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# ANTIDIABETIC AND ANTILIPIDEMIC EFFECT OF BITTER GOURD ON SELECTED DIABETICS

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## Introduction

Bitter Melon *(Momordica Charantia)* known as Bitter gourd and Karela, is a vegetable with treasured medicinal properties. Although the seeds, leaves and vines of bitter gourd have all been used, the fruit is the safest and most prevalent part of the plant used medically. Bitter gourd was traditionally used for a dazzling array conditions by people in tropical regions. Numerous infections, cancer, leukemia and diabetes are among the most common conditions it was believed to improve. It has been reported to be beneficial in the treatment of diabetes, psoriasis and HIV and it has been exposed to have anti- viral and anti-neoplastic activities.

Rich in iron, bitter gourd has twice the beta carotene of broccoli, twice the calcium of spinach, twice the potassium of bananas and contains vitamins B1, B2, B3, C, phosphorous and good dietary fiber. It is believed to be good for the liver and has been proven by western scientists to contain insulin which acts as an anti- tumor agent and inhibit HIV -1 infection.

Today a great number of modern drugs are still derived from plant sources and 25 per cent of all prescriptions contain one or more active ingredients from plants (Thorfeldt, 2005). At least 32 active constituents have been identified in bitter gourd so far, including beta- sitosterol -d-glucoside, citrulline, GABA, lutein, lycopene and zeaxanthin.

Recently, the Department of Health in the Philippines has recommended bitter gourd as one on the best herbal medicines for diabetic management. And multiple clinical studies have clearly established the role of bitter gourd in people with diabetes.

Diabetes Mellitus is the universal problem affecting human societies at all stages of development. It is one of the leading causes of death and it ranks third among the chronic diseases and India is referred as the diabetic paradise of the world, in view of the high prevalence of diabetes mellitus in the country. Diabetes is an umbrella term to cover a group of metabolic disorders characterized by insulin resistance and elevated blood glucose levels which can lead to hyperglycemia and dyslipidemia. Dietary modification, weight control and regular exercise are the main approaches in the

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management of diabetes, diet being the chief anchor. Currently the challenge is to identify hypoglycemic diet supplements to control blood glucose levels.

Three active constituents in bitter gourd namely steroidal saponins - charantin, insulin like peptides and alkaloids are believed to be responsible for the blood sugar lowering effect. The charantin, which is composed of mixed steroids, was found to be more effective than the oral hypoglycemic drugs. Another, an insulin - like polypeptide, called polypeptide P, appears to lower blood sugar in type I ( insulin dependent) diabetics, while alkaloids present in the bitter melon have also been noted to have a blood sugar lowering effect. It is also a powerful weapon against HIV/AIDS since some reports claim that bitter gourd has substance Q. It is one of the most favorite vegetables among the Asians and the most popular herbal tea as well.

Bitter gourd also holds lipid lowering action. Researchers have reported the hypoglycemic effect of dietary methanol extract from bitter gourd and triglyceride lowering activity. It has been reported to decrease the tumour incidence observed in short and long term studies because of the anti- cancer properties.

Scientific research claimed that bitter melon controls sugar in a two-fold manner acting as a mediator between the body's insulin. This herb is designed to control glucose formation in the blood stream and breaks down the barrier that prevents cells from using own natural insulin. Regular intake of bitter gourd can prevent many complications brought about by diabetes.

Bitter gourd is believed to be supportive in preventing many complications associated with diabetes including hypertension, eye complications, neuritis and the defective metabolism of carbohydrates (www.ayurverdiccure.com). The present study aimed at assessing the antidiabetic and antilpidemic effect of the bitter gourd in curry form on selected type II diabetics with the following objectives : To

- elicit the dietary background and assess the nutritional status of the selected diabetics
- supplement the bitter gourd as a vegetable preparation in curry form
- assess the effect of supplementation of the bitter gourd in terms of its hypoglycemic and hypolipidemic property on selected diabetics

## Methodology

The area selected for the present study was Coimbatore city of Tamilnadu state. Two hundred diabetics in the age group of 45 -65 years of male and female in and around the city were selected for the study using random sampling technique. Diabetics with other health complications and cardiovascular disorders were neglected. Among the 200 diabetics, a subsamble of 24 who expressed their willingness and

cooperation for the supplementation study were selected.

