
NATURE'S SILENT HEALER: *MOMORDICA CHARANTIA* L.

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ABSTRACT

Momordica charantia, a member of the Cucurbitaceae family, is a plant that is frequently cultivated in tropical and subtropical climates. *M. charantia*, which has been used for a long time to treat several diseases. Asian herbal treatments employ curcumin to treat a variety of diseases and conditions. *Momordica charantia* is a plant that is used to cure diabetes, tumours, parasites, viruses, and stomach ulcers. It includes a number of physiologically and pharmacologically active components, including triterpene, collagen, antibiotics, alkaloids, inorganic, lipid, and phenolic compounds. As a result of the addition of Ayurvedic goods like Gunna, Rasa, and Virya, GunnaRasa becomes GunnaRasa, which is, in turn, drier, more pungent, less bitter, and hotter. The current study looks to examine if *M. Charantia* has antioxidant and antibacterial characteristics to emphasise more about its biology.

Keyword: *Momordica charantia* L, traditional medicinal plant

INTRODUCTION

Momordica charantia L. (MC), often known as bitter melon or bitter gourd, is a tropical and subtropical plant that is a member of the Cucurbitaceae family. It is thought that the numerous phytochemicals found in *Momordica* species offer a variety of positive health effects. The plant has been used for both traditional and alternative medicine for a very long time; it has also been the subject of extensive research [1], and studies have shown that it is effective for a wide range of illnesses, including AIDS, diabetes, obesity, asthma, tuberculosis, and viral and bacterial infections.

Karela, commonly known as bitter melon, has long been utilised in Ayurvedic treatment. The seeds, roots, leaves, and, in especially, the unripe fruits of the plant, each have unique pharmacological properties [2]. Juices of all kinds are used in medicine for a variety of health advantages, including the relief of joint pain, the treatment of jaundice, liver and digestive tract illnesses, and the treatment of persons who have a persistent fever. Juice also has diuretic, laxative, and anti-helminthic properties.

It works well when used locally to treat chronic skin conditions and to cure open wounds, boils, and rashes. To cure type 2 diabetes, it is advised to ingest the entire plant [2]. In order to heal and relieve stomach ulcers, an oil infusion made from bitter melon and warm olive oil from the sun is given topically to the digestive system [3]. Among other things, bitter melon is used in African folk medicine to treat rheumatism, skin conditions, dysentery, fever, and parasitic infections (roots).

T2DM practitioners treat liver illness, ulcers, boils, and burns with a decoction of leaves, fruits, and herbs. On top of that, gonorrhoea, scabies, measles, chicken pox, and malaria are all treated using

momordica remedies. In the Caribbean, it's usual practise to treat diabetes with fruit juice or leaf decoction.

The leaf decoction is occasionally used to prevent excessive blood pressure, diarrhoea, malaria, and other illnesses. Rheumatoid arthritis is treated with it [1].



Figure 1 Momordica plant with fruits and flowers

Botanical features

Hindi name: Karela, kareli

English name: Bitter gourd

Sanskrit: Karavelli

Growth habit: This tropical, subtropical, tendril-bearing climber (*Momordica charantia* Linn.) is a family of plant native to tropical and subtropical regions.

Root: Tap root.

Stem: Stem is slender, pubescent

Distribution: Along with other regions, it can be found in Asia, some nations in Europe, Africa, and the Caribbean. Since Momordica is a warm-season crop, it is grown there all year long. Every year, between April and July, this crop is grown.

Leaf: Simple palmately 5-7 lobed, typically glabrous or with little pubescence, and tendrils solitary or forked into two branches with alternate leaves having 3-7 deeply separated lobes The lobes have a few small peripheral tips, but the majority of them are blunt. The fashion has no rules.

Flower: Actinomorphic flowers with staminate plants often have a single, calyx-toothed flower with five lobes, five petals, three stamens, and several ovules that develop horizontally with a stigmatic stigma with three lobes. On short peduncles (female) or long peduncles (male), the perianth bears a brief to lengthy epigynous zone that transforms from yellow to yellowish green (male).

Fruit: Pepo, a fruit approximately 5-25 cm long with a pendant, fusiform, beaked, scaly body; has several tubercles, a rosette-like exterior, and an oblong shape. The young fruit is a vivid emerald green as it is but can change to a brilliant orange as it is mature. It is noticeably bitter across all foods.

Seed: Common and widely distributed, with diameters of 13-16 mm, ellipsoid, compressed, embedded in red pulp, wrinkled around the margins, and sculptured on both sides.

