RESEARCH PAPER

Comparative Study on Anti-Diabetic Effect Between Cissus Quadrangularis and Trigonella Foenum-Graecum

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Received: 20th Feb, 2026 | **Revised:** 4th Mar, 2026 | **Accepted:** 25th Mar, 2026 | **Available Online:** 10th Apr, 2026

ABSTRACT

Background: The increase in the prevalence of diabetes is parallel with an increase in associated risk factors such as being overweight or obese. The revolution of traditional medicine is growing nowadays. Natural products are found to be the better alternative in the current scenario for replacing routine drugs.

Aim: The aim of this study is to compare the antidiabetic activity of Cissus Quadrangularis and Trigonella Foenum-graecum.

Methods: The α-amylase inhibition assay was performed using the 3,5-dinitrosalicylic acid (DNSA) method. A sample of Cissus Quadrangularis and Trigonella Foenum-graecum extract at five different concentrations were made and a positive control sample was prepared using metformin (500mg) (1 µg/ml) and the reaction was performed similarly to the reaction with plant extract as mentioned above.

Results: As the concentration of the sample increased from 20% to 100% microgram/milliliter, there was a noticeable trend of increased inhibition percentage, indicating a dose-dependent response. It was found that fenugreek has better inhibition of α-amylase when compared to pirandai even at the lowest concentration.

Conclusion: Although Cissus quadrangularis and Trigonella foenum-graecum both have antidiabetic characteristics; the evidence indicates that Trigonella foenum-graecum is more effective.

Keywords: Cissus quadrangularis, Trigonella foenum-graecum, Anti-diabetic, α-amylase inhibition, Diabetes mellitus, Herbal medicine.

How to cite this article: Sudarsan S, Rahman F, Elizabeth AA, Kaviya Varshini KS. Comparative Study on Anti-Diabetic Effect Between Cissus Quadrangularis and Trigonella Foenum-Graecum. Int J Drug Deliv Technol. 2026;16(4):599-602. DOI: 10.25258/ijddt.16.4.65

Source of support: Nil.

Conflict of interest: The authors declare no conflict of interest.

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder characterized by chronic hyperglycemia either because the pancreas does not produce enough insulin or the peripheral target tissues are unable to respond to the normal concentration of insulin (1,2). It is a major cause of morbidity and mortality with an increasing prevalence and the fastest growing disease worldwide (3,4).

The universal prevalence of diabetes has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population. Moreover, the prevalence of diabetes has also been found to steadily increase for the past 3 decades and has risen faster in low- and middle-income countries compared to high-income countries. The increase in the prevalence of diabetes is parallel with an increase in associated risk factors such as being overweight or obese. If not properly treated or controlled, diabetes may cause blindness, kidney failure, lower limb amputation, and other long-term consequences that impact significantly on the quality of life (5). Interestingly, the WHO also projects that diabetes will be the seventh leading cause of death in 2030 (6).

Natural products, particularly of plant origin, are the main quarry for discovering promising lead candidates and play an imperative role in the upcoming drug development programs (7). Ease of availability,

low cost, and least side effects make plant-based preparations the main key player of all available therapies, especially in rural areas (8). Moreover, many plants provide a rich source of bioactive chemicals, which are free from undesirable side effects and possess powerful pharmacological actions.(9) Plants also have always been an exemplary source of drugs with many of the currently available drugs being obtained directly or indirectly from them (10). The recent review of Durazzo et al. gives a current snapshot of the strict interaction between the main biologically active compounds in plants and botanicals by giving a mini overview of botanicals features, a definition of the study, and examples of innovative (i.e., an assessment of the interaction of bioactive compounds, chemometrics, and the new goal of biorefineries) and a description of existing databases (i.e., plant metabolic pathways, food composition, bioactive compounds, dietary supplements, and dietary markers); in this regard, the authors marked the need for categorization of botanicals as useful tools for health research.(11)

