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Evaluation of Pharmacological Profile of Momordica Charantia Linn: A Review

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Abstract:

Momordica Charantia is a herbal plant which is mostly found in tropical and subtropical regions. It is also known as Karela. It belongs to the family Cucurbitaceae. It has been used against various diseases for quite a long time. Diseases like anaemia, Cancer, Blood related diseases, Diabetes mellitus, Hyperlipidaemia can be cured by different parts of Momordica Charantia. Various chemical constituents are present in Momordica Charantia like alkaloids, triterpenes, steroids, lipids and phenolic compounds which are pharmacologically active against previous diseases. In this article pharmacological profile of different parts of Momordica Charantia is discussed.

Keywords:

Momordica Charantia, Antihyperglycemic agent, Antihyperlipidemic agent, Antiulcer, Antimicrobial agent, Antiviral agent, Antiurolithiatic agent, Antioxidant agent, Anti-cancer agent.

Introduction:

Momordica Charantia which is a climbing shrub is one of the mostly used plant in Asian countries. It has enormous number of medicinal uses. As it is a herbal drug so it has less side effects. It belongs to the family Cucurbitaceae. It is commonly known as bitter gourd, balsam pear, bitter melon or kugra. Momordica is a Latin word which means to bite which refers to its jagged edges. It is mainly found in Asia, China, South America, Caribbean and East Africa. It is used as a medicine in various countries like Cuba, Columbia, China, Brazil, India, Mexico, Malaysia, New Zealand, Ghana and Peru [1]. It is also used as Carminative and it also act as Antiseptic which helps in wound healing. Other pharmacological uses of Momordica Charantia are antiviral, antibacterial, antileukemic, anti-inflammatory, hypotensive, immunostimulant and antimutagenic properties. This work will mainly focus on the pharmacological properties of Momordica Charantia.

Plant profile:

VERNACULAR NAME [2]

English	Bitter gourd, Balsam pear, Balsam apple
Arab	Quisaul – barri
Nepali	Teeta Karela

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Assam	Kakiral, Kakral
Bengali	Kerula, Karela, Uchchhe
Gujarati	Karela
Hindi	Karela, Kardi
Kannada	Hagal
Malayalam	Kaipp, Kaippavlli, Paval
Tamil	Pavaka,Chedi,Paharkai, Pakal
Telegu	Koekara, Kaaya
Urdu	Karela
Sanskrit	Sushavi, Karavella
Oria	Kalara, Salara

SCIENTIFIC IDENTIFICATION

Scientific name	Momordica Charantia
Division	Magnoliophyta
Kingdom	Plantae
Family	Cucurbetaceae
Species	charantia
Genus	Momordica
Duration	Annual

Cultivation

Momordica charantia is a perennial climber found all over India and it is also cultivated up to a height of 1500m. It is cultivated during summer season when temperature is high i.e., during May to July by sowing seeds in the soil. Seeds are sown at a distance of ½ meter and provided with manures and regular water. Plant seedlings are watered once or twice a week and only one plant is reserved. After 30-35 days plant start to produce flower and and after 15-20 days of flowering fruits are prepared for harvesting. [3, 4]

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General plant description

The length of plant grows from six metre or maybe longer. The size of its leaves is from 4-12 cm with 3-7 deeply separated sections having marginal points. Flowers are always unisexual and actinomorphic in nature. Its fruit has irregular valves and inner layer is filled with flesh and seeds. Seeds are 8-13 mm in size. It has bitter taste than other vegetables. They are yellow to green in colour.[5] For vegetable the fruit part of Momordica Charantia is used. Other parts of the plant like leaves, root, seeds, fruit are used as medicines for curing a lot of diseases.Seeds are5-30, squarish rectangular, ends subtridentate, faces compressed, sculptured, 5-9×3-6 rare, margins grooved, brown or black.

