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In vitro analysis of hypoglycemic effects of homoeopathic *Cephalandra indica* through alpha- amylase and alpha-glucosidase inhibition

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Abstract

Background: Diabetes mellitus is a rapidly growing global health burden, characterized by chronic hyperglycemia and associated complications [1]. Herbal and homeopathic remedies, including *Cephalandra indica* (Ivy gourd), have been traditionally used for glycemic control, but their mechanistic basis remains inadequately studied [2].

Aim: To evaluate the *in vitro* hypoglycemic potential of homeopathic *Cephalandra indica* mother tincture (Q) through inhibition of α -amylase and α -glucosidase enzymes.

Methods: Standard *in vitro* enzyme inhibition assays were performed. Different concentrations (250, 500, 1000 μ L/mL) of *Cephalandra indica* tincture were tested for inhibitory activity against α -amylase and α -glucosidase. Percentage inhibition was calculated spectrophotometrically, and IC₅₀ values were determined using ED₅₀ plus V1.0 software.

Results: *Cephalandra indica* demonstrated dose-dependent inhibition of both enzymes. At 1000 μ L/mL, α -amylase inhibition reached 72.05% (IC₅₀=390.25 μ L/mL), while α -glucosidase inhibition was 67.92% (IC₅₀=493.97 μ L/mL). Comparative analysis revealed a slightly higher efficacy against α -amylase than α -glucosidase.

Conclusion: The mother tincture of *Cephalandra indica* exhibited significant dual inhibitory activity against carbohydrate-digesting enzymes. These findings validate its traditional use as an antidiabetic remedy and suggest its potential role in integrative management of type 2 diabetes.

Keywords: *Cephalandra indica*, homeopathy, diabetes mellitus, α -amylase inhibition, α -glucosidase inhibition, *in vitro* study

Introduction

Diabetes Mellitus (DM) is one of the most prevalent chronic metabolic disorders worldwide, posing significant health and economic challenges¹. India ranks second globally, with over 77 million diabetic patients, a figure projected to increase dramatically by 2045 [3]. Persistent hyperglycemia in DM leads to severe complications including retinopathy, nephropathy, neuropathy, and cardiovascular disease [4].

Conventional therapies often provide partial control and are associated with side effects, prompting interest in natural remedies [5]. *Cephalandra indica* (Family Cucurbitaceae), commonly known as Ivy gourd, has long been used in Ayurveda and Homeopathy for diabetes and related metabolic disorders [6]. Preclinical studies have demonstrated its antioxidant, hepatoprotective, and antidiabetic potential [7]. However, the mechanistic evidence of homeopathic preparations, particularly their influence on carbohydrate-digesting enzymes, remains limited [8].

This study investigates the *in vitro* inhibitory effects of *Cephalandra indica* mother tincture on α -amylase and α -glucosidase two key enzymes in carbohydrate metabolism and postprandial hyperglycemia.

Materials and Methods

Study Setting: Bio Genix Research and Development Pvt. Ltd. Sample: Homeopathic mother tincture of *Cephalandra indica* (Q).

Assays Performed

A-Amylase Inhibitory Assay: Concentrations (62.5-1000 μ L/mL) were tested using porcine

pancreatic α -amylase and starch substrate. Absorbance was measured at 540 nm, and percentage inhibition was calculated.

- **A-Glucosidase Inhibitory Assay:** Samples were incubated with p-nitrophenyl- α -D-glucopyranoside and α -glucosidase at 37 °C. Absorbance was measured at 400 nm. Acarbose was used as standard inhibitor.

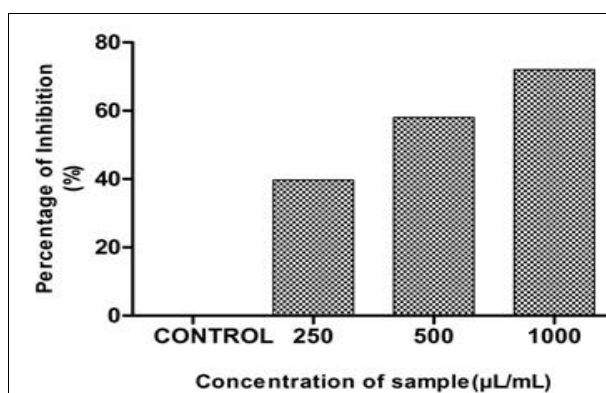
Data Analysis: All experiments were conducted in triplicates. IC₅₀ values were calculated using ED50 PLUS V1.0 software.

Results

- **Alpha-Amylase Inhibition:** At 1000 μ L/ml, *Cephalandra indica* achieved 72.05% inhibition (IC₅₀=390.25 μ L/ML).

