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Momordica charantia: An insight into the therapeutic potential

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Abstract

Momordica charantia is a worldwide well-known medicinal plant from the *Cucurbitaceae* family. In different regions of the world, it is known by different names like bitter melon, bitter gourd, balsam pear, karela, etc. *M.charantia* has so many medicinal properties including antidiabetic, anticancer, antimicrobial, antioxidative, antipyretic, and anti-inflammatory, anti-obesity. The present review focuses on different therapeutic aspects of *Momordica charantia.*

Keywords: *Momordica charantia*, Anticancer agent, Antioxidant

1. Introduction

Momordica charantia is a commonly eaten vegetable around the world. Bitter melon, bitter gourd, balsam pear, pare & karela are the most common names of.*M.charantia*. The bitter melon and bitter gourd name is due to its bitter taste. It is the most commonly grown vegetable in Southeast Asia, subtropical areas of South and Central America, East Africa, and India. Bitter melon is consumed in three different forms i.e., cooked, boiled, and juice (**Elekofehinti, Olusola Olalekan., et al 2019**).

Bitter melon is one of the most well known variety of plant related to Cucurbitaceae family having antioxidative(**Chen, Qixuan., et al 2003**), antidiabetic (**Yelchuri, BalaMurali Krishna., et al 2012)**, antipyretic and anticancer properties (**Joseph B et al., 2013**). *M.charantia* is used as medicine from the time of Ayurveda (**Lim, T. K., 2013**). In Ayurveda the utility of *M.charantia* as natural blood purifier is also mentioned.

M.charantia is a good source of vitamin A and C. The medicinal value of *M.charantia* leaves and whole fruit is due to the presence of phytochemicals like charantin, saponin, flavonoid, protein, ascorbic acid, alkaloids, momordicosides, etc (**Beloin, Nadine., et al 2005**). All the phytochemicals have reported therapeutic potential effect in humans. It is used for medicinal purposes for treating Type II diabetes in non insulin dependent patients as it

significantly lowers the glucose level in blood (**Ooi , Cheow Peng.,et al 2012**). Various phytochemicals present in aqueous extract have shown remarkable therapeutic potential in treatment of tumor/cancer cells in different *in vivo* studies conducted on rat, mice, drosophila and also in humans. *M.charantia* along with all these properties also acts like antiobesity, anti ageing, antibacterial agent (**Chou .,et al 2022**).

The scientific classification of *M.charantia* is as follows:

Scientific Classification:

Kingdom: plantae

Clade: angiosperm

Order: cucurbitales

Family: Cucurbitaceae

Genus: *Momordica*

Species: *M. charantia*

Common names: bitter melon, bitter gourd, karela etc.

M.charantia is tendril bearing herbaceous climber plant of about 16 feet in length. Plant bears separate male and female flowers of yellowish color. Seeds of *M.charantia* have slow germination speed take up 5-6 days also depends on the plant variety we are currently using. Plant got matured in about 60 days to produce fruits.

2. Discussion

Fruit of *M.charantia* was studies and verified the presence of charantin, steroidal saponin, momordicosides, proteins, ascorbic acid, polysaccharides, flavinoids, glycosides and many more to discover. According to previous studies it

was verified that *M.charantia* contains medicinal properties against various diseases like diabetes, stomachic carmination, rheumatoid arthritis, gout and tumor (**Tushar Patel *et al*., 2010**).

Among different plant species having antibacterial properties *M.charantia* plant also have antibacterial activities tested on different bacterial strains. *M.charantia* plant leaves extract prepared in methanol, ethanol hexane shows tremendous antibacterial properties against *Bacillus subtilis, E. coli, S. typhi* (**P. Supraja *et al*., 2013**).

M.charantia seeds oil had extremely high concentration of stearic acid, linoleic acid and oleic acid. Due to the presence of above mentioned acids presence its showed antitumor and antidiabetic properties. In *Drosophila* it was well tested to treat tumor cells and (Type II) insulin deficiency induced diabetes (**Evandro Fei Fang *et al*., 2015**).

