

## A MEDICINAL POTENCY OF MOMORDICA CHARANTIA

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### ABSTRACT

A herb is a plant that is valued for flavor, scent, or other qualities. Herbs are used in cooking, as medicines, and for spiritual purposes. From ancient days to now a day, medicinal plants are a potential and useful for the treatment of several diseases and disorders. Main reason behind of that is medicinal plants is not having any side effects. One of the common tropical vegetable is *Momordica charantia*, it has been used in various Asian traditional medicine. In this review, we revealed the medicinal potency of *Momordica charantia* linn.

**Key words:** *Momordica charantia* linn, description, medicinal potency, diabetes, HIV

### INTRODUCTION

*Momordica Charantia* or Bitter Melon, also known as balsam pear or Karela, is a Tropical vegetable, is a common food in Indian cuisine and has been used extensively in folk medicine as a remedy for diabetes. 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. Bitter melon 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 bitter melon 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.

### DESCRIPTION

*Momordica Charantia* (Bitter melon or Bitter guard) is a flowering vine in the family Cucurbitaceae.

**Leaves:** simple, usually palmately 5-7 lobed, tendrils unbranched or 2 branched. The herbaceous, tendril-bearing vine grows to 5 m. It bears simple, alternate leaves 4–12 cm across, with 3–7 deeply separated lobes.

**Fruit:** ovoid, ellipsoid, or spindle shaped, usually ridged or warty, dehiscent irregularly as a 3 valved fleshy capsule or indehiscent. The fruit has a distinct warty looking exterior and an oblong shape. It is hollow in cross-section, with a relatively thin layer of flesh surrounding a central seed cavity filled with large flat seeds and pith. Seeds and pith appear white in unripe fruits, ripening to red; the flesh is crunchy and watery in texture, similar to cucumber, chayote or green bell pepper. The skin is tender and edible. The fully ripe fruit turns orange and mushy.

Bitter melon comes in a variety of shapes and sizes. The typical Chinese phenotype is 20–30 cm long, oblong with bluntly tapering ends and pale green in color, with a gently undulating, warty surface. The bitter melon more typical of India has a narrower shape with pointed ends, and a surface covered with jagged, triangular “teeth” and ridges.

Coloration is green or white. Between these two extremes is any number of intermediate forms. Some bear miniature fruit of only 6–10 cm in length, which may be served individually as stuffed vegetables. These miniature fruit are popular in Southeast Asia as well as India. In Panama bitter melon is known as Balsamino. The pods are smaller and bright orange when ripe with very sweet red seeds.

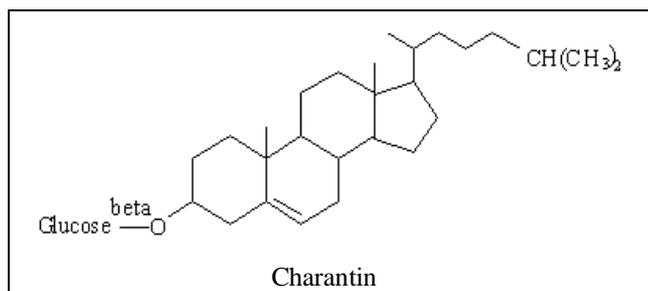
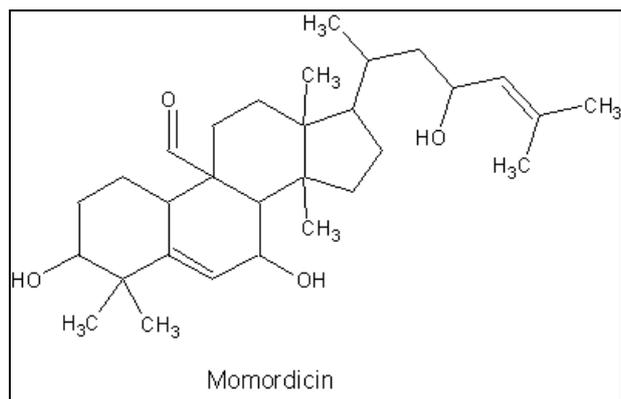
**Flowers:** Staminate flowers usually solitary on a bracteate scape, hypanthium shallow, calyx 5 lobed, petals 5, usually yellow, distinct, 1-3 with incurved scales at base, stamens usually 3, inserted toward base of hypanthium, filaments distinct, broad, anthers distinct or coherent, 2 of them dithecal, the other monotheical, cells curved or flexuous; pistillate flowers usually solitary on a bracteate scape, hypanthium ovoid to spindle shaped, perianth usually smaller than in staminate flowers, staminodes absent or 3, ovules numerous, horizontal, stigmas 3, 2 lobed. Seeds few to numerous, ovate, usually sculptured. Each plant bears separate yellow male and female flowers.

