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Original Research Article

Effect of Gurmar (*Gymnema sylvestre*) Leaf Powder on Glycemic Control in Type 2 Diabetes Mellitus

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Abstract:

Introduction: Diabetes mellitus (DM) is an endocrine disorder characterized by chronic hyperglycemia. Managing DM without side effects remains a challenge, drawing researchers to explore plant-based products. Some studies have found that the leaves of *Gymnema sylvestre* possess anti-diabetic, anti-obesity, anti-sweetener, anti-inflammatory, and antioxidant properties, which are attributed to saponins, glycosides, and flavonoids. Therefore, further investigation into its benefits is warranted.

Aim and Objectives: This research aimed to assess the antidiabeticeffect of *Gymnema sylvestre* in patients with type 2 diabetes.

Materials and Methods: Two hundred patients with type 2 DM were randomly divided into two groups. Group I (n = 100) received a placebo powder, while Group II (n = 100) was supplemented with 6 g/day of gurmar leaf powder. The patients continued taking their anti-diabetic medications as before, and patients were blinded to their treatment allocation. Fasting blood sugar (FBS) and glycosylated hemoglobin (HbA1c) levels were recorded at baseline and after 3 months.

Results: In Group I FBS decreased non-significantly from 190.67 ± 59.53 mg/dl to 184.59 ± 57.46 mg/dl whereas in Group II FBS reduced significantly from 189.93 ± 55.21 mg/dl to 157.77 ± 44.84 mg/dl after 3 month of gurmar intervention. Similarly, HbA1c in Group II reduced significantly from 8.65 ± 1.16% to 7.70 ± 1.09% after 3 months ($P < 0.05$), while a non-significant decrease from 8.51 ± 1.04% to 8.33 ± 1.08% was recorded in Group I.

Conclusion: The supplementation of Gurmar leaf powder significantly improves glycemic control in individuals with type 2 diabetes mellitus.

Keywords: Diabetes mellitus, *Gymnema sylvestre,* glycemic control.

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Introduction

Diabetes mellitus (DM) is a prevalent endocrine disorder that affects the metabolism of proteins, fats, and carbohydrates. Persistent hyperglycemia brought on by relative insulin insufficiency, resistance, or both characterizes it. [1,2] DM is the most prevalent disease in the world today. [3] The occurrence of diabetes mellitus in India is potentially reaching epidemic levels. [4] It is projected that the population of diabetics in India will rise significantly from 77 million in 2019 to 134.2 million in 2045. [5] Diabetes is still a leading cause of morbidity and mortality worldwide, despite all the advancements in treatment. Research of safer and more effective hypoglycemic medications are necessary since the allopathic medicines now used to treat diabetes have many significant adverse effects. The field of ethnobotany and traditional medicine is constantly expanding when it comes to managing and treating diabetes mellitus. [6]

Gymnema sylvestre(GS), known as gurmar (sugar destroyer) in Hindi, is a valuable medicinal plant from the Asclepiadaceae family. [7] The leaves of GS possess anti-diabetic, anti-hyperlipidemic, anti-obesity, anti-sweetener, anti-inflammatory, and antioxidant properties due to their tannins, flavonoids, and triterpene saponins, which belong to the oleanane and dammarane classes. The major constituents include gymnemic acids and gymnema saponins (oleanane saponins) and gymnemasides (dammarane saponins). [8] Gurmar leaf powder should be considered as an affordable and accessible alternative to current drugs for reducing complications. Its use could lower healthcare costs and ease the economic burden on families, society, and the nation.

Materials and Methods

The current research was planned at Sardar Patel Medical College in Bikaner, in the physiology department. It was a single-centered, single-blind, randomized controlled parallel-designed trial. The study incorporated total 200 diabetic patients of middle age group 36-55 years and were divided in two groups. Group- I included those patients who were taking conventional treatment and served as the control group. Group-II included those patients which besides conventional treatment were given powder of *Gymnema sylvestre* (GURMAR) leaves and served as study group.

Patients with chronic diseases such as liver disease, arthritis, pulmonary tuberculosis, asthma, renal failure, a history of coronary heart disease, acute myocardial infarction, valvular heart diseases, cerebrovascular, malabsorption, alcoholism, smokers, pregnant women with diabetes, and non-co-operative patients were excluded from the study.

After receiving approval from the institutional ethical committee, participants were enrolled in the research. Before enrollment, all participants were given a detailed explanation of the study's procedure, nature, and purpose, and informed consent was obtained.