Taxonomic Classification [4]

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Cucurbitales

Family: Cucurbitaceae

Genus: Momordica

Species: charantia Linn.

Phytoconstituents of the Momordica charantia Linn.

Ten metres long, *M. Charantia* is a medicinal plant. The plant has 4-5 cm wide leaves that have 3-7 evenly spaced lobes. The plant bears fruit that is oblong and has a waxy coating. The fruit's hollow interior contains seeds and a white centre [5]. Monoecious climbing weed *M. Charantia* develops from an annual to a perennial stage. It might not have any hair or have some. The stems extend from the cardinal taproot's tip to climb over every support that is present [6].

The nutritional value is decreased due to low levels of carbohydrates and proteins compared to other Cucurbitaceae members, which have great nutritional value attributed to contents of iron, phosphorus, and ascorbic acid [7]. Many *M. Charantia* species found in Thailand can be divided into two groups: Satunthottam, or Thai bitter melon, which has smaller, spindle-shaped fruit, and Mara-chin, or Chinese bitter melon, which has bigger, cylindrical fruit.

Thai bitter melon, also known as Mara-Khee-Nok, is a smaller, pear-shaped variety of bitter melon [8]. The *M. Charantia* species, a member of the Cucurbitaceae family, features vivid red blooms. The most popular fruit varieties are ellipsoid or spherical in shape, warty, pockmarked, or ridged. Some frequently possess fleshy, seed-containing capsules that split irregularly into three valves [9]. The 14th-century discovery of *M. Charantia* in India was transported to China. Both subtropical and tropical nations are familiar with acetyl [10].

The ingredient list for the product includes carantine, cycloartenols, cucurbitanes, cryptoxanthin, elaeostearic acids, diosgenin, ergythrodol, galacturonic acids, goyaglycosides, hydroxytryptamines, momordenol, gypsogenin, gentisic acid, linosterol and guanylatecyclasi.

Traditional uses

Karela has been used for a long time in numerous conventional forms of Asian medicine for the prevention and treatment of diverse diseases.

Fruits used in *Momordica charantia*, burning sensation, hypertension, colic, constipation, cough, diarrhoea, measles, gout, helminthiasis, inflammation, leprosy, skin conditions, ulcer, and bite. It has also been demonstrated that there are hypoglycaemic (antidiabetic) properties in both animal and human

research. Karela juice leaves used for fully treating stacks. Because of its bitter tonic qualities, karela is used as a blood purifier. It may cure boils and other blood disorders that appear on the skin. Karela juice is also useful to cure and avoid liver injury [11-12].

Leaves are used for menstrual diseases, sense of burning, constipation, fever (malaria), colic, infection, larvae, and parasites as emmenogogue, measles, hepatitis, and helminthiasis [13]. Leaf tea is used in traditional medicine in Guyana for asthma, for the expulsion of intestinal gas, to facilitate menstruation and antiviral treatments for measles, hepatitis, and feverish disease. Topically, it is used in worms, wounds, pathogens and internally and externally for worms and parasites [14]. Seeds are used for ulcers, liver and spleen complications, diabetes, intestinal infections, elevated cholesterol, intestinal gas, healing, gastrointestinal damage etc.

Roots for the prevention of syphilis, rheumatism, boils, ulcer, septic swelling, ophthalmia and for Prolapsus vagenae are included [15]. Karela juice helps alleviate the Pyorrhoea issue (bleeding from the gums). The United States commonly offers karela capsules and tinctures for prevention of asthma, viruses, cold influenza, disease, tumours, elevated cholesterol and psoriasis [16].

Ethnopathic use of tribals for abortions, birth control, increased milk flow, vaginal disorders, constipation, hyperglycemia, foodstuffs, diabetes, stones, kidney, fat loss, liver, fever (malaria), jaundice, gout, eczema, haemorrhoids, hydrophobia, parasitic bowels, skin, lily leprosy, pneumonia, psoriasis and rheumatism, scabies, bacterium, etc [17].

Medicinal Uses of *Momordica charantia*

⌋ Momordica is rich in minerals including potassium, calcium, manganese, magnesium, zinc oxide, phosphorus, and dietary fibre as well as nutrients like beta-carotene, foliate, thiamine, riboflavin, and vitamin A. Momordica's potent antioxidant capabilities are all related to the phenols, anthroquinones, flavonoids, terpenes, isoflavones, and glucosinolates that give it its bitter flavour [18]. Bitter gourd juice reduces eye problems and improves eyesight when regularly drank, and it increases physical endurance to prevent chronic weariness.

