REVIEW ARTICLE

Available online at www.JGTPS.com

ISSN: 2230-7346
Journal of Global Trends in Pharmaceutical Sciences
Volume 4, Issue 4, pp -1271-1278, October-December 2013

MOMORDICA CHARANTIA IN DIABETIC MANAGEMENT: A MINI REVIEW

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Journal of Global Trends in Pharmaceutical Sciences

ABSTRACT

Diabetes mellitus is dreadful lifestyle disorder of 21st century affecting more than 200 million people worldwide. In Diabetes mellitus patients have high blood level of glucose because the endocrine pancreas does not produce insulin effectively or showing resistance to insulin. Insulin is a metabolic harmone plays a main role in the stimulation of glucose intake into the body cells where it is utilized to provide energy. Prior to availability of insulin, dietary quantities admitting the traditional medicines derived from plants were the major form of treatment. A multitude of plants are used for the treatment of diabetes mellitus all over the world. One such plant is *Momordica charantia* known as karela or bitter gourd which is grown in tropical countries has tremendous beneficial values in controlling and treating diabetes mellitus. Mixture of steroidal saponins such as charantins, insulin like peptides and alkaloids which are isolated from *Momordica charantia.* Further the isolation and characterization of chemicals from *Momordica charantia* can show the exact mechanism of diabetes mellitus.

Key words: Diabetes mellitus, *Momordica Charantia(MC)*, Insulin, Ketoacidosis.

INTRODUCTION

The term diabetes mellitus depicts a metabolic disorder of multiple aetiology qualified by chronic hyperglycaemia with disruptions of carbohydrate, protein and fat metabolic process resulting from defects in insulin secretion, insulin action or both. Long term impairment, and destruction of β cell are the consequences of diabetes mellitus. The symptoms of diabetes mellitus include thirstiness, renal disorder, weight loss and blurred vision. In severe cases ketoacidosis or a non-ketotic hyperosmolar state might originated and lead to shock, coma and absence of effective treatment causes death. People with diabetes face the problems of cardio, peripheral and cerebro vascular disease[1].

Aetiological types of Diabetes Mellitus

Type 1 Diabetes mellitus

It is formerly known as Insulin dependent diabetes mellitus (IDDM) or Juvenile onset diabetes mellitus (JODM). This type 1 is determined as complete insulin deficiency due to destruction of β cell and is of two types i.e. Autoimmune Diabetes mellitus and Idiopathic.

Auto immune diabetes mellitus

The rate of destruction of β cell is quite vary , being speedy in some people mainly observed in children and slow in adults and sometimes referred to as latent autoimmune diabetes in adults (LADA)[2-3]. Particularly in children and adolescents the first manifestation of the disease is ketoacidosis. Others have small fasting hyperglycaemia that can quickly convert to serious hyperglycaemia or ketoacidosis in front of contagion or other stress[4]. Adults may hold remained β cell function, enough to forbid ketoacidosis for many years[5]. People suffering with this type 1 diabetes often get dependant on insulin for living eventually and are at high risk for ketoacidosis[6]. At this stage there is no chance of insulin secretion as evidenced by low levels of plasma C- peptide[7].

Idiopathic

Some of the patients with type 1 diabetic forms have permanent insulinopenia and have no evidence of auto immunity[8] are prone to ketoacidosis and are commonly seen in people of Africa and Asia and they required insulin

replacement therapy[9].

Type 2 Diabetes mellitus

It is formerly known as Non insulin dependent diabetes mellitus (NIDDM) or Adult onset diabetes mellitus (AODM). Grading from predominately insulin lacking to predominately insulin resistant[10-11]. It is often unknown for many years and such patients are at high risk of developing microvascular and macrovascular complications because the hyperglycaemia is often not severe enough to elicit noticeable symptoms of diabetes[12-13].

Majority of patients with type 2 diabetes are obese which itself causes insulin resistance[14-15] and have normal or elevated levels of insulin, increase in blood glucose levels and results in even higher insulin values had their β cell function been normal[16].

The plant kingdom is a good potency for finding of new medicines to treat numerous diseases including diabetes mellitus[17-19].

Medicinally the plant, whole fruit and its powder extracts have a long history of use in the treatment of various infections and diseases like viral, bacterial, microbial infections, skin diseases, HIV, quashed cholesterol and inflammation, detoxification of the body, exhausting worms from the body, hormonal balance, increases immunity, upgrades milk flow and indigestion[20-22].