Though it has been claimed that bitter melon’s bitterness comes from quinine, no evidence could be located supporting this claim.

### ORIGIN AND DISTRIBUTION:

The original home of the species is not known, other than that it is a native of the tropics. Bitter melon grows in tropical areas, including parts of the Amazon, east Africa, Asia, and the Caribbean. It is widely grown in India and other parts of the Indian subcontinent, Southeast Asia, China, Africa, and the Caribbean.

**CULTIVATION:** It is a genus of annual or perennial climbers found throughout India and is also cultivated upto an altitude of 1500m. It is cultivated during warm season i.e. during April to July by using 2-3 seeds in a pit. The pits are prepared at a distance of half a meter and provided with manures. Only one plant is retained and seedlings are watered once or twice a week. Plants begin to flower 30-35 days after sowing and the fruits are ready for harvesting 15-20 days after flowering. Bitter gourd, also known as balsam pear, is a tropical vegetable widely cultivated in Asia, Africa and South America<sup>[1, 2]</sup>.

**PHYTOCHEMICALS:**

*M.charantia* fruits consists glycosides, saponins, alkaloids, reducing sugars, resins, phenolic constituents, fixed oil and free acids. *M.Charantia* consists the following chemical constituents those are Alkaloids, charantin, charine, cryptoxanthin, cucurbitins, cucurbitacins, cucurbitanes, cycloartenols, diosgenin, elaeostearic acids, erythrodiol, galacturonic acids, gentisic acid, goglycosides, goyasaponins, guanylate cyclase inhibitors, gypsogenin, hydroxytryptamines, karounidiols, lanosterol, lauric acid, linoleic acid, linolenic acid, momorcharasides, momorcharins, momordenol, momordicilin, momordicins, momordicin, momordicosides, momordin, momordolo, multiflorenol, myristic acid, nerolidol, oleanolic acid, oleic acid, oxalic acid, pentadecans, peptides, petroselinic acid, polypeptides, proteins, ribosome-inactivating proteins, rosmarinic acid, rubixanthin, spinasterol, steroidal glycosides, stigmasta-diols, stigmasterol, taraxerol, trehalose, trypsin inhibitors, uracil, vacine, v-insulin, verbascoside, vicine, zeatin, zeatin riboside, zeaxanthin, zeinoxanthin Amino acids-aspartic acid, serine, glutamic acid, thscinne, alanine, g-amino butyric acid and pipercolic acid, ascorbigen, b-sitosterol-d-glucoside, citrulline, elasterol, flavochrome, lutein, lycopen, pipercolic acid. The fruit pulp has soluble pectin but no free pectic acid. Research has found that the leaves are nutritious sources of calcium, magnesium, potassium, phosphorus and iron; both the edible fruit and the leaves are great sources of the B vitamins<sup>[3,4]</sup>.

**USES:**

Anthelmintic, antibacterial, antibiotic, antidiabetic, anti-inflammatory, anti microbial, antileukemic, antimutagenic, antimycobacterial, antioxidant, antitumor, antiulcer, antiviral, aperitive, aphrodisiac, astringent, carminative, cytostatic, cytotoxic, depurative, hormonal, hypocholesterolemic, hypotensive, hypotriglyceridemic,

hypoglycemic, immunostimulant, insecticidal, lactagogue, laxative, purgative, refrigerant, stomachic, styptic, tonic, vermifuge<sup>[5, 6]</sup>.