Dried Gurmar (*Gymnema sylvestre*) leaf powder was purchased from a reputable company in Bikaner. Participants in the study group were administered 3 grams of Gurmar leaf powder twice daily before meals, and a placebo powder with no hypoglycemia or dyslipidemic effect was given to participants in the control group, maintaining their regular diet and exercise routines for a continuous period of three months. Anti-diabetic medications were continued as same.

A detailed clinical history was recorded, and a clinical examination was conducted according to a predesigned proforma. To determine the glycemic index, fasting blood sugar and glycosylated hemoglobin levels were measured before and after a 3-month intervention with gurmar powder. Over the course of the research, patients were kept blind to their allocated therapy.

Statistical Analysis: Microsoft Excel was used to input the data, while SPSS software was used to analyze it. By student's paired and unpaired "t-test," comparison between two groups is achieved. For significance, the probability level was chosen at $p < 0.05$. It is considered non-significant if $p > 0.05$.

Results

Table 1 shows the anthropometric parameters of control and study group participants at the baseline. The mean age, weight, height and BMI of Control Group subjects were 46.23 ± 4.70years, 74.27 ± 9.93 Kg, 1.67± 0.09 m and 26.65 ± 3.65 Kg/m^2 whereas of Study Group subjects were 46.41 ± 5.52 years, 74.45 ± 9.79 Kg, 1.67± 0.08 m and 26.66 ± 3.80 Kg/m^2. Thus, none of the anthropometric parameters showed a statistically significant difference ($p > 0.05$), making the groups comparable for studying the effect of gurmar.

Tables 2 and 3 show that the FBS and HbA1c levels of the two groups were not significantly different at the start of the study ($p = 0.927$ and 0.370, respectively). However, after 3 months, there was a significant difference between the groups ($p = 0.0001$).

Table 4 shows that the baseline mean FBS level in the study group was 189.93 ± 55.21 mg/dl, which significantly decreased to 157.77 ± 44.84 mg/dl after 3 months of gurmar intervention. In the control group, the mean FBS level decreased from 190.67 ± 59.53 mg/dl to 184.59 ± 57.46 mg/dl after 3 months.

As shown in Table 5, the mean HbA1c of participants in the study group decreased significantly from 8.65 ± 1.16% to 7.70 ± 1.09% after 3 months of supplementation with *G. sylvestre* leaf powder ($p = 0.0001$). In contrast, the mean HbA_{1c} of the control group decreased from 8.51 ± 1.04% to 8.33 ± 1.08% over the same period.

Table 1: Comparison of Anthropometric parameters of control and study groups at the baseline

Parameters	Control Group (Mean±SD)	Study Group (Mean±SD)	p
Age (years)	46.23±4.70	46.41±5.52	0.804
Weight (Kg)	74.27±9.93	74.45±9.79	0.897
Height (m)	1.67±0.09	1.67±0.08	1.000
BMI (Kg/m^2)	26.65±3.65	26.66±3.80	0.985

Table 2: Comparison of mean fasting blood sugar and mean glycosylated hemoglobin of control and study group participants at the baseline.

Parameters	Control Group	Study Group	t	p
FBS (mg/dl)	190.67 ± 59.53	189.93 ± 55.21	0.091	0.927
HbA1c (%)	8.51 ± 1.04	8.65 ± 1.16	0.899	0.370

Table 3: Comparison of mean fasting blood sugar and mean glycosylated hemoglobin of control and study group participants after intervention.

Parameters	Control Group	Study Group	t	p
FBS (mg/dl)	184.59 ± 57.46	157.77 ± 44.84	3.680	0.0001
HbA1c (%)	8.33 ± 1.08	7.70 ± 1.09	4.106	0.0001

Table 4: Comparison of mean fasting blood sugar (mg/dl) of control and study group participants before and after the intervention.

	Baseline	Post Treatment	t	p
Control Group	190.67 ± 59.53	184.59 ± 57.46	0.735	0.463
Study Group	189.93 ± 55.21	157.77 ± 44.84	4.522	0.0001

Table 5: Comparison of mean glycosylated hemoglobin (%) of control and study group participants before and after the intervention.

	Baseline	Post Treatment	t	p
Control Group	8.51 ± 1.04	8.33 ± 1.08	1.201	0.231
Study Group	8.65± 1.16	7.70± 1.09	5.968	0.0001

Discussion

Diabetes mellitus is a common disease globally that poses a substantial risk to human health. [9] It can affect multiple organ systems and cause severe complications by increasing free radical generation, leading to oxidative stress, producing advanced glycation end products, accelerating atherosclerosis, and altering gene transcription of various proteins.[10] Therefore, glycemic control is crucial in managing diabetes to prevent or delay these complications.

