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IN VITRO ANTIOXIDANT AND ANTIDIABETIC POTENTIAL OF CINNAMOMUM TAMALA AND CINNAMOMUM VERUM EXTRACTS

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ABSTRACT
Background: Diabetes is a chronic disorder characterized by oxidative stress, insulin resistance, and β-cell dysfunction. Bioactive substances found in plants, such as phenolics and flavonoids, restore redox balance and inhibit enzymes that degrade carbohydrates. *Cinnamomum tamala* (Buch.-Ham.) T.Nees and C.H.Eberm. and *Cinnamomum verum* J. Presl were used in the treatment of metabolic diseases, although less is known about their antioxidant and antidiabetic effects. **Methodology:** Ethanolic extracts of *C. tamala* leaves and *C. verum* bark were prepared and fractionated with polar and non-polar solvents. Phytochemical screening, total phenolic content (TPC, mg GAE/g), and total flavonoid content (TFC, mg QE/g) were measured, along with the antioxidant activity using DPPH and NO radical scavenging assays, and antidiabetic potential using α-amylase and α-glucosidase inhibition assays, using acarbose as the benchmark. **Result and Discussion:** Alkaloids, phenols, tannins, flavonoids, and saponins were present in both species. The n-butanol fraction had the highest TPC (16.48 mg GAE/g) and TFC (28.74 mg QE/g) in *C. verum*. In antioxidant assays, the ethyl acetate fraction exhibited higher radical-scavenging activity than the other solvent fractions. In *C. verum*, ethyl acetate fractions exhibited the strongest antidiabetic effects, with α-glucosidase inhibition comparable to that of acarbose. Both plant species exhibited significant in *vitro* antioxidant and antidiabetic activities. **Conclusion:** This study supports the use of *C. tamala* and *C. verum* in diabetes care and suggests that the ethyl acetate fraction exhibits higher *in vitro* antioxidant and antidiabetic activity; however, further *in vivo* studies, mechanistic studies, and formulation development are required to validate these findings.

INTRODUCTION

Diabetes mellitus (DM) is primarily characterized by hyperglycemia, excessive thirst (polydipsia), and increased appetite (polyphagia), which is growing rapidly on a global scale [1] and is now the tenth leading cause of death, killing 1.6 million people around the world. Based on projections, the number of cases is expected to rise to 643 million by 2030 and 783 million by 2045 [2]. While diabetes is primarily a disorder of glucose metabolism, it has been strongly linked with oxidative stress, which is essential to its onset and effects. Reactive oxygen species accumulate in response to persistent hyperglycemia through multiple mechanisms, including mitochondrial dysfunction, NADPH oxidase activation, and the AGE-RAGE

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axis, thereby inducing oxidative damage to lipids, proteins, and DNA [3]. The activation of stress kinases, such as JNK and NF-κB, by ROS disrupts the function of the insulin receptor substrate (IRS), reducing GLUT4 translocation and thereby causing insulin resistance [4]. Furthermore, oxidative stress exacerbates insulin secretory abnormalities by inducing mitochondrial damage and ER stress, which, in turn, lead to β-cell failure [3]. Vascular problems such as retinopathy, nephropathy, neuropathy, and cardiovascular disease are caused by cellular damage. To restore redox balance and enhance metabolic outcomes, antioxidant strategies targeting pathways such as Nrf2/Keap1 and employing agents such as berberine, alpha-lipoic acid, or vitamins C and E are being investigated [5]. Plant species have historically played a crucial role in promoting human health due to their high concentrations of bioactive compounds, including phenols, flavonoids, alkaloids, and terpenoids. [6]. These natural compounds have a variety of therapeutic benefits, including antioxidant, anti-inflammatory, antibacterial, and metabolic-regulating activities. Plant-derived compounds can aid in diabetes management by increasing insulin production, enhancing insulin sensitivity, inhibiting carbohydrate-digesting enzymes such as α-amylase and α-glucosidase, and protecting pancreatic β-cells from oxidative damage [7]. More than 800 medicinal plants have been reported to have antidiabetic properties [8], and additional studies have examined the two plant species *Cinnamomum tamala* (Buch.-Ham.). T.Nees & C.H.Eberm. and *Cinnamomum verum* J.Presl, both belonging to the Lauraceae family, by various solvent extraction and fractionation methods, linking their phytochemical compositions with antioxidant and antidiabetic activities. By utilizing solvent partitioning methods, the study clarifies the role of fraction-specific bioactive compounds mediating biological effects. This fraction-based comparative approach provides new insights into the bioactive potential of these species. It supports their rational selection for subsequent *in vivo* studies and the development of antidiabetic formulations.