**TRADITIONAL USES OF VARIOUS PARTS:**

The fruit is considered as tonic, stomachic, stimulant, emetic, antibilous, laxative and alterative. The fruit is useful in gout, rheumatism and subacute cases of the spleen and liver diseases. It is supposed to purify blood and dissipate melancholia and gross humours. It has also been shown to have hypoglycaemic properties (anti-diabetic) in animal as well as human studies.

The fruit juice and/or a leaf tea is employed for diabetes, malaria, colic, sores and wounds, infections, worms and parasites, as an emmenagogue, and for measles, hepatitis, and fevers.

Fruit pulp, leaf juice and seeds are antihelminthic.

Leaves act as galactagogue.

Root is astringent.

Abortifacient, anthelmintic, aphrodisiac, burn, catarrh, constipation, digestion, demulcent, dermatosis, diabetes, diarrhea, dyspepsia, eczema, emetic, emmenagogue, emollient, fever, febrifuge, hemorrhoids, hepatitis, hypoglycemic, inflammation (liver), leprosy, leucorrhoea, leukemia, malaria, menstrual colic, pain, pruritus, purgative, rheumatism, scabies, skin, tumor, wound, vaginitis, vermifuge, cancer (breast), food, glucosuria, halitosis, hematuria, polyuria, refrigerant, bite (snake), anemia, colitis, kidney (stone), sterility (female), dysentery, gonorrhoea, appetite stimulant, insecticide, laxative, rage, rhinitis, contraceptive, dysmenorrhoea, fat loss, galactagogue, gout, hydrophobia, piles, pneumonia, psoriasis, sore, asthma, headache, scald, sprue, stomachache, cold, cough, hypertension, tonic gallbladder, contusions, lung, measles, suppurative, rheumatoid arthritis and lupus.

**THERAPEUTIC CLASSIFICATION INDEX**<sup>[7]</sup>

**Central Nervous System:** It dissipates melancholia and gross humors<sup>[8]</sup>.

**Blood And Haemopoietic Tissue:** The ripe fruit of bitter melon has been shown to exhibit some remarkable anticancer effects, especially leukemia. It purifies the blood.

**Anti diabetes**<sup>[9-14]</sup>:

Folk wisdom has it that bitter melon helps to prevent or counteract type-II diabetes. Oral administration of fresh fruit juice (dose, 6 c.c. /kg. body wt.) lowered the blood sugar level in normal and alloxan-diabetic rabbits. Oral administration of alcoholic extracts of the plant to some diabetic patients did not produce any hypoglycaemic action. Bitter melon's hypoglycemic ingredients have been shown in animal and human studies. Polypeptide -p, a plant insulin, charantin, vicine, glycosides, and karavilosides improve blood sugar levels by increasing glucose uptake and glycogen synthesis in the liver, muscles, and fat cells. 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. A recent scientific study at JIPMER, India has proved that bitter melon increases insulin sensitivity. Also, in 2007, the Philippine Department of Health issued a circular stating that bitter melon, as a scientifically validated herbal medicinal plant, can lower elevated blood sugar levels. The study revealed that a 100 milligram per kilo dose per day is comparable to 2.5 milligrams of the anti-diabetes drug Glibenclamide taken twice per day. Bitter Melon contains four very promising bioactive compounds. These compounds activate a protein called AMPK, which is well known for regulating fuel metabolism and enabling glucose uptake, processes which are impaired in diabetics. Bitter melon contains a lectin that has insulin-like activity. The insulin-like bioactivity of this lectin is due to its linking together 2 insulin receptors. This lectin lowers blood glucose concentrations by acting on peripheral tissues and, similar to insulin's effects in the brain, suppressing appetite. This lectin is likely a major contributor to the hypoglycemic effect that develops after eating bitter melon and why it may be a way of managing adult-onset diabetes. Lectin binding is non-protein specific, and this is likely why bitter melon has been credited with immunostimulatory activity - by linking receptors that modulate the immune system, thereby stimulating said receptors. Charantin extracted by alcohol, is a hypoglycemic agent composed of mixed steroids that is more potent than the drug tolbutamide, which is sometimes used in the treatment of diabetes to lower the blood sugar levels. *Momordica* also contains an insulin-like polypeptide, polypeptide-P, which lowers blood sugar levels when injected subcutaneously into type 1 diabetic patient. The oral administration of 50-60 ml of the juice has shown good results in clinical trials. Excessively high doses of bitter melon juice can cause abdominal pain and diarrhea. Small children or anyone with hypoglycemia should not take bitter melon, since this herb could theoretically trigger or worsen low blood sugar, or hypoglycemia. Furthermore, diabetics taking hypoglycemic drugs (such as chlorpropamide, glyburide, or phenformin) or insulin should use bitter melon with caution, as it may potentiate the effectiveness of the drugs, leading to severe hypoglycemia. The effect of *Momordica charantia* on glucose and insulin concentrations was studied in nine non-insulin-dependent diabetics and six non-diabetic laboratory rats. A water-soluble extract of the fruits significantly reduced blood glucose concentrations during a 50 g oral glucose tolerance test in the diabetics and after force-feeding in the rats. Fried fruits consumed as a daily supplement to the diet produced a small but significant improvement in glucose tolerance. Improvement in glucose tolerance was not associated with an increase in serum insulin responses. These results shown that improves glucose tolerance in diabetes. Bitter Melon increase the number of beta cells in the pancreas: Bitter melon has been shown to increase the number of beta cells in the pancreas thereby improving the body's ability to produce insulin. The fruit has also shown the ability to enhance cells' uptake of glucose, to promote insulin release, and potentiate the effect of insulin. Diabetics should check with their physicians before using