There are several treatment options for diabetes management, such as insulin therapy and oral hypoglycemic medications. None of these treatments, however, properly manages diabetes without causing adverse effects. As a result, a lot of diabetic people look for alternate medications for treatment. Although only a small number of herbal medicines have been thoroughly investigated to ascertain their efficacy in regulating blood sugar levels and identifying their active ingredients, Ayurveda and ancient literature suggest a variety of them for the treatment of diabetes.

Our study demonstrated the effectiveness of *G. sylvestre* in lowering blood glucose levels in patients with type 2 DM. Mean FBS levels reduced significantly from 189.93 ± 55.21 mg/dl to 157.77 ± 44.84 mg/dl ($p = 0.0001$) after 3 months of supplementation with *G. Sylvestre* leaf powder.

Furthermore, our investigation revealed a statistically significant reduction in HbA1c after a three-month supplementation with *G sylvestre* leaf powder, from a baseline mean of 8.65 ± 1.16% to 7.70 ± 1.09% ($p = 0.0001$). This result suggests that using *G. sylvestre* leaf powder consistently is beneficial over the long run.

The results of this investigation are consistent with the Baskaran et al. research. [11] They found that patients with type 2 diabetes who received 400 mg of *Gymnema sylvestre* leaf extract daily alongside their hypoglycemic medications significantly reduced their fasting blood glucose, insulin requirements, and serum lipids. Similar results were found by Shanmugasundaram ERB et al. [12] They found that insulin-dependent diabetics who consumed 400 mg/day of a water-soluble *Gymnema sylvestre* extract had lower serum lipids, glycosylated hemoglobin, insulin requirements, and glycosylated hemoglobin.

Effectiveness of hypoglycemic impact of a methanolic extract derived from GS leaves was observed by studies done by Sugihar et al. [13], Galletto et al. [14] and Sujin RM et al.. [15]

During their study, Paliwal and colleagues [16] found that Gudmar powder effectively reduced FBS and PPBS levels without adverse health effects on non-insulin dependent diabetic women.

Similarly, Al-Romaiyan et al. [17] showed that oral treatment of *G.sylvestre* extract (1 g/day for 60 days) substantially boosted circulating insulin and C-peptide levels, leading to notable reductions in fasting (from 162 ± 23 to 119 ± 17 mg/dl, $p < 0.005$) and postprandial blood sugar (PPBS) (from 291 ± 10 to 236 ± 30 mg/dl, $p < 0.02$) in T2DM patients.

In their study, Martínez et al. [18] discovered that *G. sylvestre* therapy resulted in significant reductions in body weight, BMI, and cholesterol levels during a 2-hour oral glucose tolerance test in 30 patients with impaired glucose tolerance. Furthermore, after the intervention, 46.7% of the patients attained normal HbA1C levels.

Additionally, in an open-label trial by Joshi A.M. et al. [19] showed a substantial decrease in FBS and PPBS levels by 19.3% and 16.7%, respectively, indicating the potential of dried *G. sylvestre* leaves in lowering blood glucose levels in 43 T2DM participants.

A meta-analysis of 10 studies involving 419 participants found that *G.sylvestre* supplementation significantly lowers glycated hemoglobin levels, postprandial blood glucose, triglycerides, and total cholesterol levels. This suggests that *Gymnema sylvestre* could be a promising therapeutic strategy for managing type 2 diabetes. [20]

Comparable results were attained by Muzaffar et al. [21] in 2023, they found that *G. sylvestre* supplementation in an alloxan-induced hyperglycemic rat model increased plasma insulin levels, significantly lowered blood glucose, and strongly influenced insulin gene transcription.

The proposed mechanisms for hypoglycemic effects of leaf extract of *G. sylvestre* observed in various preclinical studies include stimulating the secretion of pancreatic insulin. Several investigations reported that gurmar administration initiates the regeneration of pancreatic islet cells. According to other research gurmar inhibits glucose absorption from the intestine. Additionally, it increases glucose utilization by enhancing the activities of enzymes responsible for glucose metabolism through insulin-dependent pathways, including increased phosphorylase activity and decreased activities of gluconeogenic enzymes and sorbitol dehydrogenase. [22]

Conclusion

The study's outcomes highlight the hypoglycemic effects of *G. sylvestre* leaf powder, suggesting it may be a complementary medicine for effectively controlling blood sugar levels in patients with type 2 DM. Additionally, it could play a role in reducing diabetes-related morbidity and mortality.

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