⌋ Bitter melon stimulates acid secretion and treats dyspepsia by the stimulation of the digestive tract.

⌋ Bitter melon juice helps to keep insulin levels under control and reduces blood sugar levels. The phytochemical charantine, alkaloids, and insulin-like peptides all reduce glucose resistance without raising blood sugar levels and share the hypoglycaemic function of bitter guardians. These bioactive substances aid in the absorption of glucose and every other diabetic action, activate the AMPK protein, and regulate fuel metabolism. The amount of Beta cells in the pancreas that makes insulin increases as a result of bitter melon. The bitter gourd's anti-cancer, anti-inflammatory, and anti-diabetic properties have been noted in numerous studies, and many pharmaceutical companies have utilised them in their formulations [19]. Bitter gourd juice to enhance the liver and avoid yolk. Bitter melon juice can detox and nourish the liver and be effective in the treatment of hips.

⌋ An immune modulator, hypothetically bitter melon, will improve the immune cell role of patients with cancer. It is frequently used for malaria, cold and flu, fever, tumours, elevated cholesterol, psoriasis, and cancer treatments.

JA hypothetical bitter melon immune modulator would enhance the immune cell function of cancer patients. It is also used for malaria, cold and influenza, fever, tumours, high cholesterol, psoriasis, and cancer therapies[20].

Antidiabetic Activity

Phytochemicals found in *Momordica charantia* include vicine, charantine, polypeptides-p, insulin plants, and caravilosides and glycosides. This increases the amount of glucose consumed and the amount of glycogen produced in the liver, muscles, and fat cells, which helps to lower blood sugar levels. Fruits and nuts include the polypeptide TP-insulin, which lowers blood sugar levels in treated rats and returns them to normal. Bitter melon contains a bioactive substance called insulin-like lectin. It serves as insulin and connects the two insulin receptors. Lectin has similar effects to cortisol in that it lowers blood glucose levels and damages peripheral tissues.

The hypoglycaemic action of bitter gil is greatly influenced by lectin. Alcoholic extract from charantin, which contains a combination of steroids, is a potent hypoglycaemic medication used to lower blood and diabetic patient sugar levels. By encouraging the release of insulin to promote insulin action, the bitter melon fruit improves cell glucose absorption. Fresh and dried fruit extracts also lowered blood sugar levels in diabetic mice. In rats with alloxane-induced diabetes, bitter gourd extracts have hypoglycaemic, antidiabetic, hypolipidemic, and hepatocrinal antioxidant properties. Bitter melon reduces arterial and capillary permeability to regulate microvascular dysfunction, a common diabetic consequence.

One of the hypoglycaemic medications is charantine, which combines steroidal saponins, stigmasteryl glucoside, and sitosteryl glucoside in a 1:1 ratio. When given intravenously or orally, charantin causes hypoglycemic symptoms in rabbits[21]. A polypeptide of 166 molecularly weighted amino acids makes up p-insulin. Da is yet another hypoglycemic with a cruel guard. Clinical studies have demonstrated that polypeptide-pZnCl₂ lowers blood sugar levels. In rats, the pyrimidine nucleoside found in seeds and fruits can cause intraperitoneal hypoglycemia. Charantine-rich *momordica* extracts enhance insulin sensitivity in type-2 diabetics [22].

Anti-Microbial Activity

Biologically, fresh leaf extracts are made of numerous secondary metabolites in *M. Charantia* with various therapeutic applications. Secondary metabolites include flavonoids, tannins, which have antiviral, antibacterial, tumor- and moluscicidal properties (anticarcinogenic, antioxidant antiviral, and antihemorrhagic). *Salmonella*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Streptococcus*, and *Bacillus* are left with antibacterial effect by BM. Different fresh leaf extractions proved effective against strains of *Escherichia coli*, *S. aureus*, and *B. cereus*. The fresh and dried fever extracts contain a variety of secondary metabolites, such as tannins, alkaloids, and flavonoids, with a variety of pharmacological effects, including antimicrobials. *Shigella*, *Staphylococcus*, *Pseudomonas*, *Salmonella*, *H. pylori*, *Escherichia coli*, *Streptococcus*, *Streptobacillus*, parasitic species *Plasmodium falciparum* & *Entamoeba histolitica*, as well as gram-positive and gram-negative bacteria, can all be controlled in growth and infection by bitter melon seed extracts. Potential options for leishmaniasis chemotherapeutics include the bioactive compounds found in bitter melon[23].