Biological activities

The different parts of the Momordica Charantia (Karela) have following uses:

Root - Acrid, astringent

Leaf - emetic, purgative, Antipyretic, bitter

Fruits - depurative, digestive, purgative, stimulant, stomachic, thermogenic, acrid, anthelmintic, anti-diabetic, anti-inflammatory, appetizer, bitter

Active Phytochemical Constituents

Various Chemical Constituents which are present in Momordica Charantia are momorchanins, momordicilin, charantin, gypsogenin, lauric acid, lanosterol, linolenic acid, momordicius, momordicosides, momordenol, momordicinin, momordenol, momordin, momordolol, cryptoxanthin, cucuritacins, cucurbitns, cycloartenols, cucuritanes, erythrodiol, elaeostearic acids, galacturonic acid, gentisic acid, goyaglycosides, goyasaponins, and multiflorenol, cucurbitacins, , cucurbitanes, diosgenin erythrodiol, guanylate cyclase inhibitors, , karounidiols, hydroxytryptamines. [6]

Different chemical constituents present in the fruit part of the Momordica Charantia are reducing sugars, resins, glycosides, saponins, alkaloids, phenolic constituents, fixed oil and free acids.

Leaves of the plant are also beneficial in nature. It contains various chemical constituents like magnesium (4%), calcium (1%), iron (3%), phosphorous (5%), potassium (7%).

Fruits are rich in B vitamins: thiamine (4%), riboflavin (4%), niacin (2%), pyridoxine (3%), folate (13%). [7, 8]

Momordica Charantia contain phenolic acid and flavonoids like ascorbic acid, quinic acid, gallic acid, catechin, vanillic acid, o-coumaric acid, 4-coumaric acid, cinnamic acid, p-methoxy-benzoic acid which employ anti-oxidant activity.

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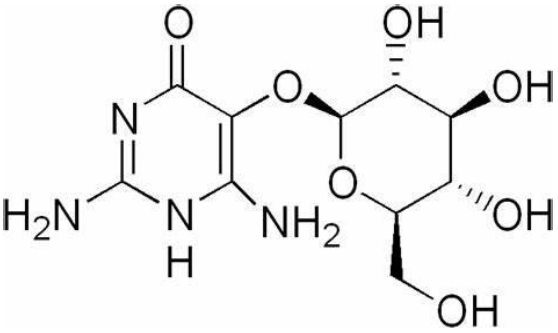

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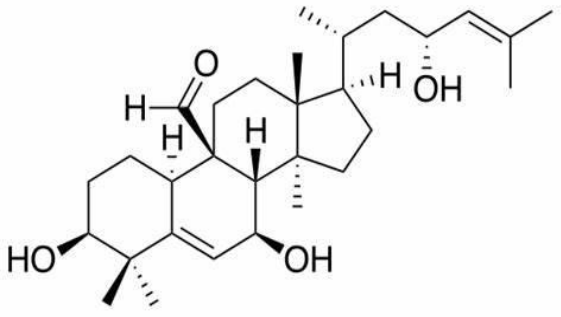

Momordicin

Nutrient composition of Momordica charantia

Constituents	Quantity
Moisture (g/100 g)	83.20
Carbohydrates (g/100 g)	10.60
Fiber (g/100 g)	1.70
Proteins (g/100 g)	2.10
Calcium(mg/100g)	23.00
Potassium (mg/100 g)	171.00
Phosphorus (mg/100 g)	38.00
Sodium (mg/100 g)	2.40
Iron (mg/100 g)	2.00
Copper (mg/100 g)	0.19
Manganese (mg/100 g)	0.08
B carotene	126
Vitamin C	96
Zinc (mg/100 g)	0.46

Fig.-1

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Pharmacological profile of Momordica Charantia

