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ANTIDIABETIC POTENTIAL OF *XANTHOSOMA BRASILIENSE* AND *JACQUEMONTIA PENTANTHOS*: A COMPARATIVE STUDY

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ABSTRACT

Diabetes mellitus represents a long-term metabolic disorder that demands effective control strategies. This comparative investigation explored the antidiabetic potential of extracts from *Xanthosoma brasiliense* and *Jacquemontia pentanthos*. The study was conducted during 2024. The extracts were evaluated for their inhibitory activities against alpha-amylase and alpha-glucosidase enzymes. The results showed that *Xanthosoma brasiliense* exhibited potent inhibitory activities against alpha-amylase (IC_{50}: 3.741924 ± 0.011 μg/mL) and alpha-glucosidase (IC_{50}: 2.39175 ± 0.021 μg/mL). *Jacquemontia pentanthos* demonstrated significant inhibitory activities against alpha-glucosidase (IC_{50}: 3.368435 ± 0.031 μg/mL) and moderate activity against alpha-amylase (IC_{50}: 15.38087 ± 0.027 μg/mL). The results indicate that extracts of *Xanthosoma brasiliense* and *Jacquemontia pentanthos* could aid in creating natural antidiabetic agents, offering an alternative or supportive option for diabetes management.

Keywords: Alpha-amylase, Alpha-glucosidase, Antidiabetic assays, *Jacquemontia pentanthos and Xanthosoma brasiliense*.

INTRODUCTION

Diabetes mellitus consists of various metabolic disorders, all characterized by sustained and abnormal increases in blood glucose concentrations. It's causes are complex, involving problems in insulin release, different levels of resistance to insulin, or most commonly, a complex interplay between both. If left unmanaged, insufficiently treated, or undiagnosed for long periods, diabetes mellitus is closely associated with heightened risks of severe complications such as heart disease, kidney disorders, vision problems and lower-limb amputations (Petersmann *et al.,* 2018 and Schleicher *et al.,* 2022).

At present, standard antidiabetic treatments like oral glucose-lowering medications and insulin can produce side effects such as hypoglycemia, weight gain and greater chances of cardiovascular problems. Furthermore, these therapies may not always be effective in achieving optimal glycemic control.The worldwide increase in diabetes mellitus cases has created the need to explore alternative therapies, including natural products, to support standard treatments. Plant-based treatments are emerging as a promising means of managing diabetes, with many studies showing their ability to regulate

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glucose metabolism, improve insulin sensitivity and minimize oxidative stress.

As the global burden of diabetes continues to escalate, the development of natural antidiabetic agents is now an urgent goal, with the capacity to transform how we manage this debilitating disease. Interest in discovering natural antidiabetic agents has grown rapidly, fueled by the demand for safer, more effective, and affordable treatments capable of enhancing life quality for people with diabetes. (Mechchate *et al.,* 2021).

Xanthosoma brasiliense, a member of the Araceae family, is commonly referred to as Tahitian spinach, tannier spinach, belembe, and Tahitian taro. Unlike some other tannia (*Xanthosoma spp.*), the corms are not consumed as food because they remain small and insufficiently developed.This plant is valued for its medicinal benefits, and its leaves are consumed as a leafy vegetable. *Jacquemontia pentanthos* (Sky blue clustervine) is an evergreen, twining vine that produces many small but appealing flowers, ranging in color from sky blue to pinkish-lavender with a white center. Skyblue clustervine is a member of the morning glory family, so flowers open in the morning.The species is recognized for its medicinal qualities, and its tender leaves are also consumed as vegetables. This research aims to examine the inhibitory effects of *Xanthosoma brasiliense* and *Jacquemontia pentanthos* extracts on alpha-amylase and alpha-glucosidase enzymes, as well as their potential role as natural antidiabetic agents.