Researcher's attraction towards *M.charantia* was due to its power of glucose modulation which could be the first step in treatment of diabetic patients. Different parts of *M.charantia* plant had been shown to have tremendous hypoglycemic effects observed in limited numbers of clinical trials, cell based assays and in various animal models (humans, rat, mice, *Drosophila* etc). *M.charantia* plant fruit extract had been showed direct effect on pancreas especially on β cells and intestinal absorption of dietary glucose. It stimulates the insulin secretion in pancreas when tested in obese mice (**Edrallin A. Lucas *et al*., 2010**).

Plants from Cucurbitaceae family are rich in various phytochemicals. Leaves, stem, flower, fruit, seed, roots etc of these plants show overabundance of pharmacological activity including hypolipidemic, antihperglycemic, anticancer, antimicrobial, analgesic, anti-inflammatory, anti stress and antiimmunomodulatory activities. Along with all these properties it also showed inhibitory potential against α-glycosidase, α-amylase, lipase, carbonic anhydrase enzyme (**Pulok. K. Mukherjee *et al*., 2021**).

Aqueous extract of *M.charantia* affects the survival rate, locomotive behavior and also antioxidant response in D. melanogaster at different concentrations in culture media for feeding. An increase in superoxide dismutase and acetyl cholinesterase activity also noticed when studies under dose dependent manner. At high concentration of plant extract higher mortality and shorter life span also noticed (**Opeyemi C. De-Campos *et al*., 2021**).

Momordica charantia plant extract had tremendous glycemic control when tested in model organism. *Momordica* improved the insulin secretion, insulin sensitivity or both but how it was happened yet unknown (**Marisol Cortez-Naverrete *et al*., 2018**).

Momordica has been used to treat varieties of diseases and also clinically tested. *Momordica* have anti- obesity effect at cellular level as well as organism level. A number of bioactive phytochemicals discovered in *Momordica* plant extract like proteins, triterpenoids, saponins, phenolics and conjugate linoleic acid. All these bioactive components inhibited the fat synthesis, promoted the glucose utilization and also stimulated the auxiliary lipid lowering activity in obese rat. Due to anti obesity effect of *Momordica* it is used in development of anti obesity medicine and nutritional health products (**Meiqi Fan *et al*., 2019**).

MAP30 proteins of bitter melon seeds extract have ability to abolish the ovarian cancer cells. Mixture of MAP30 protein and cisplastin when injected into mice with ovarian cancer reveals a new fact that both these MAP30 and cisplastin have cytotoxicity against ovarian cancer cells and blood test of that test animal did not show any type of side effect due to MAP30 administration (**David W Chan *et al*., 2020**).

Antioxidant capacity and phenolic content ratio highest in ripe fruit and moderate in unripe fruit but lowest ratio observed in packaged powder of fruit of *Momordica*(**Esin Akyliz *et al*., 2020**).

Main character of *Momordica* is antioxidative effect but recently it was revealed that when gel and cream formulation prepared from *Momordica* extract could heal the induced wounds of mice. *Momordica* extract boost the healing ability in mice (**William Antonio Sagastegui- Guarniz *et al*., 2021**).

Momordica plant extract when prepared on ethanol as solvent have neurogenerative effect. Oxidative stress induced by H_2O_2 caused the death of neuronal cell in human beings. Ethanol prepared extract improves the neuronal cell death by boosting cell viability and apoptosis (**Kkot Byeol Kim *et al*., 2018**).

Phytochemicals present in *Momordica charantia* L. ethanol extract (*M.charantia* E) have anti aging effect when administered in mice having subacute aging induced by d- galactose. *M.charantia* E treated mice shows refined learning ability and memory. Anti aging ability in *M.charantia* E is because of 14 triterpenoids present among all phytochemicals (**Dongxue Wang *et al*., 2022**).

Fruit juice of karela or balsum pear has positive effect on the rats having streptozotocin-induced type 2 diabetes mellitus. The results shows have shown that when diseased rats have been treated with karela juice, there is significant increase in serum insulin, ß-cell function. There is also an improvement in histopathological changes in pancreas and reduction in pancreatic glutathione (GSH) content in diseased rats as compared to the normal rats. Glucose uptake by diaphragm also increased as noticed (**Mona F Mahmoud *et al*., 2017**).