MATERIAL AND METHODS

Plant Material

Both plant species were collected from the Barpeta district of Assam in different months and years. They were subsequently confirmed by the Department of Botany, Guwahati University, Assam, under authentication numbers *Herb./GUBH/2024*/031 & *Herb./GUBH/2025*/092.

Cinnamomum tamala (Buch.-Ham.) T.Nees & C.H.Eberm. *Cinnamomum verum* J.Presl.

Figure 1: Plant Species

Preparation of plant extract-

Cinnamomum tamala (Buch.-Ham.) T.Nees & C.H.Eberm. as leaf part and *Cinnamomum verum* J.Presl as bark part were ground into moderately coarse powder using an electric grinder. The powder was then extracted by large-scale cold maceration with ethanol. 400 g of powdered material was weighed and soaked in a large glass vessel containing 4 liters of ethanol (1:10) for three days, with occasional stirring. After three days, filtration was carried out first through a muslin cloth, then through cotton. The filtrate was concentrated by rotary evaporation at 50 °C. The resulting extracts were further oven-dried at a controlled temperature for 6 to 8 hours, and yields were determined using the following formula: [9].

$$\%\ of\ Yield = \frac{Mass\ of\ dried\ extract\ (g)}{Mass\ of\ dried\ plant\ material\ used\ (g)} \times 100$$

Fractionation of crude extract

After obtaining the extract of both the plants, the fractionation was done by using liquid-liquid partitioning with polar & non-polar solvents (i.e., petroleum ether, ethyl acetate, n-butanol, and aqueous) to separate the extract into polar & non-polar constituents. The crude extract was diluted in 200 ml of distilled water, and the solution was poured into a separating funnel. An equal volume of petroleum ether (200 ml) was added, and the mixture was stirred for 5 to 10 minutes, with occasional venting to relieve pressure buildup. The mixture was allowed to stand until the aqueous and petroleum ether layers were completely separated. The upper petroleum ether layer was collected, and the solvent was evaporated by rotary evaporation at 40–45 °C to yield the petroleum ether fraction. To the remaining aqueous layer, an equal volume of ethyl acetate (200 ml) was added; the

procedure was repeated with n-butanol. Lastly, the aqueous layer remaining after evaporation of the n-butanol fraction was concentrated at 40–45 °C, and the % yield of the fractions was determined using the following formula [10].

$$\%\ \boldsymbol{of\ Fraction\ Yield} = \frac{\boldsymbol{Mass\ of\ Fraction\ (g)}}{\boldsymbol{Mass\ of\ Crude\ Extract\ (g)}} \times \mathbf{100}$$

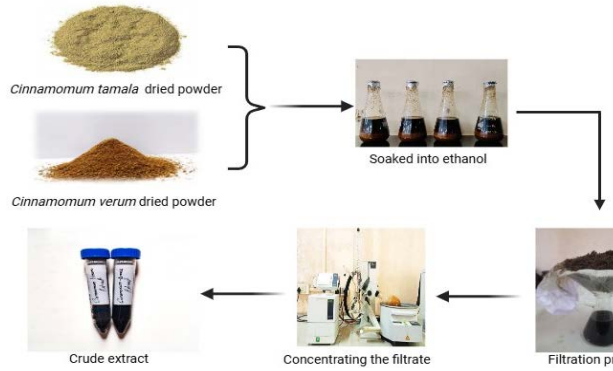

Figure 2: Extraction

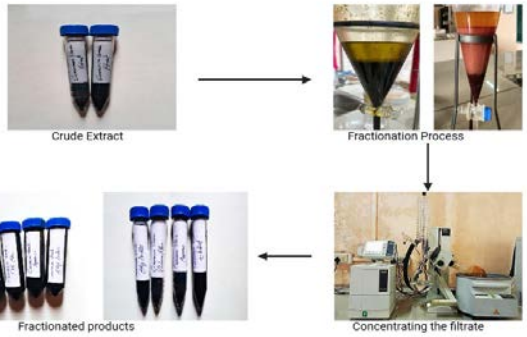

Figure 3: Fractionation

Preliminary Phytochemical Screening

The preliminary analysis of various phytoconstituents in the different fractions (ethyl acetate, petroleum ether, n-butanol, and aqueous) was executed using the standard protocol techniques [11][12].