The active chemicals present in *Momordica charantia* are saponins, glycosides, alkaloids, fixed oils, triterpenes, proteins and steroids[23]. The unripe fruits are a good source of vitamin C and also render vitamin A, phosphorus and iron[24-25].

Various phytochemicals such as momorcharins, momordenol, momordicins, momordolol, charantin, charine, cryptoxanthin, cucurbitacins, cucurbitanes, cucurbitins, cycloartenols, diosgenin, erythrodiol, galacturonic acids, gentisic acid, goyasaponins, multiflorenol, and goyaglycosides have been isolated from all parts of plant[26-27].

Mode of hypoglycaemic action of MC

The possible modes of hypoglycaemic actions are insulin secretagogue effect, stimulation of skeletal and peripheral muscle glucose utilisation, inhibition of glucose intake and hexokinase activity, suppression of key gluconeogenic enzymes, stimulation of key enzyme of HMP pathway, preservation of islet β cells and their functions[28-36].

Isolation of phytoconstituents in *Momordica charantia*

There are many types of extraction have been done to *Momordica charantia* in order to extract the active compounds. This includes the following methods[37]:

1. Pressurized Boiler Set Up
2. Soxhlet extraction and boiling
3. Aqueous extract

Pressurized Boiler Set Up

It was performed by using a pressurized boiler system consisting of boiler, condenser, pressure relief valve, pressure gauge and thermocouple (shown in fig 1). The sample of 10g was placed in the boiler and mixed with 550ml water at a given time (30, 60, 90, 120 min), solid to liquid ratio (1:15, 1:25, 1:35, 1:45, 1:55, 1:65) and pressure (0.5, 1.0, 2.0, 2.5 bar). Then all the screws were tightened in order to prevent leakage at the system, deliberately check the system was in pressurized condition or not. Hot plate was used to heat the water and when the temperature reaches to 100^0C, the steam gets pressurized in the boiler and gives reading at the pressure gauge. The analysis was made in the pressure range between 0.5± 0.5 bar to 2.5± 0.5 bar. Then the sample was shifted to rotary evaporator to separate and clear the water from the extract under reduced pressure in vacuum.

The yield was weighted and the extract would be treated with n-hexane to extract the compounds.

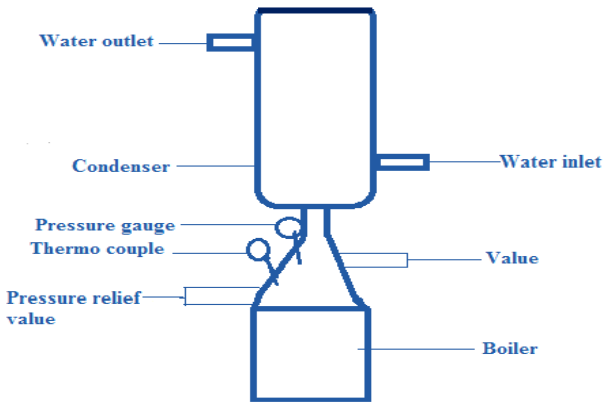

Figure 1: Pressurized boiling system

Soxhlet extraction and Boiling

It was done using hexane as a solvent. Sample of 10g was placed in Soxhlet extractor and 150ml of hexane was placed in the distillation flask and extracted for 1hr. After that the sample was collected and placed in a beaker and

boiled at 100^0C for 1hr.

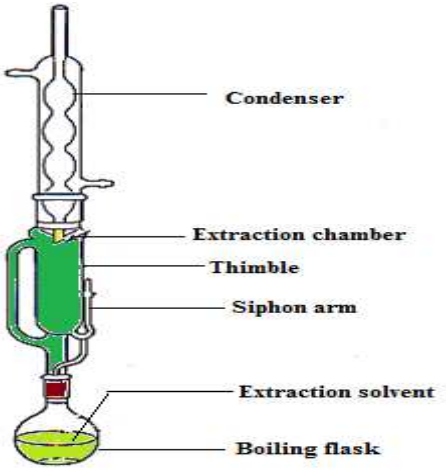

Figure 2: Soxhlet apparatus

Aqueous extraction

The fresh fruits of *Momordica charantia(MC)* were purchased from market and rinsed thoroughly with water. Then the fruits were chopped into small pieces and dried under sunlight. The dried pieces were powdered in the blender and soaked in water for an hour. The mixture was then filtered using muslin cloth and the filtrate was stored for the study[38].