1. Antihyperlipidemic activity

Hyperlipidaemia is a condition which is characterised by increase in the lipid content in the body. It is the condition in which the lipid levels increase in the body. The LDL (Low Density Lipoprotein) level increases whereas HDL (High Density Lipoprotein) level decreases. The main reason behind hyperlipidaemia is high fat intake, less workout, change in the lifestyle, obesity and diabetes. It is one of the major causes of heart related diseases. If left untreated it may lead to heart failure and may cause death. With the increase in the lipid content in the body fats start accumulating in the blood vessels. This may cause disruption in the blood flow through blood vessels and may lead to change in heart rate. It may also cause atherosclerosis. Doctors recommend Atorvastatin, Simvastatin in this condition. These drugs help in lowering down the rising LDL levels. Ayurvedic preparation of Momordica Charantia is helpful in treating hyperlipidaemia. The fruit part of plant is helpful in reducing lipid levels. To reduce cholesterol levels in the body, aqueous extract of Momordica Charantia is taken orally at doses of 100-200 mg/kg for 14 days. Different studies revealed that significant decrease in LDL levels will be seen and HDL levels increases after consumption of Momordica Charantia in diet. HDL is also known as Good Cholesterol and increase level of HDL is good for health. [9]

2. Anti-Diabetic activity

Diabetes is a condition which is characterized by increase in glucose levels in the body. It is a condition when our body is not able to take glucose into the cells for energy production. There is no proper treatment for Diabetes. We can only reduce the increased glucose levels or increase the insulin level to regulate glucose.

Diabetes mellitus is of two types:

Type 1 Diabetes mellitus

It is also called Insulin dependent Diabetes mellitus. In this type, autoimmune condition occurs in which mainly pancreas is attacked. In this condition insulin injections are given to maintain its level in the body so that glucose metabolism takes place.

Type 2 Diabetes mellitus

It is also called as non- insulin dependent Diabetes mellitus. It is due to obesity, unhealthy food intake and less workout. In this condition either pancreas do not make enough insulin or insulin resistance may occur. It may lead to heart diseases if glucose levels are not maintained. Drugs like Glipizide, metformin is given in Type 2 Diabetes mellitus. They stimulate release of insulin in the body. Type 2 Diabetes mellitus account for 90-95% patients all over the world. Along with these commercial drugs, Momordica Charantia is also useful in Diabetic patients.

It is believed that oral administration of Momordica Charantia causes secretion of insulin from pancreatic islet cells. They generally cause increase in number of β-cells than untreated diabetic patients. Various experiments have shown that Momordica Charantia cause insulin secretion from

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endocrine pancreas [10] and cause glucose uptake in the liver [11]. So, at the end of the study it is cleared that Momordica Charantia produce hypoglycemic action by two pathways. First it regulates the glucose absorption by the gut into blood stream and secondly it stimulates glucose uptake into skeletal musclesjust like insulin. Chemical constituents in Momordica Charantia also activates a protein called AMPK which is responsible for regulating and enabling glucose uptake process.

3. Anti-Ulcer activity

Ulcer is a condition in which the inner lining of the stomach or small intestine damages. It is caused by the over production of acid the stomach. Helicobacter pylori is the bacteria which is responsible for producing HCl acid in the stomach for digestion of food. But if the over production of acid occurs then inner lining of the stomach gets disrupted. It can be caused by the side effects of NSAIDs like Aspirin. Mild to severe abdominal pain occurs in this condition. Different medications mainly reduce the activity of H. Pylori bacteria and thus HCl secretion is reduced in stomach. Other than commercial medications, Momordica Charantia is also helpful in treating ulcers. Methanolic extract of Momordica Charantia fruit had good activity in healing the gastric ulcers. They mainly decrease the acid content in the stomach and increase the mucous secretion in the stomach. The mucus will form a layer in the stomach lining and thus reduce sores. [12, 13]

4. Antioxidant activity

Oxidative stress is one of the reasons for many chronic diseases like Diabetes, heart diseases and cancer. This condition happens when the free radical formation increases in the body. [14] Due to this the balance between the formation of oxygen and antioxidants is destroyed. This leads to damage of various cell components like lipid, protein and nucleic acid and may also cause cell death. [15, 16] To get rid of such effects people use different plants which has antioxidant properties. Momordica Charantia is one of them. It contains various chemical constituents. The flavonoid part is generally responsible for producing antioxidant activity. They mainly remove free radicals in the lipid and polar phase and also inhibit various types of oxidising enzymes. Along with antioxidant, anticancer, antidiabetic and anti-inflammatory activity has also been reported.