MATERIAL AND METHODS

Plant material and extraction

Leaf of *Jacquemontia pentanthos* and *Xanthosoma brasiliense* were collected from Achankovil and Kulathupuzha in Kollam district, India. The plant material was shade-dried, cut into smaller pieces, and ground into coarse powder form. The powdered sample underwent extraction for 10 hours in a Soxhlet apparatus using ethanol as the solvent. Following extraction, the solvent was evaporated using a rotary evaporator, and the crude extracts were kept for further analysis.

Alpha glucosidase inhibition assay

Both the control and extract solutions were prepared using p-Nitrophenyl-α-D-glucopyranoside. Each extract was adjusted to a concentration of 10 μg/mL, brought to a final volume of 200 μL and incubated at 37°C. Acarbose served as the positive control. The reaction was started by adding pNPG (p-Nitrophenyl-α-D-glucopyranoside), and the amount of pNP released was measured at 410 nm using a spectrophotometer after a reaction time of 10 minutes. Absorbance from a mixture lacking enzyme was subtracted as a background correction. Higher absorbance values indicated greater enzymatic activity.

$$\text{Enzyme inhibition \%} = \frac{\text{Absorbance of control-Absorbance of sample}}{\text{Absorbance of control}} \times 100$$

The inhibition assay with varying concentration of the inhibitor was also used to determine the concentrations of the extracts resulting in 50 percent inhibition (IC_{50}) compared to the standard.

Alpha amylase inhibition assay

Porcine pancreatic α-amylase (PPA; A05329G191) was dissolved in 9 mL of 20 mM phosphate buffer (pH 6.9). Stock solutions of the extracts were prepared at different concentrations. A 0.5% (w/v) potato starch solution was made in 20 mM phosphate-buffered saline (pH 6.9) and heated in a boiling water bath until clear. Each reaction mixture contained 40 μL of sample, 160 μL of distilled water, and 400 μL of starch solution. The

reaction was initiated by adding 200 µL of enzyme solution, and the mixtures were incubated at 25 °C for 3 minutes. Enzyme solutions were added at one-minute intervals from the start. A 200 µL portion from each reaction was transferred to a separate tube containing 100 µL of DNS reagent (50.68 g sodium potassium tartrate in 70 mL of 2 M NaOH with 0.026 mM 3,5-dinitrosalicylic acid) and heated in a water bath at 85–90 °C for 15 minutes. Each mixture was then diluted with 1 mL of distilled water, and absorbance was measured at 540 nm. A blank was prepared by replacing the enzyme with 200 µL of distilled water. Acarbose, an established α-amylase inhibitor, served as the reference control. All experiments were carried out in triplicate.The α-amylase inhibitory activity was calculated by using following formula:

$$\text{The } \alpha\text{-amylase inhibitory activity} = \frac{\text{Absorbance of control-Absorbance of sample}}{\text{Absorbance of control}} \times 100$$

The concentration of acarbose and the test samples needed to inhibit 50% of α-amylase activity under the experimental conditions was defined as the IC_{50} value. The α-amylase inhibitory effects of both the extracts and acarbose were calculated, and their respective IC_{50} values were established.

RESULTS AND DISCUSSION

The α-amylase inhibitory activities of *Xanthosoma brasiliense* and *Jacquemontia pentanthos* extracts are shown in Table 1, Fig(1-5). The IC_{50} values recorded for acarbose (Standard), *Xanthosoma brasiliense*, and *Jacquemontia pentanthos* extracts were 2.018457 ± 0.047 µg/mL, 3.741924 ± 0.011 µg/mL, and 15.38087 ± 0.027 µg/mL, respectively.

The alpha-amylase inhibitory activities of *Xanthosoma brasiliense* and *Jacquemontia pentanthos* extracts

The IC_{50} value was defined as the concentration of acarbose or sample required to achieve 50 percent inhibition of α-amylase activity under the assay conditions. The α-amylase inhibitory effects for both the test

Table 1. The alpha-amylase inhibitory activities of *Xanthosoma brasiliense* and *Jacquemontia pentanthos* extracts