Anti-Malarial Activity

A naturally occurring medicinal herb called momordica charantia is used to prevent and treat malaria. In general, the Bitter Guard is regarded as anti-malarial by Asians, Colombians, and Panamanians. To combat malaria, tea is created by boiling leaves in the bath. Additionally, scientific tests have confirmed the anti-malarial effectiveness of certain Momordica species.

Antioxidant Activity

Antioxidants are molecules that may mitigate or eliminate free radicals harm to cells. The bitter melon ethanol extracts possess strong antioxidant activity like phenolic substances [24]. Bitter protection improves catalase production and reduces glutathione, which prevents the stress-induced peroxidation of lipids. Bitter melon phenolic compounds have antioxidant function. The compromised antioxidant status of Momordica charantia seeds in diabetic rats induced with streptozotocin is effectively normalised[25].

Anti-Tumor Properties

Bitter gourds prevent the growth of tumour cells and have anti-carcinogenic properties. Anti-carcinogenic or protective chemical substances are present in BM. In the rat model sample, a bitter watch water extract will prevent the development of prostate cancer. In mice, a hot water extract of the entire plant inhibited the development of tumour cells in the mammary glands. Human leukemia, liver or hepatic carcinoma, strong sarcomas, and melanoma have all been found in various in vitro testing of anti-leucemic and anti-cancer active blood plasma in several cell lines [26–27]. In cancer patients, bitter gourd is a key immunomodulator that increases the activation of immune cells. The fruit and seed extracts of bitter melon MDAMB 23140-41 tested in vitro inhibit the growth of numerous cancer cell lines, including human colon cancer, prostate adenocarcinoma, and metastatic cell lines.

Hypo-cholesterolemic activity

Momordica charantia's hypocholesterolemic effects were investigated in both normal and diabetic mice. Rats fed sunflower for four weeks were given seeds from Momordica charantia isolated as octadecatrienoic fatty acids. After 4 weeks, there was a reduction in nonenzymatic liver tissue peroxidation, erythrocytal membrane lipid peroxidation, and plasma lipid peroxidation. After receiving bitter gourd fruit and/or seeds for about 21 days, diabetic rats' triglyceride and cholesterol levels were stabilised. Blood and liver lipids are impacted by bitter gourd oil (BGO)[28].

Anti-Viral Properties

In-vitro Bitter Gourd anti-viral behaviour tests have identified various viruses, including Epstein-Barr, herpes, and HIV [29]. Bitter melon leaf extract has an immunostimulant impact in livestock, improves interferon synthesis of natural killer cells and increases tolerance to viral infection. The bitter gourd's anti-viral components are protein or glycoprotein of nature. Due to slow absorption through oral administration, bitter gourd does not decrease virus replication in people infected with HIV. However,

oral treatment of *Momordica* compensates for the harmful consequences of anti-HIV medicines. Different Bitter Guards leaf extracts have antibacterial activities against *Pseudomonas*, *Escherichia coli*, *Staphylococcus*, *Streptobacillus*, *Streptococcus* and *Salmonella*. *Entamoeba histolytica* can be used in the whole plant extract in antiprotozoal operation [30]. The berries and fruit juice have antibacterial effects and contact with the stomach ulcer-causing infection *Helicobacter pylori*.

Larvicidal Activity

The phytochemicals in bitter custody have larvicidal capacity. Many experiments have been carried out against two mosquito vectors including *C. quinquefasciatus* and *Anopheles stephensi* [31].

Anti-genotoxic activity

The antigenotoxic effects of *Momordica charantia* reduce the breakage of chromosomes by reducing the genotoxic effects of tetracycline methane sulphonate and methyl nitrosamine [32].

Anti-helminthic activity

Leaf, fruit, and seed extracts found to be pharmacologically active against helminths. Extracts from *M. Ascaridia galli* is more successful than piperazine with aqueous extracts from *Momordica*. Saponins are anthelmintic substances that block the enzyme action of acetylcholinesterase, hence the paralysis of the worm and contribute to death.

Wound healing activity

More successful than the control group, *Momordica charantia* fruit powder on goldenness has wound closing time, epithelial period, tensile strength of the wound, and tissue regeneration comparable to rat's povidone reference medicine iodine ointment [33].

Bitter melon has a strong ability to heal wounds. The bitter melon's charnatin and other phytochemicals stimulate growth factors, causing fibroblast proliferation and speeding capillary and wound oxygenation. The antioxidant and antibacterial properties of phytochemicals like flavonoids and glycosides enhance the healing process. *Momordica* has beneficial effects on wound healing rates, wound contraction, time to closure, speed of epithelization phase, and pain of the wound.