An interview schedule was used to elicit information regarding their socio economic background, life-style and dietary pattern. The nutritional status of the selected diabetics was assessed through anthropometric measurements such as height, weight and Body Mass Index (BMI) and dietary survey through 24 hours recall method. Biochemical estimations such as blood glucose and lipid profile were done for all before and after the supplementation. Among the 24 diabetics selected for the supplementation study, two groups comprising 12 persons in each group were formed namely experimental group and control group. For the supplementation study bitter gourd vegetable was selected and 75g of the cooked vegetable in the curry form was supplemented to the experimental group of diabetics for a period of three months and one group on their regular diet without any medicine, supplementation or special food served as the control. The hypoglycemic and hypolipidemic effects of the bittergourd was evaluated based on blood glucose and lipid profile of the selected diabetics before and after supplementation.

## Results and Discussion

### Socioeconomic background of the selected diabetics

In the present study a majority of 38 per cent of the selected diabetics belonged to the age group of 51 - 55 years and 32 per cent had higher secondary education. It was observed that 93 per cent of the males and 47 per cent of the females were employed. Among the selected diabetics a majority of 62 per cent belonged to high income group and were sedentary workers.

### Dietary pattern of the selected diabetics

With regard to the dietary pattern, a majority of 57 per cent followed a non-vegetarian diet pattern and a minority of five per cent ova vegetarian diet. With regard to the meal pattern, a majority of 81 per cent of the selected diabetics followed a three meal pattern. Majority of them consumed 250 - 300 g of cereals, 40 - 50 g pulses, 50 - 60g of green leafy vegetables, 50 - 75g of vegetables, 50 - 75 g roots and tubers, 50 - 75g of fruits, 100 - 150 g of milk and milk products and 10 - 20 g of fat and oils. The mean food intake of the selected diabetics was less than the ICMR RDA (2004) with regard to all the food groups expect fats and oils.

With regard to the nutrient intake of the selected diabetics the nutrients such as calorie, protein, iron, thiamine, riboflavin, niacin, folic acid and fibre were deficit when compared with the RDA. Intake of fat, calcium, vitamin A and ascorbic acid was higher than the RDA (2004).

### Life-style practices of the selected diabetics

It was observed that a majority of 73 per cent males and 55 per cent females among the selected diabetics had the habit of performing exercise regularly. A majority of female diabetics (88%) were engaged in

household work and neglected other active exercises. Regarding the habit of chewing betel leaves / tobacco / pan masala majority (70%) did not have that habit. With regard to smoking and alcohol consumption majority of the selected male diabetics did not smoke (66%) and did not drink alcohol (88%). Among the selected diabetics, 54 per cent of them had the habit of coffee consumption.

### History of diabetes

Among the selected diabetics majority of them (96%) had family history of diabetes and were suffering from the diabetic condition for the past 5 - 10 years (46%). Majority of the selected diabetics (39%) had the onset of diabetes at the age of 40 - 45 years and reported the common clinical symptom of visual disturbance and a minority reported delayed wound healing.

### Anthropometric measurements

Majority of the selected diabetics had a height ranging from 161 - 171 cm (52% males and 67% females). Among the selected diabetics majority of the males (64%) had a weight of 71-80 kg and 52 per cent of females had a weight of 61 -70 kg and they were more than the ICMR reference body weights. It was observed that a majority of 57 per cent of males and 55 per cent of females of the selected diabetics had a BMI within the normal range and a minority of 1-2 per cent were underweight.

### Impact of supplementation on blood glucose levels

The impact of bitter gourd supplementation on blood glucose levels of the selected diabetics is presented in Table 1.

**TABLE 1. Impact of supplementation of bitter gourd on blood glucose levels of the selected diabetics**

| Parameters | Normal range | Bitter gourd group | | | | Control group | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Initial | Final | Difference | t value | Initial | Final | Difference | t value |
| Fasting blood glucose (mg/dl) | 80 - 115 | 190.06 ± 6.14 | 145.58 ± 6.38 | -44.48 ± 7.09 | 14.02** | 163.75± 6.32 | 170.4 ± 7.81 | +6.66 ± 3.29 | 4.53** |
| Postprandial blood glucose (mg/dl) | 120-160 | 273.18 ± 10.49 | 207.08 ± 10.64 | -66.10 ± 12.63 | 11.69** | 253.15± 13.86 | 267.25± 15.20 | 14.10± 3.69 | 8.53** |

** P(<0.01)

It is inferred from the table that there was a significant decrease in the fasting and post prandial blood glucose levels of the experimental group after the supplementation period. The mean reduction in the fasting blood glucose was found to be 44.48 mg/dl and the post prandial blood glucose level was 66.10 mg/dl among the experimental group after the bitter gourd supplementation.