Total phenolic content analysis

The total phenol content of the extract fractions was determined using the Folin-Ciocalteu (FC) method, with gallic acid as the standard [13]. The reaction was initiated by adding a fraction in distilled water, followed by the F-C reagent, to which a 7% sodium carbonate solution was added 5 minutes later. For 30 minutes, the mixture was incubated at a controlled temperature. Using an absorbance measurement at 765 nm. The standard curve showed a linearity with the tested concentration range, with a coefficient of determination (R^2 = 0.9319) in Figure 4, and the result was expressed as milligrams of gallic acid equivalents per 100 grams of dried weight (mg GAE/100g) [14].

The total flavonoid content analysis

The TFC was performed using the aluminum chloride-based colorimetric assay, with slight modifications, on crude extract fractions [15]. Mixing 0.5 ml of the fractions with 0.1 ml of 10% aluminum chloride. Subsequently, 0.1 mL of 1 M potassium acetate and 4.3 mL of distilled water were added, and the mixture was vigorously shaken. The mixture was incubated for 30 minutes at normal temperature. The absorbance was recorded at 415 nm. The standard curve in Figure 5 showed linearity (R^2 = 0.9547), and the results were expressed as mg of quercetin equivalents per 100 g of dried weight (mg QE/100 g) [16].

***In vitro* antioxidant activities (DPPH free radical scavenging assay)**

The DPPH (2,2-diphenyl-1-picrylhydrazyl) assay was used to determine the antioxidant activity of the four prepared solvent fractions [17]. A 0.1 mM DPPH solution was prepared in methanol and stored in the dark to prevent light exposure. The standard was taken as ascorbic acid, and each solvent fraction was prepared in methanol at varying concentrations. 1 mL of DPPH solution was added to each sample; methanol containing DPPH served as the control, and methanol alone as the blank. As follows, the mixtures were kept at room temperature in the dark for 30 minutes, and the absorbance was measured at 517 nm. The DPPH radical-scavenging capacity was estimated using a formula. The dose-response curve yielded the IC_{50} value, which is the extract concentration needed to scavenge 50% of the radicals. A comparison of IC_{50} values across solvent fractions revealed relative antioxidant capacity, with lower IC_{50} values indicating greater free radical-scavenging activity [18].

***In vitro* antioxidant study (nitric oxide radical scavenging assay)**

The study was initiated by preparing a reaction combination of 5 mM sodium nitroprusside in 0.1 M phosphate buffer (pH 7.4) with varying quantities of the sample fractions [19]. At the same time, the control contained only the solvent. To produce nitric oxide, which subsequently reacts with oxygen to form nitrite ions, the mixture is incubated at ambient temperature (25-30°C) for approximately 150 minutes. Following incubation, an equal volume of Griess reagent, made by dissolving 1% sulphanilamide and 0.1% N-(1-naphthyl) ethylenediamine dihydrochloride in 2% phosphoric acid, is added to the reaction mixture, and the solution is kept for 10 min for color development. The absorbance is then measured at 540-550 nm with a

spectrophotometer. It is calculated as the percentage inhibition of nitrite formation compared to the control. The IC_{50} value, which represents the concentration of the extract required to inhibit 50% of NO radicals, can be determined by plotting percentage inhibition against extract concentration. Standard antioxidants, such as ascorbic acid, can be used as positive controls for comparison [20].

***In Vitro* Antidiabetic Assay (α-Amylase Inhibition Assay)**

The *in vitro* antidiabetic assay was conducted using fractions of the sample, as described in a modified protocol by Zhang M et al. [21]. The α-amylase enzyme was prepared in phosphate buffer (pH 6.9, 0.006 M sodium chloride) at a predetermined concentration. Different concentrations of the test extract fractions were combined with the enzyme mixture, which was maintained at 37 °C for about 30 minutes to allow sufficient enzyme–inhibitor interaction. Following incubation, a 1% (w/v) starch solution prepared in the same buffer was added as a substrate and incubated at 37 °C for an additional 10 minutes. To complete the procedure, add 1 ml of 3,5-dinitrosalicylic acid (DNS) color reagent (1.0 g of DNS, 20 ml of 2 M NaOH, and 30 g of sodium potassium tartarate in 100 ml of distilled water).

The mixture was placed in a boiling water bath for 5 minutes, cooled to room temperature, diluted with distilled water, and the absorbance at 540 nm was measured with a spectrophotometer. A control was prepared by replacing the extract with distilled water. The reduction of sugar was estimated by converting 3,5-dinitrosalicylic acid to 3-amino-5-nitrosalicylic acid. Acarbose served as the positive control [22].

***In Vitro* Antidiabetic Assay (α-Glucosidase Inhibition Assay)**

The α-glucosidase inhibition assay was performed by following a modified method described by Mechchate H et al. [23]. Each sample fraction (50 µl, 1 mg/ml) was prepared at different concentrations (10 µl to 50 µl) and replicated three times. Each glass tube received 100 µl of α-glucosidase solution (0.1 U/ml in 0.1 M phosphate buffer, pH 6.9).

