia* Seeds on Streptozotocin induced-diabetic rats have been studied and results suggest that seeds of *M. charantia* may effectively normalize the impaired antioxidant status in streptozotocin induced-diabetes (Yue *et al.*, 2019).
- **Anti-cancer activity:** The clinical trials have not been conducted using *M. charantia* extracts in cancer patients, in vitro studies indicate bitter melon fruit and seed extracts inhibit the growth of some cancer cell lines, including prostate adenocarcinoma, human colon cancer (Caco-2 cells), and the very much metastatic breast cancer cell line MDA-MB-231 (Svobodova *et al.*, 2017).
- **Immunomodulatory activity:** Immunomodulatory activity of *M. charantia* showed that it has a variable effect on the immune system in some conditions, like allograft rejection, someplace it was shown to have an immunosuppressive effect and in some other cases immunostimulant.

- The immunomodulatory activity has been attributed to an increase in interferon production and natural killer cell activity (Raish *et al.*, 2018).
- **Anti-malarial activity:** *M. charantia* is traditionally regarded by Asians, as well as Panamanians and Colombians, as a useful plant for preventing against used treating malaria. Laboratory studies have confirmed that various species of *M. charantia* have antimalarial activity. Leaves brewed in hot water to create a tea to treat malaria (He *et al.*, 2018.).
- **Anti-genotoxic activity:** *M. charantia* decreases the genotoxic activity of methyl nitrosamine, methanesulfonate, and tetracycline, as shown by the decrease in chromosome breakage (Jia *et al.*, 2017).
- **Anthelmintic activity:** *M. charantia* was found more effective in the treatment of *Ascaridiagalli*. Ethanol (95%) extract of fruit juice, was found active on *Ascaridiagalli*, whereas, hot water extract of seed at a concentration of 1:50 was active on *Haemonchus contortus* (Rao *et al.*, 2018).
- **Hypocholesterolemic activity:** Experiments carried out in normal, as well as diabetic animals, have shown hypocholesterolemic effects by *M. charantia*. In a study, sunflower fed rats were fed with conjugated octadecatrienoic fatty acid isolated from *M. charantia* seeds for 4 weeks. After 4 weeks, these rats showed a significant lowering of the plasma lipid peroxidation and erythrocyte membrane lipid peroxidation as well as non-enzymatic liver tissue lipid peroxidation (Peter *et al.*, 2019).
- **Hypolipidemic activity:** In an in vivo study the elevated cholesterol and triglyceride levels in diabetic rats were returned to normal value after 21 days of administration of bitter gourd fruit and seeds. Evaluated the effects of bitter gourd oil on the blood and liver lipids of rats (Pahlavani *et al.*, 2019).
- **Anti-inflammatory activity:** The anti-inflammatory activity of dried leaves was comparable to 10 mg/kg of indomethacin. Further, the wound healing capacity of fruit powder was comparable to those of povidone-iodine ointment in excision, incision, and dead space wound model in rats (Saad *et al.*, 2017).

Conclusion

The use of the medicinal herbal plant for curing disease has been documented in the history of all civilizations. We concluded that *M. charantia* is a potential herbal plant which is used as vegetable and medicine in the world. Thus, numerous medicinal and ethnobotanical uses of nearly all parts of the plant indicate a long association of the plant with people, especially in India. *M. charantia* is a good source of various medicinally important biochemicals (triterpene, protein, steroid, alkaloid, and phenolic) which are responsible for its biological and pharmacological activities including anti-diabetic, antioxidant, anti-carcinogenic, anti-tumorous, anti-microbial, anti-fertility, anti-viral, anthelmintic, anti-malarial, anti-ulcerative and immunomodulatory. Further studies are required to find many more activities of this plant.

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