this plant and use with caution while monitoring their blood sugar levels regularly.

**Anti cancer<sup>[15,16]</sup>:** There is absolutely no evidence that it can treat cancer. Bitter Melon and Bitter Melon Extracts inhibit cancer and tumor. A novel phytochemical in bitter melon has clinically demonstrated the ability to inhibit an enzyme named guanylate cyclase. This enzyme is thought to be linked to the pathogenesis and replication of not only psoriasis, but leukemia and cancer as well. One clinical trial found very limited evidence that bitter melon might improve immune cell function in people with cancer, but this needs to be verified and amplified in other research. Other phytochemicals that have been documented with cytotoxic activity are a group of ribosome-inactivating proteins named alpha- and beta-momorcharin, momordin, and cucurbitacin B. A chemical analog of bitter melon proteins was developed and named MAP-30 and its inventors reported that it was able to inhibit prostate tumor growth. The phytochemical momordin has clinically demonstrated cytotoxic activity against Hodgkin's lymphoma in vivo, and several other in vivo studies have demonstrated the cytostatic and antitumor activity of the entire plant of bitter melon. Further studies reported that, a water extract blocked the growth of rat prostate carcinoma and a hot water extract of the entire plant inhibited the development of mammary tumors in mice. Numerous in vitro studies have also demonstrated the anti-cancerous and anti-leukemic activity of bitter melon against numerous cell lines including liver cancer, human leukemia, melanoma and solid sarcomas.

**Liver and Biliary System:** fruit is useful in sub acute cases of liver and spleen.

Another method for carcinogen-induced lipid peroxidation in liver and DNA damage in lymphocytes were reduced by following treatment of *M.charantia*. The fruit extract was found to significantly active liver enzymes glutathione s-transferase, glutathione peroxidase and catalase, which showed a depression following exposure to the carcinogen. The result suggest the preventive role of water soluble constituents of *M.charantia* fruit during carcinogenesis, which is mediated possibly by their modulatory effect on enzymes of biotransformation and detoxification system of host.

**Digestive System:** leaf juice is purgative and emetic.

*Momordica charantia*, is also a plant found in China, where it is (not surprisingly) known as Chinese Bitter Melon. It has been used in traditional Chinese medicine as an appetite stimulant, and a treatment for gastrointestinal infection.

**Stomachic effect:**

The pure protein termed as P-insulin extracted from *M. charantia* fruits in crystalline form is also tested. Bitter melon contains a bitter compound called momordicin that is said to have a stomachic effect.

**Skin:** Fruit and leaves are used in leprosy. Bitter melon inhibits the enzyme guanylate cyclase, which may benefit people with psoriasis.

**Psoriasis:**

A novel phytochemical in bitter melon has clinically demonstrated the ability to inhibit an enzyme named guanylate cyclase. This enzyme is thought to be linked to the pathogenesis and replication of psoriasis.