The test blend was heated to 37°C for 10 minutes before use. Add 50 µL of 2 mM paranitrophenyl α-D-glucopyranoside in 0.1 M sodium phosphate buffer to start the process. Then, let it sit for a while longer. As the reaction was carried out for 30 minutes at 37°C, 50 µL of 0.1 M Na_2CO_3 was added, and the absorbance at 405 nm was measured with a spectrophotometer. The tube with α-glucosidase but without AgNPs served as a control with 100% enzyme activity, while the antidiabetic medication acarbose was a positive control [24].

STATISTICAL ANALYSIS

The experiments were performed in triplicate, and the results were statistically analyzed using one-way ANOVA followed by Dunnett's multiple comparison test with GraphPad Prism (version 8.0.2, San Diego, CA, USA). The IC_{50} was calculated by linear interpolation for DPPH, nitric oxide, α-amylase, and α-glucosidase activities. A p-value of <0.05 was considered statistically significant.

RESULT AND DISCUSSION

Percentage of Yield

The percentage yield of extracts presented in Table 1 shows that the ethanol extraction of *Cinnamomum tamala* yielded 10.5%, and *Cinnamomum verum* yielded 16.5%, exhibiting moderately high values due to the presence of predominantly polar compounds. Among the solvent fractions, the aqueous fraction shows a maximum yield, followed by the ethyl acetate fraction and the n- butanol fraction, while the petroleum ether fraction yielded the least.

Table 1: Percentage of Yield of Extract and Fractions

S. No.	Extract and Fractions	Consistency	Yield Value (%) [*C. tamala*]	Yield Value (%) [*C. verum*]
1	Ethanol extract	Semisolid	10.5%	16.5%
2	Ethyl acetate fraction	Semisolid	3.15%	4.95%
3	Petroleum ether fraction	Semisolid	1.05%	1.65%
4	n- Butanol fraction	Semisolid	2.10%	3.30%
5	Aqueous fraction	Semisolid	4.20%	6.60%

Preliminary Phytochemical Screening

The phytochemical analysis of *Cinnamomum tamala* and *Cinnamomum verum* presented in Table 2 identified significant bioactive components, including phenols, tannins, flavonoids, alkaloids, saponins, and quinones across several solvent fractions. Both plants exhibited a high level of phenolic compounds.

Table 2: Phytochemical Screening

S.No.	Phytochemical Screening	Ethyl Acetate	Petroleum Ether	n-Butanol	Aqueous	Ethyl Acetate	Petroleum Ether	n-Butanol	Aqueous
		C. tamala (Buch.-Ham.) T.Nees & C.H.Eberm.				*C. verum* J.Presl			
1	Alkaloids	-	+	+	+	-	+	+	-
2	Carbohydrate	-	+	-	-	-	+	-	+
3	Tannins	+	-	+	-	+	-	+	+
4	Phenols	+	-	+	+	+	-	+	+
5	Quinones	+	-	+	-	-	-	+	-
6	Saponins	-	+	-	-	-	+	+	+
7	Flavonoids	+	-	+	+	+	+	+	+

** (+) = Presence, (-) = Absence*

Total phenolic content

The total phenolic content (TPC) of *Cinnamomum tamala* and *Cinnamomum verum* presented in Table 3 was determined, where the n-butanol fraction had the most TPC in both plants, with *C. verum* (16.48 mg GAE/g) having more than *C. tamala* (13.08 mg GAE/g). The petroleum ether fraction had the least quantity of phenolics.

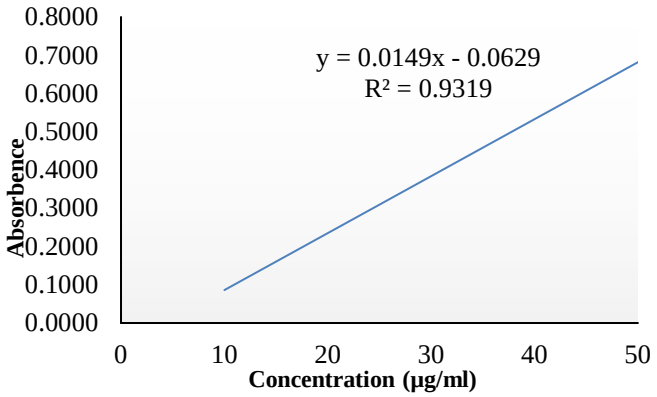

Figure 4: Standard curve of Gallic acid

Table 3: Total Phenolic Content

S No	Sample	Total Phenolic Content (mg GAE/g) *C. tamala*	Total Phenolic Content (mg GAE/g) *C. verum*
1	Ethyl acetate	10.63 ± 0.17	11.08 ± 0.14
2	Pet. ether	7.05 ± 0.24	9.63 ± 0.15
3	n-butanol	13.08 ± 0.11	16.48 ± 0.18
4	Aqueous	11.28 ± 0.16	12.28 ± 0.23

