Hypoglycemic and Lipid-Lowering Effects of Bitter Melon (*Momordica charantia*) in Type 2 Diabetic Patients

Mubashir Nazeer Malik[1,*], Sadia Malik[2], Irum Malik[3]

[1]Department of Food Science and Human Nutrition, University of Veterinary and Animal Sciences, Lahore, Pakistan

[2]Department of Allied Health Sciences, Riphah Internation University, Lahore, Pakistan

[3]Department of Nursing, University of Health Sciences, Lahore, Pakistan

[*]Corresponding author

Abstract

Type 2 diabetes mellitus (T2DM) and linked lipid disorders are now public health issues in Pakistan, which largely contribute to increased morbidity and mortality rates. The usual treatments are very costly and have unwanted side effects, creating the demand for safer, cheaper alternatives. This research examines the lipid-lowering and hypoglycemic potential of *Momordica charantia* (bitter melon), a folk medicinal plant with reported antidiabetic activity. The study was conducted in 40 T2DM patients who were randomly divided into two groups. Group A was given 2 g/day bitter melon powder in capsule form, whereas Group B was given a placebo. The intervention duration lasted for 30 days with the monitoring of fasting blood glucose (FBG), total cholesterol, and triglyceride levels. At the study's conclusion, Group A demonstrated statistically significant FBG, total cholesterol, and triglyceride reduction compared to Group B, demonstrating significant improvement in both glycemic control and lipid profile. These observations indicate that bitter melon can be used as a useful, natural, and inexpensive adjunct therapy for the control of T2DM and associated lipid disturbances. Its use in food or supplement regimens could provide a valuable alternative in resource-constrained regions such as Pakistan, where availability of optimum diabetes care is still a problem. Larger sample size and extended period of intervention are suggested in further studies to corroborate and generalize these observations.

Keywords

Bitter Melon, *Momordica charantia*, Type 2 Diabetes, Hypoglycemia, Lipid Profile

1. Introduction

Diabetes mellitus is a leading chronic health disease among millions of people globally [1]. Among its types, Type 2 diabetes mellitus (T2DM) is the most common, especially in low- and middle-income nations. Diabetes mellitus is a metabolic disorder associated with high blood glucose levels, [2] which is mainly a result of defective insulin secretion, insulin resistance, or both. Insulin, which is made by the beta cells of the pancreas, is essential in enabling the glucose to move into the cells and generate energy [3]. When the body does not make enough insulin or when its cells fail to respond to the insulin, glucose accumulates in the blood, leading to hyperglycemia [4]. With time, the uncontrolled blood sugar levels may give rise to serious complications such as heart disease, kidney failure, nerve damage, blindness, and even death.

Along with the elevated blood sugar levels, diabetic patients also have disturbed lipid metabolism, thus increasing the risk of cardiovascular diseases [5]. Hypercholesterolemia and hypertriglyceridemia are prevalent in patients of T2DM. This pairing of elevated blood sugar and lipid imbalance is a grave risk to long-term health [6]. Sadly, the incidence of diabetes is increasing rapidly, particularly in nations such as Pakistan, where modern day lifestyle modifications, unsound diet, reduced physical activity, and hereditary factors significantly drive this rise [7]. Since increasing numbers of people are being diagnosed with diabetes each year, the disorder has become a huge burden for patients, families, and the national health care system [8].

Standard treatments for diabetes include oral hypoglycemic medication, insulin injections, and lipid-lowering drugs [9]. Although such treatments are effective, they tend to be costly and have numerous side effects. For most patients in developing nations, these drugs are out of reach, and the expense of extended treatment is a financial strain [10]. Consequently, interest in other forms of therapy that are affordable, accessible, and safe has been on the rise [11]. Among them, herbal medicines have become extremely popular because they have been used for centuries, they are of natural origin, and they have few side effects. One of such traditional herbal remedies proven to control diabetes is bitter melon [12].