CONCLUSION

All civilizations have historically used medicinal plants known as herbal remedies to treat sickness. It implied that *M. Charantia* was a potential herbal plant that was used all over the world to produce vegetables and medicines. The fact that nearly every part of the plant is used medicinally and ethnobotanically suggests that the plant has a long history of being associated with Indians. Thirpenes, proteins, steroids, alkaloids, and phenolics, which are responsible for their biological and pharmacological activity as antidiabetic, antioxidant, anti-carcinogenic, anti-tumor, anti-fertility, anti-virus, anti-malarial, anti-ulcerative, and immunomodulatory agents, are abundant in *M. charantia*. It will take more research to pinpoint a number of additional actions.

REFERENCE

1. Polito L, Djemil A, Bortolotti M. Plant toxin-based immunotoxins for cancer therapy: A short overview. *Biomedicines* (2016b) 4:E12. doi: 10.3390/biomedicines4020012
2. Scartezzini P, Speroni E. Review on some plants of Indian traditional medicine with antioxidant activity. *J Ethnopharmacol* (2000) 71:23-43. doi: 10.1016/S0378-8741(00)00213-0
3. Güdr A. (2016) Influence of anthocyanins from bitter melon (*Momordica charantia* Linn.) as antidiabetic and radical scavenging agents. *Iran J Pharm Res* 15:301-309
4. Verma, P., Suyal, M., Joyshi, H., 2007. A new record of leaf spot of safed musli caused by *Alternaria alternata* in Kumaun Himalaya Uttarakhand. *Indian Phyto pathology* 37, 381-382.
5. Hamissou m., simth a. C., j. R rec., triplett j. K. Antioxidative properties of bitter melon (*M. charantia*) and zucchini (*cucurbitapepo*). *Emir J Food Agric*. 25 (9), 641, 2013
6. Anilakumar k. R., kumar g. P., ilaiyaraja n (2015). Nutritional, pharmacological and medicinal properties of *M. charantia*. *Int. J. Food Sci. Nutr.* 4 (1), 75, 2015.
7. Giuliani c., tani c., bini l. M. Micromorphology and anatomy of fruits and seeds of bitter melon (*M. charantia*, Cucurbitaceae). Published by Polish Botanical Society *Acta Soc Bot Pol.* 85 (1), 1, 2015.
8. Pornsuriya., Pramote., Pornsuriya., Pornthip., Numuen., C. Phenotypic diversity and classification of Thai bitter melon (*M. charantia*.) landraces from three provinces in central region of Thailand. *Int J Environ.* 7 (3), 849, 2011.
9. Kumar d. S., sharathnath k. V., yogeswaran p., harani a., sudhakar k., sudha p., banji d. A Medicinal Potency of *M. charantia*. *Int. J Pharm Sci Rev Res.* 1 (2), 95, 2010.
10. Panday dr., rauniarb g. P., panday k. R. M. *Charantia* (Karela); An Antidiabetic. *World. J. Pharm. Pharm. Sci.* 4 (1), 84, 2014.
11. Agharkar SP: Medicinal plants of Bombay Presidency. Scientific Publishers, Jodhpur 1953.
12. Garau C, Cummings E, Phoenix DA and Singh J: Beneficial effect and mechanism of action of *Momordica charantia* in the treatment of diabetes mellitus a mini review. *Int J Diab Metabol* 11: 2003; 46-55.
13. Kumar DS, Sharathnath KV, Yogeswaran P, Harani A, Sudhakar K, Sudha P and Banji D: A medicinal potency of *Momordica charantia*. *Int J Pharmaceu Sci Rev Res* 1(2): 2010; 95.
14. Jagessar R.C, Mohamed A and Gomes G., 2008: An evaluation of the antibacterial and antifungal activity of leaf extracts of *Momordica Charantia* against *Candida albicans*, *Staphylococcus aureus* and *Escherichia coli*. *Nat Sci*; 6(1).
15. Jadhav D: Medicinal plants of Madhya Pradesh and Chhattisgarh 2008; 213-214.
16. [www.rain-tree.com\bittermelon.htm](http://www.rain-tree.com/bittermelon.htm)
17. Grover JK and Yadav SP: Pharmacological actions and potential uses of *Momordica charantia*. *A Rev J Ethnopharmacol* 93(1): 2004; 123-132.