**values are mean±standard deviation*

Total flavonoid content

The total flavonoid content (TFC) of *Cinnamomum tamala* and *Cinnamomum verum* presented in Table 4 was determined, where the n-butanol fraction exhibited the highest flavonoid concentration. In both species, *C. verum* (28.74 mg QE/g) showed slightly higher flavonoid content than *C. tamala* (24.04 mg QE/g), while the petroleum ether extract yielded the lowest flavonoid content in both plants.

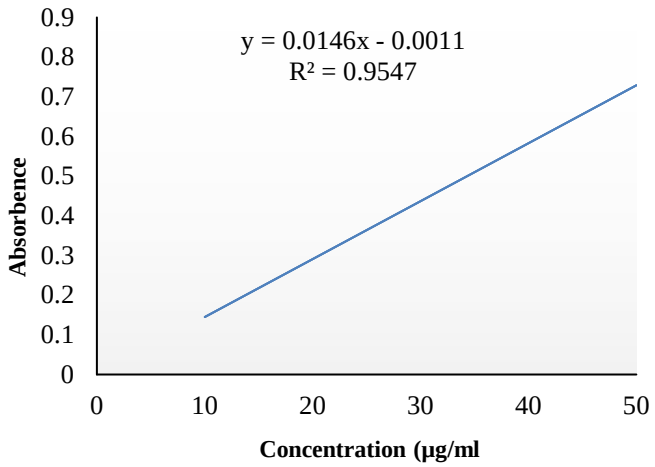

Figure 5: Standard curve of quercetin

Table 4: Total Flavanoid Content

S. No.	Sample	TFC (mg QE/g) *C. tamala*	TFC (mg QE/g) *C. verum*
1	Ethyl acetate	13.54 ± 0.14	18.64 ± 0.19
2	Pet. ether	6.78 ± 0.11	9.03 ± 0.23
3	n-butanol	24.04 ± 0.25	28.74 ± 0.13
4	Aqueous	18.78 ± 0.16	23.36 ± 0.15

**values are mean±standard deviation*

DPPH free radical scavenging assay

The assay was performed to determine the antioxidant potential of various solvent fractions of *Cinnamomum tamala* (A) and *Cinnamomum verum* (B), and the IC_{50} values are shown in Figure 6. A lower IC_{50} value indicates a stronger antioxidant activity. The standard ascorbic acid demonstrated the highest activity, with an IC_{50} of 34.10 ± 0.39 µg/mL. Whereas, the ethyl acetate fraction showed the strongest antioxidant potential in *C. tamala* (IC_{50} =37.59±1.03 µg/mL), followed by n-butanol (IC_{50} =39.65±0.90 µg/mL), aqueous extract (IC_{50} = 53.92±0.30 µg/mL) & petroleum ether (IC_{50}=60.35±0.54µg/mL). Similarly, the ethyl acetate fraction of *C. verum* exhibited the highest DPPH radical scavenging activity (IC_{50}=42.29±0.62µg/ mL), followed by n-butanol (IC_{50}=56.61±0.71µg/mL), aq. (IC_{50}= 72.7

±0.53 µg/mL) and petroleum ether (IC_{50}=85.65±0.68µg/mL). All solvent fractions of both plant species exhibited significantly lower antioxidant activity than the standard ascorbic acid ($p<0.05$).