Bitter melon, or *Momordica charantia*, or locally known as karela, is a climber vegetable characterized by its strong bitter flavor [13]. Though it tastes bad, it has been extensively utilized in South Asian, Chinese, and African traditional

medicinal systems to treat numerous health ailments, particularly diabetes [14]. Bitter melon has a number of bioactive compounds that are suspected to cause its therapeutic actions. They include charantin, vicine, and polypeptide-p - a plant insulin analogue [15]. These are suspected to increase the uptake of glucose by the cells, increase secretion of insulin, lower insulin resistance, and generally regulate blood sugar levels [16].

All above-ground portions of the bitter melon plant, from the fruit through leaves, seeds, and stem, have been utilized in herbal medicine. It may be taken in any form - fresh juice, dried powder, tea, or capsules. Its pulp has exhibited hypoglycemic action, and its juice, though sour and hard to swallow, is used extensively because of its perceived efficacy [17]. The use of bitter melon is increasing, particularly among diabetic patients who want natural remedies [18]. Most people experience significant improvement in their cholesterol and blood sugar levels upon repeated intake of bitter melon supplements.

Some recent research has also shown that bitter melon can be used to control blood lipids such as total cholesterol and triglycerides [19]. Given the prevalence of lipid disorders among diabetic patients, this dual action of bitter melon - decreasing both blood glucose and lipids - provides a strong reason for it to be considered as an integral part of diabetes control [20]. In addition, bitter melon contains many antioxidants that contribute to the elimination of oxidative stress, a condition that leads to diabetic complications [21]. It also maintains healthy insulin activity and glucose storage within the liver, and stimulates the uptake of glucose by peripheral tissues, qualifying it as a multi-action natural product [22].

The plant itself is a prolific vine with green leaves, tendrils, and separate male and female flowers. It produces fruit within 20-30 days after flowering and holds multiple seeds [23]. It can easily grow in tropical and subtropical weather and is commonly cultivated in countries such as Pakistan, India, China, and the United States [24]. Because it can be produced locally, it is a cost-effective, convenient choice for individuals from developing countries. In recent years, bitter melon-based dietary supplements and nutrient drinks have also entered the market, further contributing to its convenience and popularity among diabetic patients [25].

In Pakistan, the practice of herbal and traditional medicine is an integral part of culture and is now furthering with the help of science [26]. Approximately 30% of diabetic patients worldwide are using alternative medicine today, and more so in Asia [27]. Humans are reverting to nature not only due to tradition, but also because of the extremely high price tag and long-term hazard of pharmaceutical drugs [28]. Here, bitter melon is not only a conventional vegetable but also an emblem of hope for individuals coping with chronic ailments with limited means [29].

With increasing use of bitter melon and the imperative for effective and affordable diabetes management, there is a strong requirement for scientific proof of its health benefits [30]. While evidence from usage and traditional beliefs has validated the use of bitter melon for centuries, contemporary scientific studies need to authenticate its effectiveness and safety through clinical trials. This will help instill confidence among patients and medical practitioners and facilitate the incorporation of herbal medicines into conventional healthcare systems [31].

The aim of this research is to scientifically assess the hypoglycemic and lipid-lowering activity of bitter melon in type 2 diabetes mellitus patients [32]. Through a controlled study among diabetic patients, the study seeks to determine if daily supplementation with bitter melon powder in capsule form results in significant changes in fasting blood glucose, total cholesterol, and triglyceride levels [33]. The research also seeks to bring into focus the use of herbal medicine as an effective and inexpensive complementary therapy to standard therapy.

2. Materials and Methods

A case-control study was conducted in Lahore with ethical approval. This study was conducted in district Lahore. Forty patients diagnosed with type 2 diabetes were randomly assigned to two groups. Group A received bitter melon capsules (2g/day), and Group B received a placebo (wheat flour capsules) for one month. Patients were instructed to maintain their usual diet and exercise routines. Fasting blood glucose and lipid profiles were measured before and after the intervention. Data were analyzed using SPSS v22 with $p<0.05$ as the level of significance.