Currently, the only available treatment for TIDM is insulin therapy and has many side effects (12). Therefore, testing the efficacy of natural antidiabetic agents for the treatment of diabetes offers least/no side effects. Two medicinal plants easily available in Indian subcontinent are Cissus quadrangularis L. and Trigonella foenum-graecum L.. C. quadrangularis L. commonly known as Veldt Grape from the family Vitaceae is a perennial herb native to India. Phytoconstituent analysis of C. quadrangularis by GC-MS revealed presence of alkaloids, terpenes and terpenoids, ascorbic acid (vitamin C), tocopherols (Vitamin E), tannins, phenols, saponins, flavonoids and phytosterols (13). The plant extract is also rich in calcium ions and studies reported the formation of calcite crystal (14). Trigonella foenum-graecum L. (fenugreek), from the family Fabaceae, is common to many European, Middle Eastern, and Asian countries including India. Dried ripe seeds of T. foenum-graecum are used as spices by Indians and have medicinal values too. Extract of dried ripe seed of T. foenum-graecum are well known to possess antidiabetic properties (15). T. foenumgraecum seed extract also possess antihyperlipidemic, antihypercholesterolemic, antioxidant and estrogenic activities and is reported to improve hemorheological properties of blood(16,17). The rationale of selecting combination of C. quadrangularis and T. foenum-graecum is their importance as antidiabetic agent, respectively in traditional medicine.

MATERIALS AND METHODS

ANTIDIABETIC ACTIVITY

Inhibition of Alpha Glucosidase

The α-amylase inhibition assay was performed using the 3,5-dinitrosalicylic acid (DNSA) method suggested by Wickramaratne et al., 2016. The plant extract was dissolved in minimum amount of 10% DMSO and was further dissolved in buffer ((Na2HPO4/NaH2PO4 (0.02 M), NaCl (0.006 M) at pH 6.9) to give concentrations ranging from 10 to 1000 µg/ml. A volume of 200 µl of α-amylase solution (2 units/ml) was mixed with 200 µl of the extract and was incubated for 10 min at 30 °C. Thereafter 200 µl of the starch solution (1% in water (w/v)) was added to each tube and incubated for 3 min. The reaction was terminated by the addition of 200 µl DNSA reagent (12 g of sodium potassium tartrate tetrahydrate in 8.0 mL of 2 M NaOH and 20 mL of 96 mM of 3,5-dinitrosalicylic acid solution) and was boiled for 10 min in a water bath at 85–90 °C. The mixture was cooled to ambient temperature and was diluted with 5 ml of distilled water, and the absorbance was measured at 540 nm using a UV-Visible spectrophotometer. The blank with 100% enzyme activity was prepared by replacing the plant extract with 200 µl of buffer. A blank reaction was similarly prepared using the plant extract at each concentration in the absence of the enzyme solution. A positive control sample was prepared using Metformin(500mg) (1 µg/ml) and the reaction was performed similarly to the reaction with plant extract as mentioned above.

Procedure

100 µl of 0.1 U glucosidase was taken in different tubes. To this 50 µl of sample and standard of different concentrations were added (should not mix) and incubated at 25°C for 10 min. Then 50 µl of p-nitrophenyl alpha- D-glucosidase was added, vortexed and incubated at 25°C for 5 min. Add 800 µl of stop solution (0.1 M sodium carbonate) was added. Absorbance was measured at 405 nm.

$$\% \text{ of alpha glucosidase inhibition} = \frac{\text{OD control} - \text{OD sample}}{\text{OD control}} \times 100$$

RESULTS

Table 1: IC50 of α-amylase by different drugs

Concentration	Std (Acarbose)		Fenugreek		Pirandai	
	OD	% of Inhibition	OD	% of Inhibition	OD	% of Inhibition
200	0.92	19.29825	0.87	23.68421	0.89	21.92982
400	0.74	35.08772	0.65	42.98246	0.74	35.08772
600	0.57	50	0.51	55.26316	0.59	48.24561
800	0.32	71.92982	0.38	66.66667	0.46	59.64912
1000	0.16	85.96491	0.19	83.33333	0.31	72.80702
IC50 Value	571.051 µg/ml		538.587 µg/ml		638.463 µg/ml	

The table 1 show that Trigonella Foenum-Graecum has a lower IC50 value (538.587µg/mL) and a higher percentage inhibition at similar concentrations (compared to 638.463 µg/mL for cissus quadrangularis) further indicates that it has a stronger ability to inhibit α-amylase than cissus quadrangularis.