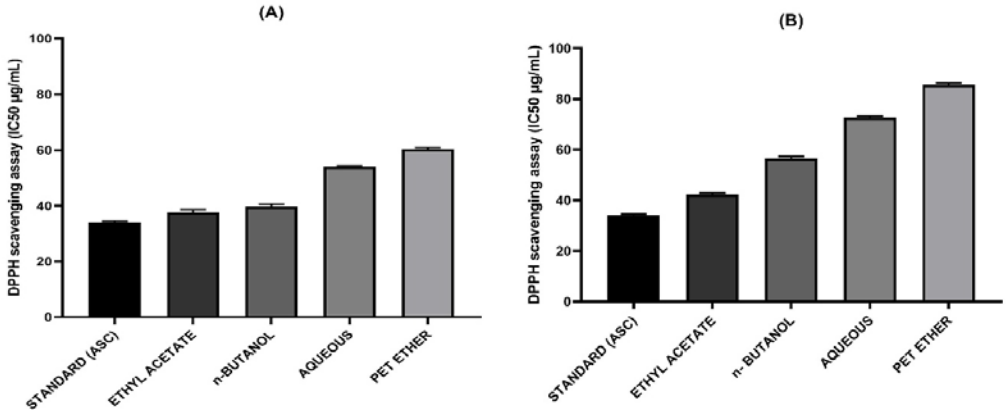

Figure 6: DPPH free radical scavenging assay (IC_{50} µg/mL)

Nitric oxide radical scavenging assay

The nitric oxide (NO) antioxidant activity of various solvent fractions of *Cinnamomum tamala* (A) and *Cinnamomum verum* (B) was assessed, and the IC_{50} values are summarized in Figure 7. A lower IC_{50} value indicates a stronger inhibition of NO radicals. As anticipated, the standard antioxidant ascorbic acid demonstrated the highest activity, with an IC_{50} of 35.05 ± 0.45 µg/mL. In contrast, the n-butanol fraction in *C. tamala* showed the strongest antioxidant potential (IC_{50} = 41.89 ± 0.72 µg/mL), followed by ethyl acetate (45.56 ± 0.91 µg/mL), aqueous extract (IC_{50} = 57.00 ± 0.30 µg/mL), and petroleum ether (IC_{50} = 79.30 ± 0.83 µg/mL). Additionally, the ethyl acetate fraction exhibits the strongest nitric oxide scavenging activity against *C. verum* (IC_{50} = 40.08 ± 0.70 µg/mL), followed by n-butanol (IC_{50} = 46.64 ± 0.68 µg/mL), aqueous (IC_{50} = 51.07 ± 0.38 µg/mL), and petroleum ether (IC_{50} = 67.2±0.51 µg/mL). All the solvent fractions of both plant species showed significantly lower antioxidant activity compared to the standard ascorbic acid ($p < 0.0001$).

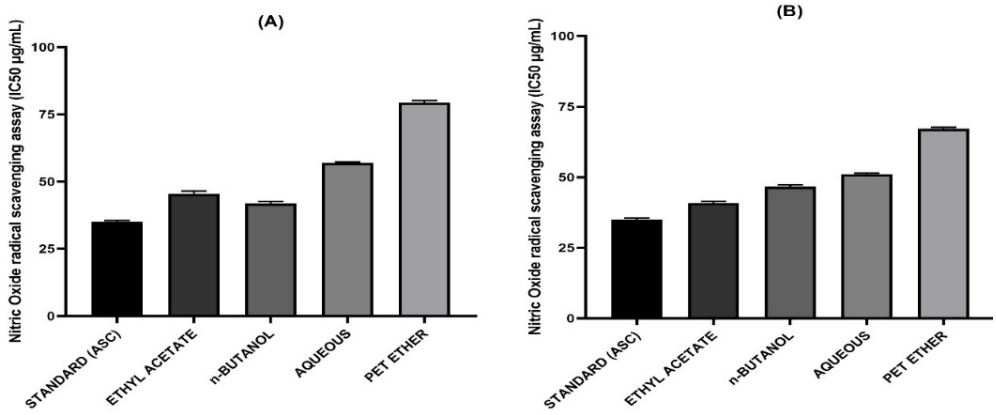

Figure 7: Nitric Oxide radical scavenging assay (IC_{50} µg/mL)

α-Amylase Inhibition Assay

A distinct dose-dependent response has been shown in the α-amylase inhibition assay for all tested fractions of *C. tamala* (A & B) and *C. verum* (C & D), as represented in Figure 8. The inhibitory activity remained within acceptable limits for all fractions at low % inhibition (A and C), but it increased with concentration. Ethyl acetate showed the highest percentage inhibition among the plant fractions, comparable to that of the standard drug acarbose at higher concentrations. For IC_{50} values (B & D), providing a comparative view of the inhibitory potency of different fractions. The standard acarbose exhibited superior activity with an (IC_{50}=38.21±0.29µg/mL). For *C. tamala*, the ethyl acetate fraction showed the lowest (IC_{50} =41.95±0.1µg/mL), indicating the strongest inhibitory effect among the plant extracts, followed by n-butanol (IC_{50} =47.87± 0.23µg/mL), aqueous (IC_{50}=52.87± 0.22µg/mL) & petroleum ether (IC_{50}=57.93±0.18µg/mL). Similarly, *C. verum* with ethyl acetate is the most potent (IC_{50}=42.23± 0.4µg/mL), followed by n-butanol (IC_{50}=44.9 ±0.26µg/mL), aqueous (IC_{50}=54.17±0.21 µg/ mL), and petroleum ether (IC_{50} = 61.02 ± 0.18 µg/mL). All

the solvent fractions of both plant species showed significantly lower α-amylase inhibitory activity compared to acarbose ($p < 0.0001$).