Cases were type 2 diabetic patients who have been confirmed diabetic by the hospital for their check upon the basis of clinical diagnosis. Data was collected with the help of professional staff who made confirmed diabetes on clinical basis. Self-interviewed questionnaire was filled for history at Hameed Latif hospital Lahore. 40 (20 cases and 20 controls) forms filled. Data were collected through simple random sampling from the outdoor registered patient .2g(2000mg) powder of bitter melon in capsule form was given to treatment cases. And other 20 control group was given placebo. I kept the slices of bitter melon to direct sunlight for three days after three days the pieces were fully dried and ready to make powder with the help of electric grinder.

Unripe bitter melon fresh fruits obtained from market will washed thoroughly with water, cut open and the seeds removed. The pieces of fruit will be dehydrated in sun light for 3days veiled with clothes to prevent moisture. The dehydrated pieces of fruit will be grinded with electric grinder machine into powder form. The hypoglycemic effects of bitter melon seeds were evaluated with the help of a cross sectional survey. This survey was conducted in properly contained environment to evaluate hypoglycemic and lipid lowering effects of bitter melon in type 2 diabetic patients. Data was collected from 40 patients of Lahore. The descriptive analysis of tables is included here and it is evident that these tables provide demographic information and the impact of bitter melon seeds on glucose metabolism of patients with type2 diabetes before and after use of bitter melon powder.

Mean of the data was assessed. The maximum number of females was 13 and maximum 27 male patients were included in this study. Weight is another necessary parameter to consider during population studies. The type 2 diabetic patients are more vulnerable to this specific parameter. The more obese a person is the more he became resistant to insulin or any other treatment like here Bitter gourd. Total 40 patient`s weight was included in this study. The mean of the age was 80.788 with maximum weight of 95.00 and minimum weight of 60.00. There were about 27 male patients and 13 female patients in group A and group B.

Total 40 patients were included in my study.20 patients were included in group A and 20 were included in group B, with a mean age of 56.15, minimum age of 41 and maximum age was 69 in my study.

Data of 40 patients were taken and maximum height was 178cm and minimum 155, mean of the data was 165.65. The histogram depicts that out of 40 patients mostly are in the range of 160-170 cm. These individuals with short stature are more likely to have lower-leg length to height ratio and hence they are more likely to be obese and resistant to treatment against hyper-glycemia.

BMI of 40 patients were taken, mean of the 40 patients were 30 with minimum BMI of 22 and maximum of 36.20. The BMI histogram depicts that mostly the persons have BMI more than healthy category. Most of them are overweight which simply proves that their disease diabetes mellitus type 2 is severe due to their high body fat and preventions should be higher in dose for these people to prevent or cure their ailments.

Smoking is injurious to health is normally use phrase in daily life. Smoking has so many harmful impacts on the life of persons. Smoking increases the risk of vascular complications and hence plays a vital role in the onset of diabetes mellitus type 2. Smoking is also directly linked to swelling, insulin resistance and lipid dysfunctions.

Out of total 40 patients, 25 were non-smokers and 15 were smokers. Most of the diabetic male patients were smokers and hence they were at high risk of cardiovascular diseases and more resistant towards insulin and bitter gourd chemical entities as compared to other patients which were non-smokers.

The table 1 and figure 1 suggested that there is a high proportion of survey respondents who are diabetic have hyper-tension at the same time. The more is the diabetes, the more will be sugar in the blood which damages the vessels and hence the blood flow increases so is the hyper-tension and individuals will suffer from this lethal ailment as well.

Table 1. Comparison of pre-treatment and post treatment diabetes in patients of group A (bitter melon) and group B (placebo)

Serial No.	Group A	Group A	Group B	Group B
Variable	Pre-treatment Diabetes (mg/dl)	Post-treatment Diabetes (mg/dl)	Pre-treatment Diabetes (mg/dl)	Post-treatment Diabetes (mg/dl)
1	230	190	240	250
2	225	190	230	230
3	250	215	245	250
4	280	230	270	280
5	270	234	260	250
6	190	180	189	200
7	200	195	210	205
8	205	160	230	230
9	230	175	210	230
10	280	200	250	240
11	180	100	180	190
12	250	180	190	200
13	230	240	235	240
14	280	260	280	280
15	289	260	270	285
16	205	195	250	235
17	270	240	245	250
18	255	212	250	260
19	240	180	260	250
20	265	230	230	240
Total	4785	3986	4709	4760
Mean	239.25	199.3	235.45	238