5. Anti-cancer activity

Cancer is one of the deadly diseases in the world. The uncontrolled proliferation of the cells leads to cancer. This causes formation of tumours in various parts of the body. Due to less symptoms, it cannot be seen in the early stages. Biopsy is done to determine the type of cancer and the extent of cancer spread in the body. Doctors recommend various drugs for the treatment of cancer like Antimetabolites (Marceptopurine, 5-Fluorouracil), Alkylating agents (Chlorambucil, Cyclophosphamide, Busulfan). These drugs have so many adverse effects like nausea, vomiting, hair loss, constipation etc. So ayurvedic preparation of Momordica Charantia is found useful in Cancer and no such side effects are observed. Various studies revealed that 50% methanolic extract of Momordica Charantia fruit, leaves shows significant reduction in tumor in Cancer patients. Several in-vivo studies claimed that the entire plant of bitter gourd show anticancer activity, whereas in another study anticancer activity of water extract of Momordica Charantia is found effective in blocking the growth of rat prostate carcinoma.

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6. Antiviral activity

Along withthe traditional uses of Momordica Charantia, it has some antiviral activity as well. It shows antiviral activity against various viruses like HIV-virus, Herpes virus. In an in-vivo study it is found that the leaves extract of Momordica Charantia possess some antiviral activity, they cause increase resistance to viral infection and also act as immunostimulant. They also increase the production of interferons and natural killer cells. But still more research is required to determine the exact antiviral activity of Momordica Charantia before it is recommended.

7. Antibacterial activity

Various in-vivo studies have shown that Momordica Charantia possess broad spectrum antibacterial activity. Momordica Charantia is found effective against various gram-positive and gram-negative bacteria like salmonella, E-coli, shigella, pseudomonas, staphylococcus, streptococcus, streptobacillus, H-pylori and plasmodium falciparum.

Conclusion

In conclusion we can say that Momordica Charantia is a magical herb which possess so many pharmacological properties. Momordica Charantia is used in so many countries to treat various diseases. It is mostly found in Asian countries and in tropical and subtropical regions. It belongs to family Cucurbitaceae. It is commonly known as bitter gourd, karela, bitter melon, balsam pear etc. It is used to treat various kinds of diseases like diabetes mellitus, hypertension, cancer, Hyperlipidaemia, Gastrointestinal problems, microbial and viral infections. It also acts as antioxidant. From its leaves to fruit to root, Momordica Charantia has so many potential benefits. Various chemical constituents which are present in Momordica Charantia are Charantin, Momordicin, momordinol, erythrodiol, momordinol, Momordin, galacturonic acid, erythrodiol, gentisic acid, guanalyte cyclase inhibitors etc. Proteins like alpha-momorcharin is also present in Momordica Charantia. It has antiproliferative action. These chemical constituents are analysed by doing phytochemical screening and different kinds of analysis. The vitamin composition is determined by using highly efficient technique called HPLC (High Performance Liquid Chromatography), whereas phytochemical screening is done to determine alkaloids, flavonoids, tannins, phenolic acids, saponins etc. The aqueous extract of Momordica Charantia is helpful in treating Hyperlipidaemia. Two other chemical constituents momocharin and Momordicin are also present in Momordica Charantia. Their structure is somewhat similar to insulin. So they act like insulin in the body and works as Antidiabetic agent. It is also found that methanolic extract of Momordica Charantia is helpful in treating various kinds of ulcers. They mainly decrease the acid production in the stomach and helps in increasing the mucous secretion so that a protective layer is formed in the stomach. Momordica Charantia is also antioxidant in nature. It contains various flavonoids, tannins, phenolic acids, alkaloids etc. Which acts as antioxidant in nature. They are also active against various microbial infections like herpes virus, HIV-virus and bacterias like E-coli, salmonella, streptobacillus, streptococcus z shigella, pseudomonas, staphylococcus, plasmodium falciparum etc. They act as immunostimulant and helps in increasing production of interferons and Natural Killer Cells (NKC) in the body. Momordica Charantia is also found effective against kidney stone. They mainly reduce the formation of calcium oxalate crystals in the kidney and thus leads to

diuresis. They decrease the concentration of stone forming agents in the kidney. Thus, it is cleared that Momordica Charantia is a magical herval plant which has numerous uses. It is also found that people are using herbal preparations more than before because of their less side effects and more benefits. They are also much cheaper than commercial drugs. So, people are focusing towards ayurvedic preparations. However various studies are still needed to be done to determine the exact dosage of Momordica Charantia in specific diseases.