α-Glucosidase Inhibition Assay

Compared with the standard drug acarbose, the α-glucosidase inhibition assay showed a distinct, concentration-dependent increase in percentage inhibition across all fractions of *C. tamala* (A and B) and *C. verum* (C and D) in Figure 9. At the lowest concentration tested, inhibition was negligible across all extracts, whereas it was significant at higher concentrations. For IC_{50} values (B and D), providing a comparative view of the inhibitory potency of different fractions. The standard acarbose exhibited the highest activity, with an IC_{50} of 41.38 ± 0.41 µg/mL. For *C. tamala*, ethyl acetate showed the strongest inhibitory potential (IC_{50} = 44.03 ± 0.15 µg/mL), followed by n-butanol (IC_{50} = 47.85 ± 0.30 µg/mL), aqueous extract (IC_{50} = 50.03 ± 0.30 µg/mL), and petroleum ether (IC_{50} = 55.73 ± 0.28 µg/mL). Similarly, among the fractions of *C. verum*, the ethyl acetate exhibited the strongest inhibitory activity (IC_{50} = 43.26 ± 0.37 µg/mL), followed by n-butanol (IC_{50} = 46.9 ± 0.22 µg/mL), aqueous (IC_{50} = 49.78 ± 0.29 µg/mL), and petroleum ether (IC_{50} = 53.93 ± 0.23 µg/mL). All the solvent fractions of both plant species showed significantly lower α-glucosidase inhibitory activity compared to acarbose ($p < 0.05$).

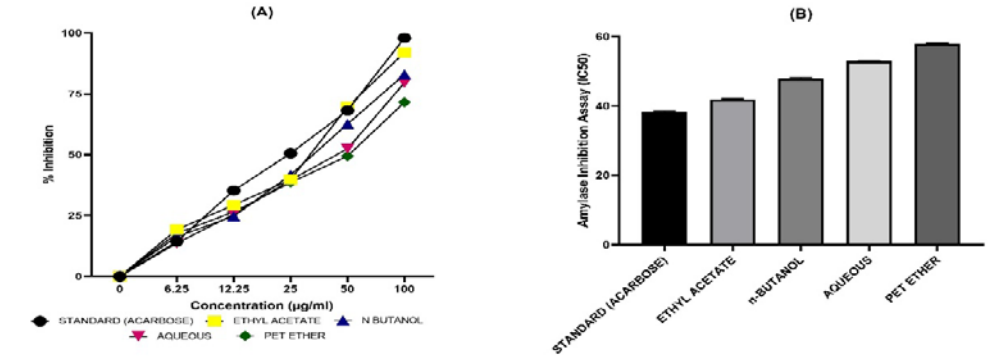

Figure 8: (A) % inhibition of α-amylase inhibition assay of *C. tamala*. (B) IC_{50} µg/mL of α-amylase inhibition assay of *C. tamala*. (C) % inhibition of α-amylase inhibition assay of *C. verum*. (D) IC_{50} µg/mL of α-amylase inhibition assay of *C. verum*.