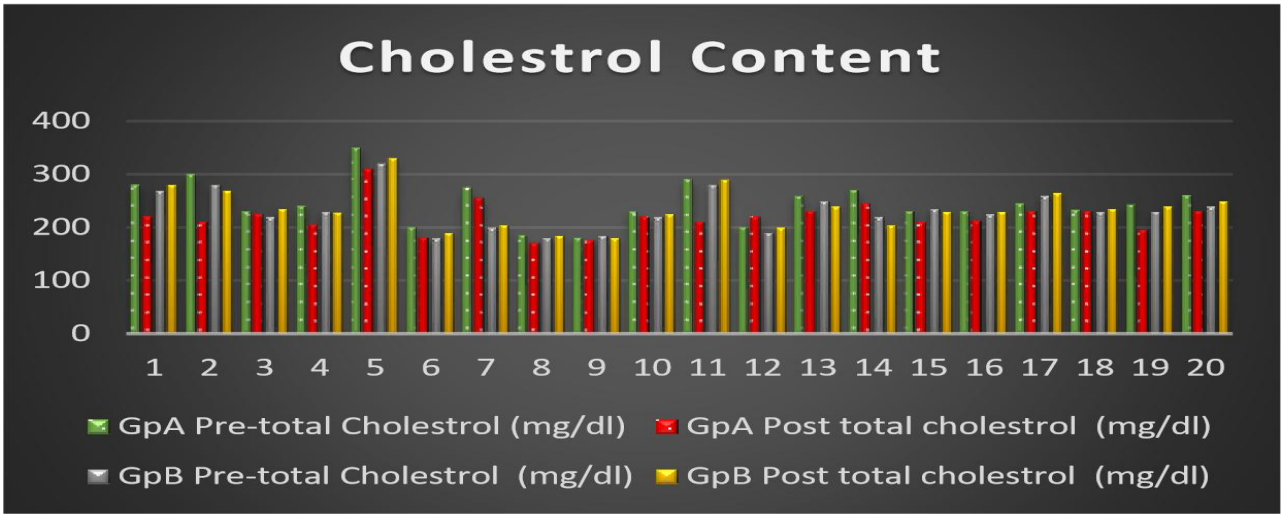

Figure 1. Fig of Comparison of pre-treatment and post treatment diabetes in patients of group A (bitter melon) and group B (placebo)

Triglycerides are the simplest and most common type of fats present in the bloodstream. The triglycerides when increased tremendously in the body they may cause lethal consequences like heart failure, artery thickening etc.

There are some complications from which these survey respondents suffer during their treatment. This was mainly due to the fact that such patients suffer from high fat and high blood glucose levels which damage the other organs as well. When the treatment was done then respondents suffer from discomforts. During treatment of diabetes patients, out of 20 patients about 8 patients shows different complications of the treatment.2 patients shows abdominal pain ,1 patient showed diarrhea ,2 patients shows fever ,1 hypoglycemia and 2 patients shows headache. As most of the patients remained with no side effects that is why it is effective and safe for use.

The hypoglycemic and lipid-lowering effects observed in Group A align with previous studies indicating that bitter melon improves insulin sensitivity and modulates lipid metabolism. Its active compounds may stimulate glucose uptake and enhance liver glycogen storage. The results suggest bitter melon could be an effective supplementary treatment for type 2 diabetes melitus.

3. Conclusion

Bitter melon demonstrates significant hypoglycemic and lipid-lowering effects in patients with type 2 diabetes. As a natural, accessible, and affordable treatment, it holds promise as an adjunct to standard diabetic care.

Ethical Consideration

In Hameed Latif hospital Lahore Pakistan, voluntary participants were noted during data collection process. Before signing on to participant, the participants were aware about the goals, objectives, positive aspects and potential hazards.

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