References

1. Riches, P. L., Wright, A. F., and Ralston, S. H. (2009) Recent insights into the pathogenesis of hyperuricaemia and gout. Hum. Mol. Genet. 18:R177-R184.
2. Zimmet P. Globalization, coca-colonization and the chronic disease epidemic: can the Doomsday scenario be averted? J Intern Med, Mar 2000; 247(3): 301–10.
3. National bitter Melon Council. http://www.bittermelon.org/pages/learn/about_reference.h tml [Accessed July, 3, 2007.
4. Beloin N, Gbeassor M, Akpagana K, Hudson J, de Soussa K, Koumaglo K and Arnason JT: Ethnomedicinal uses of Momordica charantia (Cucurbitaceae) in Togo and relation to its phytochemistry and biological activity. J Ethnopharmacol 2005; 96: 49-55
5. 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
6. Prakash A, NG TB, Tso WW. Purification and characterization of charantin, a napin like ribosomeinactivating peptide from bitter gourd (Momordica charantia) seeds, J Peptide Res. 2002; 59:197-202
7. (http://www.singleherbs.org/products/karela.htm)
8. Dhalla NS, Gupta KC, Sastry MS and Malhotra CL: Chemical composition of the fruit of Momordica charantia Linn. Ind J Pharmacol 23: 1961; 128
9. Temitope AG, Sheriff OL, Azeezat YF, Taofik A, Fatimah AI. Cardioprotective properties of Momordica charantia in albino rats. Afri J Sci Res. 2013;11(1):600.
10. Shibib, B. A.; Khan, L.A., Rahman, R. Hypoglycaemic activity enzymes glucose-6-phosphatase and fructose-1,6-bisphosphatase and elevation of both liver and red-cell shunt enzyme glucose-6- phosphate dehydrogenase. Biochem. J., 1993, 292, 267-270.
11. Ahmed, I.; Adeghate, E.; Sharma, A.K.; Pallot, D.J.; Singh, J. Effects of Momordica charantia fruit juice on islet morphology in the pancreas of the streptozotocin-diabetic rat. Diabetes Res. Clin. Pract., 1998, 40, 145-151.
12. Cummings, E.; Hundal, H.S.; Wackerhage, H.; Hope, M.; Belle, M.; Adeghate, E.; Singh, J. Momordica charantia fruit juice stimulates glucose and amino acid uptakes in L6 myotubes. Mol. Cell Biochem., 2004, 261, 99-104.
13. Dr. Naveen Nandal, Ms. Nisha Nandal, Dr. Kirti Mankotia, Ms. Neetu Jora. (2021). Investigating Digital Transactions in the Interest of a Sustainable Economy. International Journal of Modern Agriculture, 10(1), 1150 - 1162. Retrieved from http://www.modern-journals.com/index.php/ijma/article/view/1378
14. Lee, A.D.; Hansen, A.; Hollosby, A. Wortmannin inhibits insulin stimulated but not contraction stimulated glucose activity in skeletal muscle. FEBS Letts., 1985, 361, 51-

15. Gurbuz, I., Akyuz, C., Yesilada, E., Sener, B., 2000. Anti-ulcerogenic effect ofMomordica charantia L. fruits on various ulcer models in rats. Journal of Ethnopharmacology 71, 77–82.
16. Suzuki, Y., Ishihara, M., Segami, T., Ito, M., 1998. Anti-ulcer effects of antioxidants, quercetin, alpha-tocopherol, nifedipine and tetracycline in rats. Japan Journal of Pharmacology 78, 435–441.
17. Elmastas M, Gülçin, Iildak Ö, Küfreviolu Öbaolu K, Aboul-Enein HY (2006). Radical scavenging activity and antioxidant capacity of Bay leaf extracts. J. Iran Chem. Soc. 3(3): l258-266.