The control group on regular diet which had no supplementation had an increment in the fasting blood glucose levels by 6.66 mg/dl during the study period and the mean post prandial blood glucose levels increased by 14.10 mg/dl. Sheety *et al.,* (2005) have reported that dried bitter gourd powder in the diet at 10 per cent level improved diabetic status signifying its beneficial effect during diabetes. It has been reported that a mixture of equal quantities of amla juice and bitter gourd juice taken every morning showed a reduction in blood glucose levels.

### Impact of supplementation on lipid profile

The impact of bitter gourd supplementation on lipid profiles of the selected diabetics is presented in the Table 2.

**TABLE 2. Impact of supplementation of bitter gourd on lipid profile of the selected diabetics**

| Parameters | Normal range | Bitter gourd group | | | | Control group | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Initial | Final | Difference | t value | Initial | Final | Difference | t value |
| Triglycerides (mg/dl) | <150 | 164.08 ± 10.39 | 145.87 ± 11.24 | -18.22 ± 1.41 | 14.02** | 149.10± 10.08 | 157.90± 12.46 | +8.80 ± 5.98 | 3.29** |
| Total Cholestrol (mg/dl) | <200 | 221.72 ± 9.10 | 203.80 ± 14.67 | -17.92 ± 8.47 | 4.73** | 219.28± 15.56 | 221.67± 9.52 | +2.38 ± 12.09 | 0.44$^{NS}$ |
| HDL Cholesterol (mg/dl) | 40 -60 | 54.60± 7.38 | 60.80± 7.01 | +6.20 ± 1.85 | 7.49** | 46.75± 5.84 | 46.13± 4.68 | -0.62± 5.51 | 0.25$^{NS}$ |
| LDL Cholesterol (mg/dl) | <100 | 136.12 ± 9.84 | 122.78 ± 9.92 | -13.33 ± 3.83 | 7.78** | 144.32± 9.62 | 149.20± 5.30 | ±4.22± 7.20 | 1.31$^{NS}$ |
| VLDL Cholesterol (mg/dl) | 5 -40 | 32.35 ± 3.46 | 28.18 ± 3.47 | -4.17 ± 0.71 | 13.13** | 26.82± 5.22 | 32.73± 4.78 | ±4.92± 4.92 | 2.23$^{NS}$ |

** P(<0.01) NS - Not Significant

Lipid abnormalities occur more frequently in type II patients. The characteristic diabetic dyslipidemia consists of hypertrigly Ceridemia, low serum High Density Lipoprotein (HDL) and essentially normal Low Density Lipoprotein (LDL) cholesterol Levels.

From Table 2 it is evident that there was a significant decrease in the triglyceride, total cholesterol, Low Density Lipoprotein (LDL) and Very Low Density Lipoprotein (VLDL) and a significant increase in the High Density Lipoprotein (HDL) was noted after the bitter gourd supplementation among the experimental group. The control group which did not receive any supplement had higher levels of the triglyceride, total cholesterol, Low Density Lipoprotein (LDL) and Very Low Density Lipoprotein (VLDL) levels than the initial stage of study and a slight decrease in the High Density Lipoprotein (HDL) levels.

Research reports state that bitter gourd exhibits a marked reduction in the hepatic total cholestrol and triglyceride levels both in the presence and absence of dietary cholestrol. Chaturvedi *et al.,* (2004) reported that administration of methanol extract of bitter gourd showed a significant decrease in triglyceride, low density lipoprotein and a significant increase in high density lipoprotein level. Sustained control of blood glucose and maintenance of round the clock normalizes cholestrol and triglyceride level.

## Conclusion

The present study on supplementation of bitter gourd vegetable had brought out the health benefits as hypoglycemic and hypolipidemic agents. The results of the present study showed that there was a significant reduction in the blood glucose levels and lipid profile of the selected diabetics after supplementation of the bitter gourd. The results clearly indicate that the bitter gourd would prove to be more useful, simple, effective, easily available and economically affordable supplement for the effective management of type II diabetes. The present study thus paves the way for thew nutrition professionals and research workers to make use of the bitter gourd in the management and treatment of various types of non communicable diseases along with curative substances.

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