



Review Article

**A REVIEW OF HYPOGLYCEMIC EFFECT OF *MOMORDICA CHARANTIA* W.S.R. TO *MADHUMEH***

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**ABSTRACT**

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both processes are involved in the development of diabetes. Diabetes is also known as *Madhumeha* in Ayurveda. Diabetes Mellitus has become a global problem in spite of advances in modern science. Ancient science of Ayurveda has discussed diabetes at length thousands of years ago. Number of diabetic patients are increasing in very high range. Year by year, its growing speed is very fast. In Ayurveda there are many ways to prevent diabetes mellitus and to cure its complications. Ayurvedic medications and management is very helpful and very effective in specially for diabetes. In this paper, trying to explain the hypoglycemic effect of *Momordica (Karela)* in diabetes mellitus (*Madhumeh*). *Karela* is specifically used as a folk medicine for diabetes. Several researches proved that it contains a hypoglycaemic or insulin-like principle, designated as 'plant-insulin', which has been found highly beneficial in lowering the blood and urine sugar levels.

**KEYWORDS:** *Karela, Momordica Charantia, Diabetes mellitus, Madhumeh, Ayurveda.*

**INTRODUCTION**

Diabetes mellitus is considered as one of the five leading causes of death in the world. It is a syndrome of disordered metabolism, usually due to a combination of hereditary and environmental causes, resulting in abnormally high blood sugar levels (hyperglycemia).<sup>[1]</sup> Being a major degenerative disease, diabetes is found in all parts of the world and it is becoming the third most lethal disease of mankind and increasing rapidly.<sup>[2]</sup> It is the most common endocrine disorder, affecting 16 million individuals in the United States and as many as 200 million individuals worldwide.

*Madhumeha (Prameha)* Ayurvedic remedies for *Madhumeha* (diabetes mellitus) are the oldest among all the available therapies, which includes in the *Prameha* category. *Pramehas* are a list of urinary disorders, especially characterized by profuse urination with several abnormal qualities due to *Doshic* imbalances. The word *Prameha* is derived from, *Pra* - means excess, *Meha* - *ksharane* - passing of urine. So *Prameha* is passing excessive urine and turbid in color ('*prabhootha avila mootrata*'). The main causes of *Prameha* are lack of exercise and improper food habits in excess food intake which falls in the category of *Ushna, Snigdha* and *guru* are the primal cause of this disease - Fish, curd are good example. Foods that increase *Kapha, Medhas* and *Moothra* are the etiological factors for *Prameha*. Main causes Sleeping in day time, lack of exercise, Laziness,

Sedentary habits, consumes food and drinks which are cold, unctuous, sweet and fatty items etc, (Fat rich Diet).<sup>[3]</sup>

**Classification**

- I.) *Prameha* is classified aetiologically in to *Sahaja* (Hereditary) and *Apathya nimittaja* (Unwholesome things - food and exercise etc,).
- II.) According to physical management i. *Apatharpana uthaja prameha* describing the lean diabetic ii. *Santharpana uthaja prameha* relating the obese diabetic.
- III.) According to the *Doshic* causes, these *Pramehas* are classified as twenty types : i. *Vataja pramehas* - There are totally four *Vataja pramehas*. ii. *Pittaja pramehas* - There are totally six *Pittaja pramehas*. iii. *Kaphaja pramehas* - There are totally ten *Kaphaja pramehas*.<sup>[4,5]</sup>

**Samprapthighatakas (favorable things for disease)**

- *Dosha* (humur) - *Vata, Pitta, Kapha*
- *Dushya* - *Meda, Mamsa, Kleda, Rakta, Vasa, Majja, Lasika, Rasa* and *Ojas*
- *Srotas* (channel) - *Mootravaha*
- *Srotodusti* - *Atipravrutti*
- *Agni* - *Dhatvagni*
- *Udhhavasthana* - *Kostha*
- *Vyaktasthana* - *Mootravaha srotas* (urinary tract)<sup>[6]</sup>