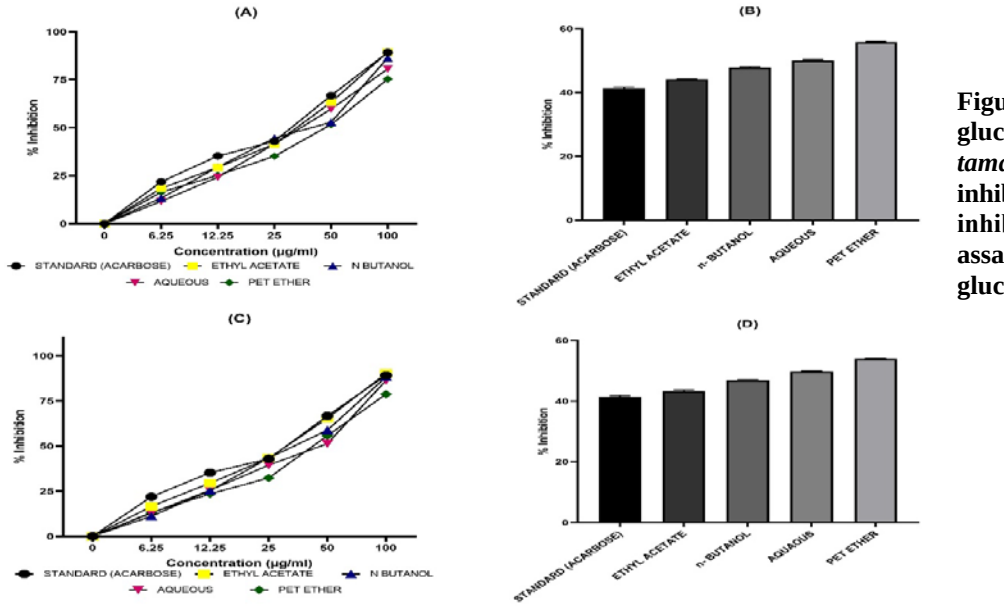

Figure 9: (A) % inhibition of α-glucosidase inhibition assay of *C. tamala*. (B) IC_{50} µg/mL of α-glucosidase inhibition assay of *C. tamala*. (C) % inhibition of α-glucosidase inhibition assay of *C. verum*. (D) IC_{50} µg/mL of α-glucosidase inhibition assay of *C. verum*.

The present study evaluated the phytochemical screening, TPC, TFC, antioxidant activity, and *in vitro* antidiabetic activities of *Cinnamomum tamala* and *Cinnamomum verum*. The phytochemical screening confirmed the presence of key secondary metabolites, including phenols, tannins, flavonoids, alkaloids, quinones, and saponins, in both species, with variations depending on solvent polarity. In quantitative analyses, *C. verum* with n-butanol fractions showed higher TPC and TFC than *C. tamala*, suggesting that it is a richer source of phenolic antioxidants, whereas petroleum ether fractions contained the least. Antioxidant assays such as the DPPH assay showed that the ethyl acetate fractions of both *C. tamala* and *C. verum* exhibited superior activity, with IC_{50} values closer to that of the standard ascorbic acid ($p < 0.05$). In contrast, the petroleum ether fractions exhibited the weakest scavenging potential. Similarly, NO scavenging activity indicated the effectiveness of the ethyl acetate and n-butanol fractions of both *C. tamala* and *C. verum* ($p < 0.0001$). The *in vitro* antidiabetic assays provided strong evidence of the enzyme-inhibitory potential of both of these plants. Both α-amylase and α-glucosidase inhibition assays showed dose-dependent responses, with the ethyl acetate fraction exhibiting the strongest activity in both *C. tamala* and *C. verum* ($p < 0.05$) and being significantly closer to the standard acarbose, highlighting its therapeutic potential. The enhanced antioxidant and antidiabetic effects observed in the ethyl acetate fraction of both plant species may be linked to the intermediate polarity of the solvent, which promotes the selective extraction of bioactive phenolic and flavonoid compounds. These compounds are known to exhibit strong free-radical scavenging activity and to inhibit carbohydrate-hydrolyzing enzymes, such as alpha-amylase and beta-glucosidase. Compared with previously reported research on Cinnamomum species using crude extracts and non-fractionated samples, the IC50 values in this study are similar to or lower, particularly in enzyme inhibition assays, indicating improved efficacy due to fractionation.

CONCLUSION

Diabetes is a metabolic illness that involves glucose regulation and oxidative stress, leading to insulin resistance, β-cell dysfunction, and consequences such as neuropathy, nephropathy, and cardiovascular disorders. Plant-derived antioxidants can restore redox equilibrium and inhibit carbohydrate-digesting enzymes such as α-amylase and α-glucosidase, thereby promoting glycemic control and pancreatic function. This study shows that *Cinnamomum tamala* and *Cinnamomum verum* are phytochemically rich, exhibit antioxidant and antidiabetic properties, and are rich in antioxidants. The ethyl acetate fraction exhibited the highest antioxidant and antidiabetic activities, particularly against α-amylase and α-glucosidase, indicating the therapeutic relevance of bioactive compounds. Ethyl acetate fractions, especially from *C. verum*, show promise as antioxidants and antidiabetics, supporting the traditional use in diabetes control. However, as this study is limited to *in vitro* experimental models, the findings should be considered preliminary. Further *in vivo* studies, mechanistic investigations, and formulation development are essential to validate the antidiabetic potential and clinical applicability of these plant-based extracts.

FINANCIAL ASSISTANCE

NIL

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

Dhiraj Baishya contributed to the research's conceptualization, methodology, data analysis, and writing of the original draft. Ananta Choudhury provided supervision, data analysis, and project administration.

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