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Studies on Hypoglycemic and Hypocholesterolemic Effects of Mulberry Leaves

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Abstract

Optimum nutrition is vital for building strong body and mind, promoting health, vigor and vitality. We need to be conscious about the food we are eating. There are many foodstuffs whose excessive intake is detrimental to health. Foods can be regarded as functional foods if they can satisfactorily demonstrate to contain bioactive principles that reduce the risk of diseases or act positively in promoting health. The ancient Indian system of medicine is bound with information regarding plant products having medicinal properties. Mulberry leaves is an important medicinal plant and its leaves have good nutritive value. Diabetes mellitus is a chronic metabolic disorder and it has increased in India to a large. There are various plants which have hypoglycemic effects, mulberry is one of them. The objective of the present study was to study the effect of mulberry leaves on type 2 diabetes. Selection of diabetic subjects was done and their nutritional status was assessed by conducting anthropometry to measure height and weight and computing BMI. They were evaluated for biochemical profile in terms of blood sugar and lipid profile. Two products namely Mathri and Biscuits were developed with the incorporation of mulberry leaves in the ratio of 1:10 with wheat flour. Supplementation of these products was done to all the subjects for three months. After three months supplementation, subjects were again evaluated for anthropometry and biochemical parameters. The analysis of results indicated that mulberry leaves have the lowering effects on blood cholesterol, fasting blood sugar, blood pressure and BMI. The study infers that mulberry leaves may be used as a general health enhancer. It has hypocholesterolemic and hypoglycemic effects. Further, no side effects were observed on feeding for long duration.

Keywords: Hypoglycemic, Hypocholesterolemic, Mulberry Leaves.

Introduction

Diabetes mellitus is a chronic disease characterized by high blood glucose levels due to absolute or relative deficiency of circulating insulin level[1]. Diabetes is a heterogeneous metabolic disorder characterized by altered carbohydrate, lipid, and protein metabolism which cause hyperglycemia resulting from insufficient insulin secretion, insulin action or both[2, 3]. Diabetes mellitus is a metabolic disorder characterized by increased blood glucose level. The disease is characterized by either lack of insulin production or deficient activity of the pancrease of normal or even elevated level of insulin[4]. Diabetes poses great challenge to the world health care system. Its world wide prevalence was estimated at 366 million in 2011 and of these 183 million people was believed to be unaware about the condition. If no measure taken, the prevalence is projected to rise to 552 million people by 2030 representing around 10 % of the global adult population[5].

In traditional practice, medicinal plants are used in many countries to control diabetes mellitus and from some of them active principle have been isolated[6]. Herbal medicines have been used for the treatment of diabetic patients since long and they are currently accepted as an alternative therapy for diabetic treatment[7]. There are various medicinal plants in India which are considered to have anti-diabetic property so can be used to control the blood glucose level. Mulberry leaves *Morus Indica* commonly known as Shahtoot is a fast growing deciduos plant, it is known to posses medicinal applications and it contains diuretic, hypoglycemic and hypotensive properties. Mulberry tree, a plant of the family of moraceae, genous morus has been widely cultivated to feed silkworm for the production of silk. Mulberry plant is very widely distributed in China, Japan and South Europe etc. It helps in treatment of many diseases like diabetes mellitus, atherosclerosis, hyperlipidemia, hypertension etc[8].

Mulberry leaves are rich in amino acids, vitamin C and antioxidants and are considered effective in regulating blood fat and sugar, blanching blood pressure and boosting metabolism. These have anti inflammatory anti aging and health maintaining qualities. In a study, mulberry leave powder has been incorporated with wheat flour to prepare paratha, a common breakfast and dinner item in Indian diet. Since the predominantly vegetarian (mostly grain-based) diet is low in protein and too low in vegetable and fruits for good health, the highly nutritious, non toxic and inexpensive mulberry leaves are seen as a potential remedy[9]. In view of the above, the present study was conducted with an aim to study the effect of mulberry leaves on type 2 diabetes.

The specific objectives of the study were as follows: i. To assess the nutritional composition of mulberry leaves powder. ii. To prepare two products Mathri and Biscuits incorporating mulberry leaves powder. iii. To assess the efficacy of mulberry leaves on blood glucose and serum lipid profile in pre and post intervention stages.