**Samprapthi (Pathogenesis):** *Kapha* undergoing increase by the etiological factors, reaches various *Dooshyas* like *Rasa* (plasma), *Rakta* (blood) etc., As there is a *Shaithilyata* (looseness) in the body and it being fluid predominant, spreads all over the body and gets vitiated, while spreading it gets mixed with *Medas* (fat – adipose tissue), *Mamsa* (muscle) and *Kleda* (body fluids). Body fluids which got vitiated draw them to the urinary bladder and produces *Prameha*; similarly the *Pitta* affects them, *Vata* also brings about vitiation in them and produce *Prameha*. [7,8]

Medicinal plants and its products continue to be an important therapeutic aid for alleviating the ailments of human kind. Herbs for diabetes treatment are not new. Since ancient times, plants and plant extracts were used to combat diabetes. Many traditional medicines in use are derived from medicinal plants, minerals and organic matter. [9]

The incidence of diabetes is increasing day by day. Being a silent killer, it is attacking the young generation secretly that increases the burden of exchequer on the people as well as the government. Two things are common these days- Side effects and Insulin resistance among the people who are taking modern medicines for diabetes treatment. It leads to searching of alternative system of medicine where Ayurveda has greater application and importance. Ayurveda treats diabetes through drugs, diet, Panchakarma and exercise. Many drugs and herbs are used in diabetes. As this way, *M. Charantia* is very useful in diabetes according to Ayurveda as well as allopath also. [10]

*Momordica charantia*, also known as bitter melon, Karela, balsam pear, or bitter gourd, is a popular plant used for the treating of diabetes-related conditions amongst the indigenous populations of Asia, South America, India, the Caribbean and East Africa. [11] Its fruit has a distinguishing bitter taste, which is more pronounced as it ripens, hence the name bitter melon or bitter gourd.

Diabetes mellitus is well known clinical entity with various late complications like retinopathy, neuropathy, nephropathy, etc. *M. charantia* has significant antidiabetic as well as hypolipidemic activity so that it can be used as an adjuvant along with allopathic treatment of medicine to treat diabetes as well as to delay the late complications of diabetes.

### The Profile of *M. Charantia* (Karela)

#### • Plant description

*M. Charantia* (bitter melon or bitter gourd) is a flowering vine in the family *Cucurbitaceae*. It is a

tropical plant that is widely cultivated in Asia, India, East Africa, and South America for its intensely bitter fruits that are commonly used in cooking and as a natural remedy for treating diabetes. [12] It is a climbing perennial that usually grows up to 5 m, and bears elongated fruits with a knobby surface. It is a useful medicinal and vegetable plant for human health and one of the most promising plants for diabetes. [13]

According to Ayurveda, pharmacodynamics of *M. Charantia*-

*Rasa- Tikta, Katu*

*Guna- Laghu, Ruksha*

*Virya- Ushana*

*Vipak- Katu*

*M. Charantia* is *Kapha- Pita dosha shamak*. It is help in decrease lipid content in body and also reduces fat from body.

- Useful Part: fruit, whole parts
- Dose: *Swaras*= 10-20 ml. [14]

#### Phytochemistry of *M. Charantia*

The main constituents of bitter melon which are responsible for the antidiabetic effects are triterpene, proteid, steroid, alkaloid, inorganic, lipid, and phenolic compounds. Several glycosides have been isolated from the *M. charantia* stem and fruit and are grouped under the genera of cucurbitane-type triterpenoids. [15]

*M. charantia* fruits consist glycosides, saponins, alkaloids, reducing sugars, resins, phenolic constituents, fixed oil and free acids. *M. charantia* consists the following chemical constituents including alkaloids, charantin, charine, cryptoxanthin, cucurbitins, cucurbitacins, cucurbitanes, cycloartenols, diosgenin, elaeostearic acids, erythrodiol, galacturonic acids, gentisic acid, goyaglycosides, goyasaponins, guanylate cyclase inhibitors, gypsogenin, hydroxytryptamines, karounidiols, lanosterol, lauric acid, linoleic acid, linolenic acid, momorcharasides, momorcharins, momordenol, momordicilin, momordicin, momordicinin, momordicosides, momordin, momordolo, multiflorenol, myristic acid. [16]

The major compounds that have been isolated from bitter melon and identified as hypoglycemic agents include charantin, polypeptide-p and vicine.