Effect of *MC* in hypoglycaemic condition

Various low quality human studies have suggested that *MC* lowers serum glucose levels[39-42]. The extracted elements appears to have similar structures related to animal insulin, as evaluated by electrophoresis and infrared spectroscopic analysis and also have insulin like properties[43-45].

Other manifest suggests that *Momordica charantia(MC)* may decrease hepatic gluconeogenesis, enhance hepatic glycogen synthesis and increase peripheral glucose oxidation in erythrocytes and adipocytes[46]. The polypeptide isolated from the seeds called "polypeptide p" and a mixture of two steroid glycosides referred as "charantin" [47-48].

Applications of *MC* in diabetes

The fresh juice of *Momordica charantia* can lowers the blood glucose levels and hold insulin under control. It is mainly due to presence of phytoconstituents i.e. charantin, insulin like peptides and alkaloids which pretend together and improves glucose allowance without enhancing insulin levels. These elements trigger a protein named AMPK, which governs fuel metabolic process and alters glucose uptake processes which are afflicted in diabetes. It also noticed, that increase in number of insulin releasing β cells in the pancreas. Multiple clinical examines have authenticated the efficacy of *Momordica charantia* and respective pharmaceutical companies have started and let them in their preparations.

Applications of *MC* in other diseases

Anti bacterial activity

The extract of entire *Momordica charantia* plant has antiprotozoal activity against *Entamoeba histolytica, E.coli, Salmonella paratyphi, Streptomyces griseus, Shigella dysenterae*[49-50].

Antiviral activity

The extract of *Momordica charantia* contain α and β momorcharin, lecithin and MAP 30 have been documented to have *in-vitro* antiviral activity against *Epstein barr, herpes*, HIV, *Coxsackievirus* B3 and *polio viruses.*

Anti HIV activity

Isolated protein known as MAP 30 having anti HIV activity[51-53]

Anti herpes activity

Two *in-vitro* studies have shown antiherpes activity of *Momordica charantia* ribosome deactivating proteins and MAP 30 against HSV-1 and HSV-2. This effect is probably mediated through inhibition of protein synthesis[54-55].

Anti polio virus activity

Momordica charantia ribosome deactivating proteins inhibited polio virus replication by inhibiting protein synthesis suggested its use against sexually transmitted diseases, as it had no effect on the motility or vitality of spermatozoa[56].

Anti cancer activity

Momordica charantia crude extract containing MAP30 shown activity against lymphoid leukemia, lymphoma, choriocarcinoma, melanoma, breast cancer, skin tumour, prostatic cancer, squamous carcinoma of tongue and larynx, human bladder, carcinomas and Hodgkin's disease[57-60].

Anti ulcer activity

Momordin Ic potentially inhibited ethanol induced gastric mucosal lesions and also have anti H.pylori activity which would also be beneficially contribute to antiulcer activity[61-63].

Anti helmintic activity

Preparations from *Momordica charantia* exhibited *in-vitro* activity against *Ascardia galli* worms shown to be effective than piperazine hexahydrate[64].

Anti malarial activity

Observe weak *in-vitro* antiplasmodial activity for *Momordica charantia* and moderate *in-vivo* activity against rodent protozoal infection P.vinckeipetteri65[-66].

Immunomodulatory activity

α, β momorcharin showed immunosuppressive activity via lymphocyte toxicity or to a shift in the kinetic parameters of the immune response[67].

Miscellaneous

Anti infective and Analgesic activity

Momordin Ic and its aglycone, oleanolic acid are active principles with anti rheumatoid activity[68-71].

Hypotension and antiprothrombin activity

Observed mild hypotensive with momordin. In another study, *Momordica charantia* prolonged prothrombin time by inhibiting activation of factor X[72].

Hypocholesterolemic, antioxidant potential

Feeding of conjugated octadecatrienoic fattyacid isolated from *Momordica charantia* seed for 4 weeks significantly lowered the plasma lipid and erythrocyte membrane lipid peroxidation as well as non- enzymatic liver tissue lipid peroxidation in sunflower oil fed rats[73-75].

CONCLUSION

The herbal plants find out application in pharmaceutical, agriculture, cosmetic and food industry and have negligible side effects than the synthetic drugs. It was concluded that *Momordica charantia* contains the active constituents known as steroidal saponins (charantin, insulin like peptide and alkaloids) which was responsible for the lowering of blood glucose levels. Isolation and recognition of active ingredients from plants, formulation of standardized dose and dosage form can act as a substantial part in improving the hypoglycaemic action.

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