**Antiobesity<sup>[17,18]</sup>:**

Five compounds in bitter melon increase the activity of adenosine 5 monophosphate kinase (AMPK), an enzyme that facilitates cellular glucose uptake and fatty acid oxidation. Hypoglycemic agents in bitter melon promotes *efficient oxidation of glucose into fuel, and conversion into starch*. (Glycogen or animal starch is stored in the liver and muscle cells). During glucose shortages, fats/fatty acids are used as fuel. Continued demand for energy in the absence or shortage of glucose causes fat cells to release their fat contents to maintain energy balance. This increased fatty acid oxidation eventually leads to weight loss.

Compounds in bitter melon improves lipid profiles. They reduce liver secretion of *apolipoprotein B (Apo B)* - the primary lipoprotein of low-density "bad" cholesterol ; reduce apolipoprotein C- III expression, the protein found in *very-low density cholesterol* which turns into LDL/bad cholesterol; and increases the expression of *apolipoprotein A-I (ApoA1)* - the major protein component of high-density "good" cholesterol. It also lowers cellular triglyceride content. In other in vivo studies, bitter melon fruit and/or seed have been shown to reduce total cholesterol and triglycerides both the presence and absence of dietary cholesterol. In one study, elevated cholesterol and triglyceride levels in diabetic rats were returned to normal after 10 weeks of treatment. The fruit and seed of bitter melon have demonstrated (in animal studies) to lower blood cholesterol levels. Persons on medications to lower blood cholesterol should monitor their cholesterol levels. Various cautions are indicated.

**Reproductive System:** leaves act as a galactagogue

**Antifertility:**

However, toxicity and even death in laboratory animals has been reported when extracts are injected intravenously or intraperitoneally (with the fruit and seed demonstrating greater toxicity than the leaf or aerial parts of the plant). Other studies have shown ethanol and water extracts of the fruit and leaf (ingested orally) to be safe during pregnancy. The seeds, however, have demonstrated the ability to induce abortions in rats and mice, and the root has been documented with a uterine stimulant effect in animals. The fruit and leaf of bitter melon has demonstrated an in vivo antifertility effect in female animals; in male animals, it was reported to affect the production of sperm negatively. Bitter melon traditionally has been used as an abortive and has been documented with weak uterine stimulant activity; therefore, it is contraindicated during pregnancy. This plant has been documented to reduce fertility in both males and females and should therefore not be used by those undergoing fertility treatment or seeking pregnancy. The active chemicals in bitter melon have shown in animal studies to be transferred through breast milk; therefore, it is contraindicated in women who are breast feeding.

One of the study explained that various extracts (ether, benzene and alcohol) of *M. charantia* seeds were administered orally and intraperitoneally to male rats for 35 days. The tests showed indirect evidence of reduced availability of pituitary gonadotrophs necessary for spermatogenesis. With intraperitoneal administration, increased cholesterol and Sudanophilic lipid levels denoted inhibited steroidogenesis, further evidence of reduced availability of gonadotrophs<sup>[19]</sup>.

**Antimicrobial Agents<sup>[20]</sup>**

In addition to these properties, leaf extracts of bitter melon have clinically demonstrated broad spectrum antimicrobial activity. Various water, ethanol, and methanol extracts of the leaves have demonstrated in vitro antibacterial activities against *E. coli*, *Staphylococcus*, *Pseudomonas*, *Salmonella*, *Streptobacillus* and *Streptococcus*; an extract of the entire plant was shown to have antiprotozoal activity against *Entamoeba histolytica*. The fruit and fruit juice has demonstrated the same type of antibacterial properties and, in another study, a fruit extract has demonstrated activity against the stomach ulcer-causing bacteria *Helicobacter pylori*. Although all parts of the plant have demonstrated active antibacterial activity, none have shown activity against fungi or yeast. Long-term use of this plant may result in the die-off of friendly bacteria with resulting yeast/candida opportunistic overgrowth. Cycling off the use of the plant (every 30 days for one week) may be warranted, and adding probiotics to the diet may be beneficial if this plant is used for longer than 30 days.