✓ Charantin-

Charantin is a typical cucurbitane-type triterpenoid in *M. charantia* and is a potential substance with antidiabetic properties. [17]

✓ Polypeptide-p

Bitter melon is one of the most commonly used vegetable that contains polypeptide-p and is used to

control diabetes naturally. Polypeptide-p or p-insulin is an insulin-like hypoglycemic protein, shown to lower blood glucose levels in gerbils, langurs and humans when injected subcutaneously.<sup>[18]</sup>

✓ Vicine

The other major compound that has been isolated from the seeds of bitter melon is a glycol alkaloid known as vicine.<sup>[19]</sup>

### Medicinal Properties of *M. Charantia*

Bitter melon is traditionally known for its medicinal properties such as antidiabetic, anticancer, anti-inflammation, antiviral, and cholesterol lowering effects. It contains many phenolic compounds that may have the potential as antioxidant and antimutagen. The fruit, stems, leaves and roots of bitter melon have all been used in traditional medicine to help treat ailments such as hyperlipidemia, digestive disorders, microbial infections and menstrual problems. Bitter melon has been shown to possess powerful antiviral properties that can stimulate the immune system and activate the body's natural killer cells to help fight off viruses such as white spot syndrome virus and human immunodeficiency virus.<sup>[20,21]</sup>

Like most fresh vegetables, bitter gourd is low in calories, and as such great for weight-loss. In Ayurveda, bitter gourd juice has long been used as a solution for diabetic issues and liver organ issues. It stimulates liver for secretion of bile juices that are very essential for metabolism of fats. Bitter gourd contains a chemical called charantin which lower the urine and blood glucose levels, and hence the best home remedy for diabetes. The health benefits of bitter gourd are greater than those of many vegetables. It has numerous vital nutritional supplements including vitamin A, Vitamin B1, Vitamin B2, Vitamin C, Iron, Calcium, Phosphorous, Copper and Potassium. It energizes the appetite, cleanses the liver, purifies the blood and provides many other benefits.<sup>[22]</sup>

It consists of lot of nutritional value like vitamins, minerals and trace elements like vitamin C, iron, zinc, potassium, calcium and phosphorus containing lots of fibers. It is also having low calories and it is effective in weight loss. It also consists of chemical known as charantin which lowers the high blood glucose levels. It is very effective and excellent in source of various health benefits flavonoids i.e. beta-carotene, alpha-carotene, lutein and zeaxanthin.<sup>[23]</sup>

### Anti-diabetic Effect of *M. Charantia*

There are many traditional herbal remedies that have been used to treat diabetes in Asia and other developing countries. *M. charantia* is one of the

plants that has been investigated thoroughly for the treatment of diabetes. With the traditional use supported by modern scientific evidence of the beneficial function of *M. charantia*, it is one of the most promising plants for diabetes today.<sup>[24]</sup> Investigation of the traditional uses of *M. charantia* in India revealed that it is one of the most important plant for lowering blood glucose levels in patients with diabetes. Juice of Bitter melon/Karela may be taken on empty stomach daily in the early morning.

Its help in lowers down the blood glucose as it consists of chemical known as Charantin which help in lowering blood glucose levels, so it is very effective for diabetic person. It leads to influence the glucose metabolism all over the body not than other drugs which only target one organ or tissue. It generally consists of anti-oxidants that will lead to fight the body against complications that are generally seen in diabetic person. The seeds of this plant consist of plant insulin known as polypeptide - P, which lowers the insulin production by the human pancreas and reduces ones sugar levels.<sup>[25]</sup>

### M. Charantia and Glucose Metabolism

Insulin plays a major biochemical role in stimulating the uptake of glucose by different cells of the body for the production of energy. Since *M. charantia* and its various extracts and components have been reported to exert hypoglycemic effects, and then it is important to understand whether *M. charantia* may have a direct effect in inducing a reduction in blood glucose level.<sup>[26]</sup>

#### 1. Lowers Blood Glucose Levels

As stated earlier, bitter gourd has been found to be effective in lowering blood glucose levels. Instead of targeting one particular organ or tissue like medicinal drugs, bitter gourd facilitates glucose metabolism in the entire body. This can be attributed to the presence of two essential compounds called charatin and momordicin which play a key role in lowering blood sugar levels.