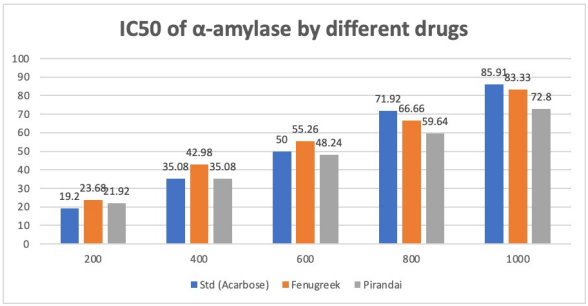

Figure 1: Bar graph showing IC50 of α-amylase by different drugs

Table 2: α-amylase inhibition assay conducted at various concentrations (µg/mL)

Sample Concentration (µg)	20	40	60	80	100
Std. Acarbose	0.16	0.14	0.11	0.09	0.04
% of inhibition	11.1	22.2	38.8	50	77.7
Pirandai	0.18	0.16	0.14	0.13	0.11
% of inhibition	0	11.1	22.2	27.7	38.8
Fenugreek	0.17	0.15	0.13	0.10	0.08
% of inhibition	5.5	16.6	27.7	44.4	55.5

The table 2 presents the results of an α-amylase inhibition assay conducted at various concentrations (µg/mL) of a sample substance. Each concentration was evaluated for its percentage of inhibition compared to the control. Cissus Quadrangularis And Trigonella Foenum-Graecum

As the concentration of the sample increased from 20% to 100% microgram/milliliter, there was a noticeable trend of increased inhibition percentage, indicating a dose-dependent response. It was found that fenugreek have better inhibition of α-amylase when compared to pirandai even at the lowest concentration.

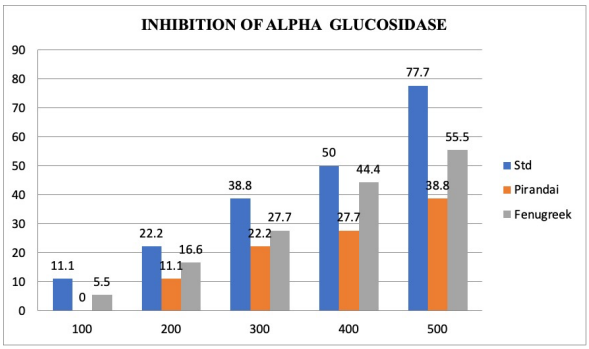

Figure 2: Bar graph showing % inhibition of α-amylase by different groups

SUMMARY AND CONCLUSION:

The study evaluated the antidiabetic activity of two samples, Cissus quadrangularis and Trigonella foenum-graecum, by measuring their "α-amylase" enzyme inhibition. There was a steady rise in inhibition amount of Trigonella foenum-graecum with increasing concentration, reaching 55.5% at 100µg/mL. whereas, Cissus quadrangularis showed the inhibition only at 40 µg/mL and at maximum concentration the inhibition was 38.8%.

This study indicates that Trigonella foenum-graecum has a stronger ability to inhibit α-amylase than Cissus quadrangularis. Based on this information, Trigonella foenum-graecum may be able to work better as an antidiabetic agent by blocking "α-amylase". Trigonella foenum-graecum Powder may have a greater potential for antidiabetic activity than Cissus quadrangularis due to its ability to inhibit α- amylase.

CONCLUSION

Although Cissus quadrangularis and Trigonella foenum-graecum both have antidiabetic characteristics, the evidence indicates that Trigonella foenum-graecum is more effective. As a diabetes treatment, Trigonella foenum-graecum works well.

Further studies and clinical trials would be beneficial to confirm these findings and explore the therapeutic potential of these natural products.

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