When plant extracts of karela and Trigonella foenum- graecum had been given to the diabetic rats to check the anti-oxidant and anti-hyperglycemic effect, its shows huge change in the status of cardiac tissues of diseased rats. Antioxidant enzymes such as Superoxide Dismutases, Catalase and reduced GSH content in diabetic rat cardiac tissues had been increased. Lipid peroxidation also decreased (**Uma Nath Tripathi *et al*., 2009**).

Momordica charantia plant extract was given orally to the rats having thick membrane of the Bowman's capsule, edema, necrosis and hyaline deposits. Due to the antioxidant properties of the plant extract, it prevents the oxidative damage to the diabetic kidney (**S L Teoh *et al*., 2010**).

We already know about the anti-inflammatory property of the *Momordica charantia*. Plant extract prepared in methanol solvent when injected to the diseased organism in a fixed concentration. There is suppression of TAK1 (transforming growth factor activated kinase 1) activity which also affects the NF (a nuclear factor) due to the anti-inflammatory properties. (**Woo Seok Yang *et al*., 2018**).

leaf ethanol extract of Karela was checked for its antioxidant and hypolipidemic potential on mice fed on diet with high fat content. When a fixed amount of dose was given to those mice showed the elevation in SOD activities of liver tissues. When the liver tissues of those mice were histopathological examined it confirmed that LE has hepatoprotective effect against liver damage induced by high fat diet (**Qingfeng He *et al*., 2018**).

Hypertension is one of the major factors of cardiovascular disease all around the world. Hypertension could be cause of death when not treated at the right time. Salt induced hypertension in Dahl salt sensitive rats (DSS) was reduced by the anti-hypertensive effect of the bitter gourd extract. Salt induced hypertension was restored in DSS by increasing the synthesis of arginine and nitric oxide (NO) and also maintains the blood pressure (**Li Zeng *et al*., 2022**).

Wild bitter melon could be used a good biomaterial to develop various Pharma products.. Ethyl acetate (EA) &n-butanol (Bu) fractions shows protective effect against H_2O_2 induced DNA damage, inhibits the α-amylase enzyme activity and has anti-inflammatory effect by production of nitric oxide(**Thi My Hanh Pham *et al*., 2019**).

Bitter melon extract contains various phytochemical having different types of medicinal properties like antioxidant, antidiabetic, antipyretic and anticancer. Some phytochemicals acts as neurodegenerative and neurotraumative agent. Risk of neuroinflammation and abnormal mitochondrial function rose due to activation of nuclear factor Kb. Two phytochemicals extracted from bitter melon named alpha-eleostearic acid (α-ESA), a polyphenol named curcumin present in rhizomes of *Curcuma longa* L. Both of these phytochemicals have potential to target the neuronal injuries and diseases. An animal affected with central nervous system (CNS) malfunction when treated with both the above mentioned phytochemicals, a noticeable recovery was seen (**Woon Man Kung *et al*., 2021**).

Vegetable oils of different vegetables have potential anti-oxidant properties to treat different diseases in rats. Papaya, olive, fenugreek, bitter gourd and fish was prepared and when given to a group of mice having diabetes. After feeding the mice with all these oils, kidney and blood was collected. The pathological study showed that there is remarkable decrease blood sugar level, glycated hemoglobin, total cholesterol, triglycerides and low density lipoprotein-cholesterol in diabetic rats (**Kehkashan Parveen *et al*., 2019**).

Leaf extract of Gulf Leaf Flower (*Phyllanthus amarus*) and Karela characterize chemically by liquid chromatography shows the presence of different phytochemicals. All these phenolic compounds are responsible for the cardio-protective properties. When the rats are treated with these cardio-protective agents of Karela and Gulf Leaf Flower showed positive improvement in redox imbalance and other biomolecules are required for heart function that was affected by doxorubicin (**Jamiyu A. Saliu *et al*., 2022**).

Conclusion and future prospective

Karela is one of the most widely used for its medicinal properties. It can induce positive effect in *drosophila.* Egg count and fecundity could be improved in a positive manner. In future it could be used to study different aspects in *drosophila* which could be so helpful in different researches. We can also study the oxidative stress and also many more.

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