#### 2. Facilitates Carbohydrate Digestion

Bitter gourd inhibits the enzymes that are involved in breaking down the disaccharides to two monosaccharides, thereby reducing the amount of glucose released into the blood. Bitter gourd is effective in the treatment of both Type I and Type II diabetes as it influences the transport channels for glucose. This is particularly beneficial in preventing the spikes in blood sugar levels after meals.

#### 3. Increases Insulin Secretion

Insulin is involved in transporting sugar from the blood to the skeletal muscle and fat tissue. This sugar is then used for energy production. Insulin prevents the production of sugar by the liver and its

release into the blood. Type I diabetes, also known as insulin-dependent diabetes, is caused by the failure of the pancreas to produce enough insulin for prevention of spikes in blood sugar levels. By increasing pancreatic insulin secretion, bitter gourd can help in treating type I diabetes. Besides, scientists have discovered an insulin-like molecule called polypeptide P in bitter gourd which can lower blood sugar levels in type I diabetics. Hence, consumption of bitter gourd can reduce the requirement of insulin injections to manage type I diabetes.

#### 4. Reverses Insulin Resistance

Bitter gourd has been found to be effective in the treatment of Type II diabetes. As stated earlier, it is caused due to the failure of the skeletal muscles, fat tissues, and liver to respond adequately to insulin. This is called insulin resistance which increases the risk of developing type II diabetes. Research has shown that bitter gourd contains compounds called oleanolic acid glycosides which can improve glucose tolerance in Type II diabetics, by preventing or reversing insulin resistance.

#### 5. Antioxidant Properties

Thus, high sugar concentration in the blood increases the risk of both Type I and Type II diabetes which further increases the risk of oxidation and inflammation in the whole body, leading to blindness, diabetic feet, stroke, heart attack or kidney disease. Bitter gourd can prevent all these ailments not only by lowering blood sugar levels but also through its antioxidant properties. [27]

The bitter gourd is specifically used as a folk medicine for diabetes. Several researches proved that it contains a hypoglycaemic or insulin-like principle, designated as 'plant-insulin', which has been found highly beneficial in lowering the blood and urine sugar levels. [28]

#### Preliminary Dietary Supplementation

Results of this preliminary study demonstrate, for the first time, the beneficial effects of WBG in Taiwanese adult subjects with MetS. A daily dose of 4.8 grams lyophilized WBG powders in capsules significantly decreased the incidence of MetS after three months of supplementation and the improved status remained after stopping the supplementation for one month, but not for two and three months. This indicates that the washout period should be at least one month if a crossover study is to be conducted. Our results show that it is worth to conduct further randomized-placebo controlled trials to confirm the benefits of WBG on metabolic disorders. [29]

#### CONCLUSION

The concept of food as medicine is a central theme in dietetic and nutritional sciences. The goal from a diet perspective is to control your sugar in your bloodstream in such a way that the insulin in your bloodstream can manage it efficiently. *M. charantia* has been used as dietary supplements and ethnomedicine throughout centuries for relieving symptoms and conditions related to what we know in modern days as diabetes.

In relation to diabetes, only charantin, insulin-like peptide and alkaloid-like extracts possess hypoglycemic properties similar to the plant itself or its crude extracts. These different compounds seem to exert their beneficial effects via several mechanisms to control and treat diabetes mellitus.

*M. Charantia* is very useful in diabetes. whole plant, its seeds and its fruit all are having anti-diabetic property. Diabetes treatment is very good in allpath but very effective and good result is found in Ayurveda. *M. Charantia* have anti-diabetic property and it is very well understand by its bitter property and its chemical composition.

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