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Momordica charantia of phytochemical study: A review

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Abstract
Momordica charantia is used for some medicinal purposes in traditional medicine. The phytochemical composition of bitter gourd was investigated using standard analytical methods. Phytochemicals like tannin, flavonoids, phenolic compounds, alkaloids, saponins, steroids, cardiac glycosides, phlobatannins and anthraquinones were also found present/ absent. The proximate composition showed the per cent of tannin, flavonoids, phenolic compounds, alkaloids and saponins.

Keywords: *Momordica charantia*, medicinal plant, homoeopathy, Phyto chemical studies

1. Introduction
Momordica charantia Linn. (Palisota Reichb) commonly known as bitter melon, bitter gourd or gourd, was originated from India and carried to China in the 14th century. It is a tropical and subtropical vine of the family Cucurbitaceae, widely grown in Asia, Africa, and the Caribbean. The fruit juice and/or a leaf tea are employed for diabetes, malaria, colic, sores and wounds, infections, measles, hepatitis, and fevers. Leaves are used for treating catarrh, constipation, dermatitis, diabetes, diarrhoea, eczema, fever, leprosy, malaria, rheumatism, breast cancer, snake bite, anaemia, dysentery, gonorrhoea, measles, rheumatoid arthritis. 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.
Momordica charantia member of Cucarbitaceae, is a slender, tendril climbing, annual vine. Bitter melon is a common food item of the tropics and is used for the treatment of cancer, diabetes and many ailments [1-4]. It is a potent hypoglycemic agent [5, 6] and hypoglycaemic actions for potential benefit in diabetes mellitus are possible due to at least three different groups of constituents in bitter melon. These include alkaloids, insulin like peptides, and a mixture of steroidal sapogenins known as charantin. Clinical studies with multiple controls have confirmed the benefit of bitter melon for diabetes [7]. Alpha and beta momarcharin are two proteins found in bitter melon, which are known to inhibit the AIDS virus [8]. M. charantia plant has not been much investigated for its *in vitro* culture response. However, formation of callus is reported [9].
The immature fruits are eaten as vegetable and are good source of vitamin c, vitamin A, phosphorous and iron. Fruits and seeds of bitter gourd possess medicinal property such as anti HIV, anti ulcer, anti inflammatory, anti leukemic, anti microbial, antitumor, and last but not the least the important anti diabetic property. Although the different parts of the plants of bitter gourd are used as food and drug, but the fruit is most important part of the plant.
The young fruits and shoots are reported to serve as supplementary or emergency food in some part of West Africa, and as an effective emanagogue to facilitate child birth in Ivory Coast. All plant species contain poisonous, medicinal and nutritional compounds. Many of these traditional plants are used with no attention paid to their nutritional values. Thus, this work is aim to exploit the nutritional composition and chemical profile of *Momordica charantia*.

2. History and Distribution
The Karela is believed to be originated in the tropics of the old world. It is widely grown in India and other parts of the Indian subcontinent, Southeast Asia, China, Africa, and the Caribbean and South America as a food and medicine.

(A) Flower in Stage (B) Fruiting Stage

(C) Mature Fruit Stage (D) Seeds of *Momordica charantia*

Fig 1: Different Stages of *Momordica charantia*

3. Botanical Description

Momordica charantia Linn. (Karela) is a flowering climber of family cucurbitaceae. The herbaceous, tendrilbearing plant grows to six meters or longer. It bears simple, alternate leaves 4-12 cm across, with 3-7 deeply separated lobes. The lobes are mostly blunt, but have small marginal points. Stipules are absent. Flowers are actinomorphic and always unisexual. Perianth has a short to prolonged epigynous zone; yellow on short (female) or long (male) peduncles that are short lived. Fruit has ovoid, ellipsoid or spindle shaped usually 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 seed and pith [10]. Seeds in size 8-13mm, long compressed, corrugate on the margin, sculptured on both faces [11]. In India, it has typical morphology i.e. narrower shape, pointed ends and surface covered with jagged, triangular "teeth" and ridges with green coloration. It has a strong bitter taste among all vegetables.

4. Phytochemical studies

Phyto' is the Greek word for plant. There are many families of phytochemicals and they help the human body in a variety of ways. Phytochemicals may protect human from a host of diseases.

Momordica charantia consists the following chemical constituents those are alkaloids, momordicin and charantin, charine, cryptoxanthin, cucurbitins, cucurbitacins, cucurbitanes, cycloartenols, diosgenin, elaeostearic acids, erythrodiol, galacturonic acids, gentisic acid, goyaglycosides, goyasaponins, guanylate cyclise inhibitors, gypsogenin, hydroxytryptamines, karounidiols, lanosterol, lauric acid, linoleic acid, linolenic acid, momorcharasides, momorcharins, momordenol, momordicillin, momordicinin, 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, stigmastadiols, stigmasterol, taraxerol, trehalose, trypsin inhibitors, uracil, vacine, v-insuline, verbascoside, vicine, zeatin, zeatinriboside, zeaxanthin, zeinoxanthin Amino acidsaspartic acid, serine, glutamic acid, thscinne, alanine, gamino butyric acid and pipecolic acid, ascorbigen, bsistosterol- d-glucicide, citruline, elasterol, flavochrome, lutein, lycopene, pipecolic acid.