**Anti viral activity:**

Bitter melon (and several of its isolated phytochemicals) also has been documented with in vitro antiviral activity against numerous viruses including Epstein-Barr, herpes, and HIV viruses. In an in vivo study, a leaf extract demonstrated the ability to increase resistance to viral infections as well as to provide an immunostimulant effect in humans and animals (increasing interferon production and natural killer cell activity). *Momordica* Anti-human Immunovirus Protein (MAP30) activates natural killer cells, interferes with the ability of HIV viruses to divide and spread. It also increases the body's production of *interferon-gamma*, a natural substance that fights all types of viruses. Another clinical study showed that MAP-30's antiviral activity was also relative to the herpes virus in vitro. It contains three anti-HIV proteins: alpha- and beta momorcharin, and MAP-30, and charantin, beta-D-Sitosterol-beta-D-glucoside, 5,25-Stigmastadien-3-beta-D-glucoside, serotonin, and many kinds of amino acids.

**Anti HIV agents<sup>[21]</sup>:**

Bitter melon has also been suggested as a treatment for AIDS, but the evidence thus far is too weak to even mention. Laboratory tests suggest that compounds in bitter melon might be effective for treating HIV infection. As most compounds isolated from bitter melon that impact HIV have either been proteins or glycoproteins (lectins), neither of which are well-absorbed, it is unlikely that oral intake of bitter melon will slow HIV in infected people. It is possible oral ingestion of bitter melon could offset negative effects of anti-HIV drugs, if a test tube study can

be shown to be applicable to people. Clearly more research is necessary before this could be recommended. The other realm showing the most promise related to bitter melon is as an immunomodulator. One clinical trial found very limited evidence that bitter melon might improve immune cell function in people with cancer, but this needs to be verified and amplified in other research. If proven correct this is another way bitter melon could help people infected with HIV. Two proteins known as alpha- and beta-momorcharin (which are present in the seeds, fruit, and leaves) have been reported to inhibit the HIV virus but research has only been demonstrated in test tubes and not in humans. Another study explained that HIV-infected cells treated with alpha- and beta-momorcharin showed a nearly complete loss of viral antigen while healthy cells were largely unaffected. "Useful for treating tumors and HIV infections. In treating HIV infections, the protein is administered alone or in conjunction with conventional AIDS therapies" stated by inventors of MAP-30 protein analog in U.S. Patent. The proteins (alpha and beta momorcharin) appeared to modulate the activity of both T and B lymphocytes and significantly suppressed the macrophage activity.

#### Larvicidal Activity:

*M. charantia* has shown good larvicidal activity against three container breeding mosquitoes— *An. stephensi*, *Cx. quinquefasciatus* and *Ae. aegypti* in<sup>[22]</sup>

#### Anti-genotoxic activity

*Momordica charantia* decreased the genotoxic activity of methyl nitrosamine, methanesulfonate and tetracycline, as shown by the decrease in chromosome breakage<sup>[23]</sup>.

#### Anti-helmintic activity

*Momordica* was more effective than piperazine in the treatment of *Ascaridia galli*.<sup>[24]</sup>

#### Wound healing activity:

Researchers found that *Momordica charantia* Linn. fruit powder, in the form of an ointment (10% w/w dried powder in simple ointment base), showed a statically significant response ( $P < 0.01$ ), in terms of wound-contracting ability, wound closure time, period of epithelization, tensile strength of the wound and regeneration of tissues at wound site when compared with the control group, and these results were comparable to those of a reference drug povidone iodine ointment in an excision, incision and dead space wound model in rats. [20]

#### TOXICITY:

The seed contains vicine and therefore can trigger symptoms of favism in susceptible individuals. In addition, the red arils of the seeds are reported to be toxic to children. Many in vivo clinical studies have demonstrated the relatively low toxicity of all parts of the bitter melon plant when ingested orally.

**DRUG INTERACTIONS:** May potentiate insulin and anti-diabetic drugs. May potentiate cholesterol-lowering drugs.

#### SIDE EFFECTS:

It can sometimes make heartburn and ulcers worse.

#### WARNING

Pregnant women should not eat bitter melon as it stimulates the uterus and may cause premature birth.

#### CONCLUSION:

We concluded that *Momordica charantia* is a potential herbal in the world. Further studies are required to find many more activities of this plant.

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