18. Snee LS, Nerurkar VR, Dooley DA, Efird JT, Shovic AC and Nerurkar PV. Strategies to improve palatability and increase consumption intentions for *Momordica charantia* (bitter melon): A vegetable commonly used for diabetes management.
19. Jayasooriya AP, Sakono M, Yukizaki C, et al. Effects of *Momordica charantia* powder on serum glucose levels and various lipid parameters in rats fed with cholesterol-free and cholesterol-enriched diets.
20. Leatherdale BA, Panesar RK, Singh G, et al. Improvement in glucose tolerance due to *Momordica charantia*.
21. Lolitkar MM, et al. Pharmacology of a hypoglycaemic principle isolated from the fruits of *Momordica charantia*. Linn.
22. Anti-diabetic Activity of *Momordica charantia* or Bitter Melon: A Review Ranabir Chanda¹, Asim Samadder² and Janmajoy Banerjee.
23. Olasehinde GI, Ojuronbe O, Adeyeba AO, Fagade OE, Valecha N, Ayanda IO, Ajayi AA and Egwari LO. In Vitro Studies on the Sensitivity Pattern of *Plasmodium Falciparum* to Anti-Malarial Drugs and Local Herbal Extracts.
24. Aljohi A, Matou-Nasri S and Ahmed N. Antiglycation and Antioxidant Properties of *Momordica charantia*.
25. Sathishsekar D and Subramanian S. Antioxidant properties of *Momordica charantia* (bitter gourd) seeds on Streptozotocin induced diabetic rats.
26. Fang EF, Zhang CZY, Wong JH, Shen JY, Li CH and Ng TB. The MAP30 protein from bitter gourd *Momordica charantia* seeds promotes apoptosis in liver cancer cells in vitro and in vivo.
27. Jayasooriya AP, Sakono M, Yukizaki C, et al. Effects of *Momordica charantia* powder on serum glucose levels and various lipid parameters in rats fed with cholesterol-free and cholesterol-enriched diets.
28. Leatherdale BA, Panesar RK, Singh G, et al. Improvement in glucose tolerance due to *Momordica charantia*.
29. Lolitkar MM, et al. Pharmacology of a hypoglycaemic principle isolated from the fruits of *Momordica charantia*. Linn.
30. Anti-diabetic Activity of *Momordica charantia* or Bitter Melon: A Review Ranabir Chanda¹, Asim Samadder² and Janmajoy Banerjee.
31. Olasehinde GI, Ojuronbe O, Adeyeba AO, Fagade OE, Valecha N, Ayanda IO, Ajayi AA and Egwari LO. In Vitro Studies on the Sensitivity Pattern of *Plasmodium Falciparum* to Anti-Malarial Drugs and Local Herbal Extracts.
32. Aljohi A, Matou-Nasri S and Ahmed N. Antiglycation and Antioxidant Properties of *Momordica charantia*.
33. Sathishsekar D and Subramanian S. Antioxidant properties of *Momordica charantia* (bitter gourd) seeds on Streptozotocin induced diabetic rats.
34. Fang EF, Zhang CZY, Wong JH, Shen JY, Li CH and Ng TB. The MAP30 protein from bitter gourd *Momordica charantia* seeds promotes apoptosis in liver cancer cells in vitro and in vivo.

35. Grover JK and Yadav SP. Pharmacological actions and potential uses of Momordica charantia: A review.
36. Nutritional, pharmacological and medicinal properties of Momordica charantia Kandangath Raghavan Anilakumar, Garlapati Phani Kumar, Nallamuthu Ilaiyaraja.
37. Bourinbaiar AS and Lee-Huang S. Potentiation of anti-HIV activity of the anti-inflammatory drugs dexamethasone and indomethacin by MAP30, the antiviral agent from bitter melon.
38. Gupta S, Raychaudhuri B, Banerjee S, Das B, Mukhopadhaya S and Datta SC. Momordicatin purified from fruits of Momordica charantia is effective to act as a potent antileishmania agent.
39. Balboa JG and Lim-Sylianco CY. Antigenotoxic effects of drug preparations Akapulko and Ampalaya.
40. Hussan F, Teoh SL, Muhamad N, Mazlan M and Latiff AA. Momordica charantia Ointment Accelerates Diabetic Wound Healing and Enhances Transforming Growth factor- Expression.
41. Subhashchandra P, Tushar P, Kaushal P, Yagnesh B, Yogesh P and Dr. NM Patel. Isolation, Characterization and antimicrobial activity of charantin from Momordica charantia fruit.