5. Pharmacological Studies

5.1 Anticancer activity: The anti carcinogenic effect of aqueous extract of the bitter melon fruit was studied in a two step skin carcinogenesis model in mice. Oral administration of the fruit extract protected the mice from the development of skin tumors and increased life expectancy. The extract also reduced carcinogen-induced lipid peroxidation in liver and dna damage in lymphocytes. The fruit extract was furthermore found to significantly activate the liver enzymes glutathione-s-transferase, glutathione peroxidase and catalase ($p < 0.001$), which showed a depression following exposure to the carcinogen. The results suggest a preventive role of water-soluble constituents of bitter melon fruit during carcinogenesis, which is possibly mediated by their modulatory effect on enzymes of the biotransformation and detoxification system of the host.

5.2 Anti hyperglycemic activity
at the dose of 250.0mg/kg acetone extract of dried fruit in ration of rats shows the anti hyperglycemic activity. Fall in sugar of 49% in30 days. Blood sugar in maintained within normal limits for two weeks after treatment ceased vs alloxan induced hyperglycemia. at the dose of 1.0mg/kg of benzene extract of dried fruit administered intra gastrically to rabbit it shows the anti hyperglycemic activity. alloxan recovered rabbits were tested for glucose tolerance following sample treatment vs glucose induced hyperglycemia. Decoction of dried fruit taken orally by the human adult at dose of 500.0mg/person it was show the anti hyperglycemic activity. ethanol (95%) extract of dried fruit administered intra gasrtically to female rats at the dose of 250.0mg/kg was show the anti hyperglycemic activity vs streptozotocin induced hyperglycemia. dried powder fruit, taken orally once daily for 11 days by ten male patients with mild diabetes (23-28 years of age), at a dose of 2.0gm/person was shows the anti hyperglycemic activity.

5.3 Antiviral Activity
Karela and its isolated phytochemicals, also has been documented with *in vitro* antiviral activity against numerous viruses including Epstein-Barr, herpes and HIV viruses[12,13]. 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) [14]. 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 *in vitro*). In one study, HIVinfected cells treated with alpha- and beta-momocharin showed a nearly complete loss of viral antigen while healthy cells were largely unaffected [15]. In 1996 the inventors of the chemical protein along MAP-30 filed a U.S. patent, stating it was "useful for treating tumors and HIV infections. In treating HIV infection, the protein is administered alone or in conjunction with conventional AIDS therapies [16]. Another clinical study showed that MAP 30's antiviral activity was also relative to the herpesvirus *in vitro*.

5.4 Hypoglycemic activity
studies done in animal model, mainly steptozotocin induced diabetic rats and mice have shown significant lowering of blood glucose levels. Bitter gourd extract improves insulin sensitivity, glucose tolerance and insulin signaling in hfd induced insulin resistance, which may open new therapeutic targets for the treatment of obesity/dyslipidemia induced insulin resistance.

5.5 Glucose tolerance
The effect of karela (*Momordica charantia*), a fruit indigenous to south America and Asia, 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 karela 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 show that karela improves glucose tolerance in diabetes.

5.6 Anti fertility activity
a protein in bitter melon was reported to have anti fertility activity in male rats. Oral administration of the fruit (1.7 g/day extract) to male dogs caused testicular lesions and atrophy of spermatogenic aspects. In female mice, the plant exhibited similar, but reversible, anti fertility effects. momorcharins are capable of producing abortions. Uterine bleeding has been induced in pregnant rats given the juice, as well as in rabbits, but not in non pregnant females.

5.7 Anti Malarial Activity
Karela is traditionally regarded by Asians, as well as Panamanians and Colombians, as useful plant for preventing and treating malaria. Laboratory studies have confirmed that various species of Karela have anti malarial activity. Leaves brewed in hot water to create a tea to treat malaria.

5.8 Antiulcerative and Immunomodulatory Activity
The traditional use of bitter melon for treating gastrointestinal ulcers is recommended. Dried fruits powder administered in filtered honey have significant and dose dependent activity against ethanol induced ulcerogenesis in rats. Various studies have found both immunostimulating and immunosuppressive effects, due to extracts and isolated constituents of bitter melon. It is highly dependent on the type of extract or constituent, its dosage and its route of administration.

6. Conclusion
Momordica charantia is a good source of various medicinally important biochemicals like, triterpene, protein, steroid, alkaloid, and phenolic which are responsible for its biological and pharmacological activities including anti diabetic, antioxidant, anti cancerous and anti tumorous, antimicrobial, anti fertility, anti viral, anti helmintic, antimalarial, anti ulcerative and immunomodulatory etc. The information collected above on the uses of *Momordica charantia* across the globe having similarity with available literature. *Momordica charantia* is traditionally used for the treatment of various diseases especially diabetes.
Based on these facts, this review highlights the role of *Momordica charantia* in various treatments and recommend that further Phytochemical and clinical research should be done on this traditional medicinal plant for the discovery of safer drugs. Studies should also be on understanding which of the phytochemicals are responsible for the observed beneficially effects and if effective, their mechanism of action.
This review describes the information about *Momordica charantia* which includes Homoeopathic description, botanical description, medical action and Phytochemical and pharmacological studies. *Momordica charantia* is one of those plants which have been used in Homoeopathic system of medicine for the treatment of Diabetes Mellitus, insipidus and other diseases.

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