Table 1: Comparative analysis of alpha amylase inhibition rate of *C. indica*

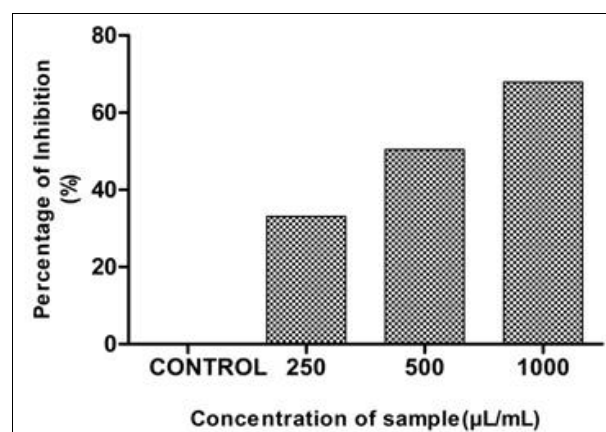
Concentration (μ L/mL)	OD at 540nm	% Inhibition
Control	2.764	0.00%
250	1.666	39.73%
500	1.160	58.04%
1000	0.773	72.05%



Graph 1: Representation of Alpha amylase inhibition rate of *C. indica*

The IC₅₀ value for *Cephalandra indica* against α -amylase was calculated as 390.257 μ L/mL using ED50 plus V1.0 software.

- **Alpha-Glucosidase Inhibition:** At 1000 μ L/ml, inhibition reached 67.92% (IC₅₀=493.97 μ L/ml).



Graph 2: Representation of alpha glucosidase inhibition rate of *C. indica*

Table 2: Comparative Analysis of alpha glucosidase inhibition rate of *C. indica*

Concentration (μ L/mL)	Absorbance	% Inhibition
Control	0.480	0.00%
250	0.321	33.13%
500	0.238	50.42%
1000	0.154	67.92%

The IC₅₀ value for *Cephalandra indica* against α -glucosidase was determined to be 493.971 μ L/mL

Comparative Analysis: Alpha-Amylase inhibition was slightly stronger than Alpha-glucosidase inhibition at equivalent concentrations

Table 3: Comparative analysis of alpha amylase and alpha glucosidase inhibition rate of *C. indica*

Assay	Percentage of inhibition at concentration 250 μ L/mL	Percentage of inhibition at concentration 500 μ L/mL	Percentage of inhibition at concentration 1000 μ L/mL
Alpha-amylase assay	39.73	58.04	72.05
Alpha-glucosidase assay	33.13	50.42	67.92

The study evaluated its *in vitro* inhibitory activity against α -amylase and α -glucosidase, enzymes directly involved in starch digestion and glucose absorption. The results showed:

- A-Amylase inhibition reached 72.05% at 1000 μ L/mL, with an IC₅₀ of 390.257 μ L/mL
- A-Glucosidase inhibition reached 67.92% at 1000 μ L/mL, with an IC₅₀ of 493.971 μ L/mL

These findings suggest that the mother tincture of *Cephalandra indica* significantly inhibits carbohydrate-digesting enzymes, supporting its traditional role in glycemic control.

Discussion

This study provides the first *in vitro* enzyme-based evidence of homeopathic *Cephalandra indica* mother tincture as an antidiabetic agent. The significant inhibition of both α -amylase and α -glucosidase demonstrates its potential to delay carbohydrate digestion and glucose absorption.

Previous *in vivo* studies reported that *Cephalandra indica* reduced blood glucose and supported pancreatic β -cell regeneration [9]. Kishore and Singh [10] demonstrated nephroprotective and antioxidant properties, while Sampath *et al.* [11] reported enhanced insulin signaling in skeletal muscle. These findings align with our results, suggesting that inhibition of digestive enzymes may be one of the mechanisms underlying its observed antidiabetic benefits.

The slightly stronger inhibition of α -amylase compared to α -glucosidase highlights its role as a broad-spectrum carbohydrate metabolism regulator. Such dual inhibition resembles standard enzyme inhibitors, indicating its promise as a natural therapeutic adjunct.

Conclusion

Homeopathic *Cephalandra indica* mother tincture demonstrated significant inhibitory activity against both α -amylase and α -glucosidase *in vitro*. The dose-dependent inhibition suggests its potential role in reducing postprandial

hyperglycemia.

These results validate its traditional application in diabetes care and highlight the need for further *in vivo* and clinical studies to establish its therapeutic efficacy as an adjunct in type 2 diabetes management.

Conflict of Interest

Not available

Financial Support

Not available

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