Material and Methods

Mulberry leaves (Morus Indica) were collected, washed, shade dried for two days and then ground into a fine powder in an electric mixture. This powder was incorporated in the ratio of 1: 10 with wheat flour to prepare two different products namely mathri and biscuits.

For intervention study, selection of diabetic subjects was done on the basis of purposive and convenient sampling from the campus residents of Banasthali University, Rajasthan. 40 subjects were selected including males and females between the ages of 40 to 60 years. These were divided into two groups Group A - Control group and group B Experimental group. Mulberry incorporated products were supplemented to the experimental group so as to have 3 gm of leaves powder per day per subject. The supplementation was done for 90 days. During the intervention period the subject were not receiving any medication. Anthropometric measurements such as height and weight were measured for all the subjects on initial day and on 90^{th} day of intervention and the BMI was computed accordingly. Blood pressure (mm hg) and various biochemical parameters such as Fasting blood sugar (mg/dl) and lipid profile- Serum Total cholesterol (TC-C), Triglycerides (TG-C), High density lipoprotein (HDL-C), Low density lipoprotein cholesterol (LDL-C), Very low density lipoprotein (VLDL-C) were estimated on initial day and final day of intervention for all the subjects. The data was analyzed with the help of suitable statistical parameters and tools.

Results and Discussion

Nutritional Composition of mulberry leaves powder: Nutritional composition analysis showed that mean moisture, ash, protein, fat and crude fiber content was 14.5, 13.8, 6.2, 5.5 and 16.0 g per 100g of leaves powder respectively. Calcium, iron and vitamin C content were observed to be 4.2, 4.05 and 17.4 mg per 100g respectively. Various factors including inorganic nutrients may affect the protein levels content of mulberry leaves[10]. As reported, Moringa leaves contain crude protein, crude fiber and ash as 17.01, 7.09 and 7.93 percent respectively[11]. Iron content of mulberry leaves was observed to be higher than the values reported for tomato leaves, tomato and carrot while calcium was lower than the reported values in grapes and jambul[12,13,14].

Weight (kg) and BMI (kg/m^2) of the subjects: Weight (kg) and computed BMI (kg/m^2) of the subjects on Pre and post intervention days are presented in table 1.

In control group, mean weight was 73.4 ± 5.83 kg on a 0 day and 69.6± 1.87 kg on 90^{th} day of intervention. In experimental group, mean weight was 71.6 ± 6.58 on 0 day and 68.3±4.62 on 90^{th} day of intervention. Further a significant decrease ($P \leq 0.05$) was observed in weight of experimental group during the intervention period. In control group, mean BMI kg/m^2 was 24.8 ± 2.12 on 0 day and 23.5± 1.87 on 90^{th} day of intervention. In experimental group mean BMI was 25.1 ± 3.25 on 0 day and 23.9 ± 2 on 90^{th} day of intervention. Further a significant decrease ($P \leq 0.05$) was observed in (BMI kg/m^2) of experimental group during the intervention period.

Blood pressure (mm hg): As presented in table 2, in control group, mean systolic blood pressure (SBP) was 162.8 ± 2.08 mm hg and diastolic blood pressure (DBP) was 96.9 ± 0.83 mm hg on 0 day and SBP was 153.9 ± 2.07 mm hg and DBP was 93.1 ± 1.92 mm hg on 90^{th} day of intervention. In experimental group, mean blood pressure was as SBP 162 .8 ± 2.08 mm hg and DBP 96.9 ± 0.83 mm hg on 0 day of intervention while on 90^{th} day of intervention (post intervention) SBP was 161.8 ± 1.32 mm hg and DBP was 95.4 ± 1.23 mm hg.

Biochemical parameters: Biochemical parameters of the subjects evaluated on 0 day and 90^{th} day of intervention are presented in table 3.

Table-1
Mean weight (kg) and BMI (kg/m^2) of the subjects

Dietary group	Pre intervention (0 day)	Post intervention (90 day)
Weight (kg)		
Control	73.4 ± 5.83	69.6± 1.87
Experimental	71.6 ± 6.58	68.3±4.62*
BMI (kg/m^2)		
Control	24.8 ± 2.12	23.5± 1.87
Experimental	25.1 ± 3.25	23.9 ± 2.37*

*($P \leq 0.05$): Significant

Table-2
Pre and post intervention blood pressure (mm hg) (Mean) of the subjects

Dietary Group	0th day	90th day	0th day	90th day
	Control group		Experimental group	
	SBP	DBP	SBP	DBP
Control	162.8 ± 2.08	96.9 ± 0.83	153.9 ± 2.07	93.1 ± 1.92
Experimental (ml)	162 .8 ± 2.08	96.9 ± 0.83	161.8 ± 1.32	95.4 ± 1.23

Table-3
Biochemical parameters of the subjects (Mean)

Parameters	Control group		Experimental group	
	0th day	90th day	0th day	90th day
Fasting blood sugar (FBS) (mg/dl)	155.2±14.4	154.2±13.4	160.7±26.23	121.5±6.30 *
Total cholesterol (mg/dl)	220.2±22.2	221.4±24.7	238.9±39.02	209.3±24.7 *
Triglycerides-C (mg/dl)	140.8±17.05	145.1±12.05	147±17.05	139.1±9.89 *
HDL-C (mg/dl)	52.4±17.05	55.7±12.05	55.7±14.85	55.1± 14.31
LDL-C (mg/dl)	162.5±36.56	160.2±36.50	164.5±33.26	138.5±11.63 *
VLDL-C (mg/dl)	26.9.5±3.63	29.2±4.74	31.9±6.54	26.1±5.30 *

*(P≤0.05): Significant

The mean value of FBS was 155.2±14.4 and 154.2±13.4, mg/dl respectively on 0 day and 90th day of intervention in control group while in experimental group, the value were 160.7±26.23 and 121.5±6.30 mg/dl respectively on 0 and 90th day of intervention. A significant decrease (P≤0.05) was found in FBS (mg/dl) of experimental group during the intervention period.

The mean value of Total Cholesterol (TC) was 220.2±22.2 and 221.4±24.7 mg/dl respectively on 0 day and 90th day of intervention in control group while in experimental group, the value were 238.9±39.02 and 209.3±24.7 mg/dl respectively on 0 and 90th day of intervention. A significant decrease P≤0.05 was found in TC (mg/dl) of experimental group during the intervention period.

The mean value of Triglyceride Cholesterol (TC mg/dl) was 140.8±17.05 and 145.1±12.05 mg/dl respectively on 0 day and 90th day of intervention in control group while in experimental group, the values were 147±17.05 and 139.1±9.89 mg/dl respectively on 0 and 90th day of intervention. A significant decrease P≤0.05 was found in TC (mg/dl) of experimental group during the intervention period.

The mean value of High density lipoprotein Cholesterol (HDL) was 52.4±17.05 and 55.7±12.05 mg/dl respectively on 0 day and 90th day of intervention in control group while in experimental group, the values were 55.7±14.85 and 55.1± 14.31 mg/dl respectively on 0 and 90th day of intervention. A significant decrease P≤0.05 was found in HDL-C (mg/dl) of experimental group during the intervention period.

The mean value of Low density lipoprotein Cholesterol (LDL) was 162.5±36.56 and 160.2±36.50 mg/dl respectively on 0 day and 90th day of intervention in control group while in experimental group, the values were 164.5±33.26 and 138.5±11.63 mg/dl respectively on 0 and 90th day of intervention. A significant decrease P≤0.05 was found in LDL-C (mg/dl) of experimental group during the intervention period.

The mean value of Very low density lipoprotein cholesterol (VLDL) was 26.9±3.63 and 29.2±4.74 mg/dl respectively on 0 day and 90th day of intervention in control group while in experimental group, the values were 31.9±6.54 and 26.1±5.30 mg/dl respectively on 0 and 90th day of intervention. A significant decrease P≤0.05 was found in VLDL-C (mg/dl) of experimental group during the intervention period.

Conclusion

The study shows that mulberry leaves powder incorporated products had improved lipid profile and fasting blood sugar of the diabetic subjects studied. The data indicate that maximum improvement was observed in the value of experimental group, which shows the hypoglycemic and hypocholesteromic effects of mulberry leaves. In general mulberry leaves showed no ill effects and acts as a general health enhancer.

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