			Jaquemontia pentanthos		*Xanthosoma brasiliense*	
Concentration (µg/ml)	Average absorbance of standard (nm)	Average % inhibition of standard	Average absorbance (nm)	Average % inhibition	Average absorbance (nm)	Average % inhibition
0.2	0.597	40.06	0.998	0.1	0.891	10.81
0.4	0.514	48.39	0.969	3	0.723	27.63
0.6	0.399	59.94	0.965	3.4	0.675	32.43
0.8	0.274	72.49	0.918	8.11	0.417	58.26
1	0.118	88.15	0.846	15.32	0.325	67.47

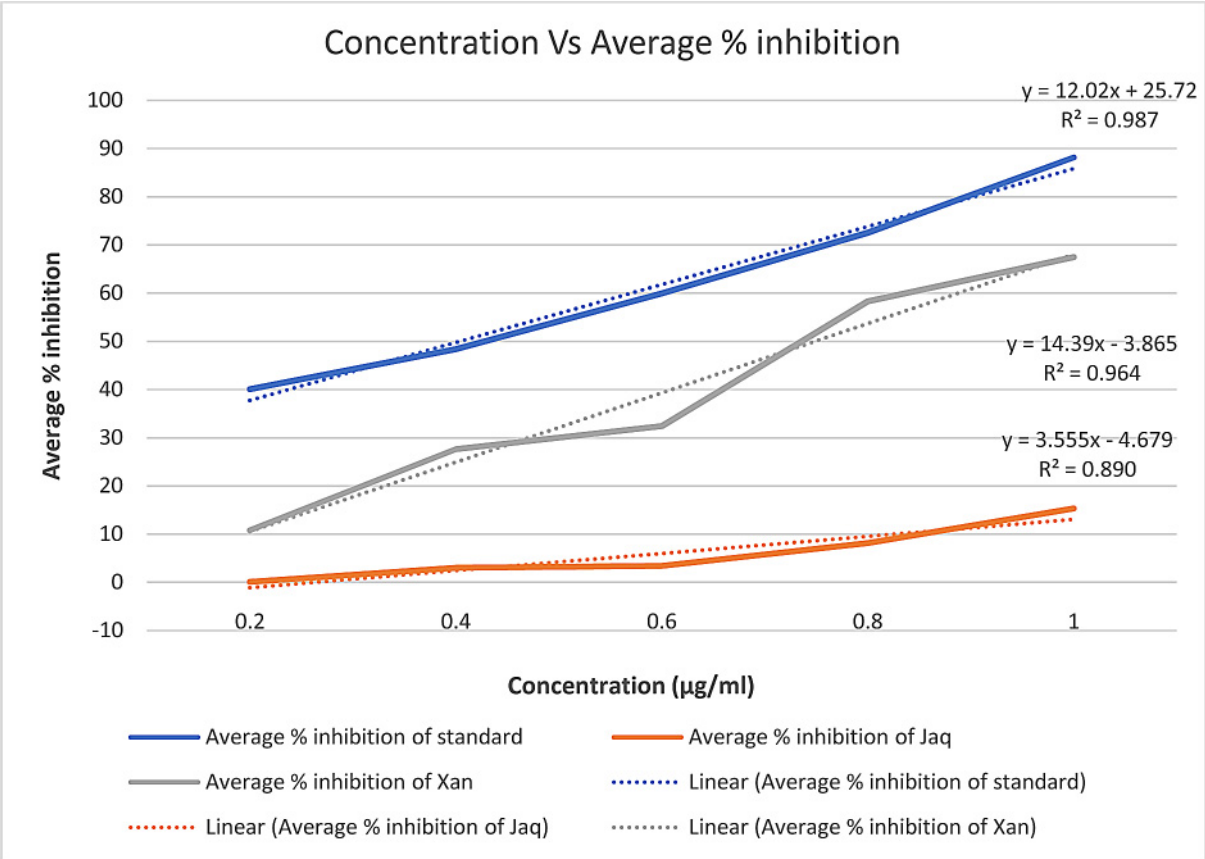

Fig 1. Concentration Vs Average percentage Alpha-amylase inhibitory activities of *Xanthosoma brasiliense* and *Jacquemontia pentanthos* extracts

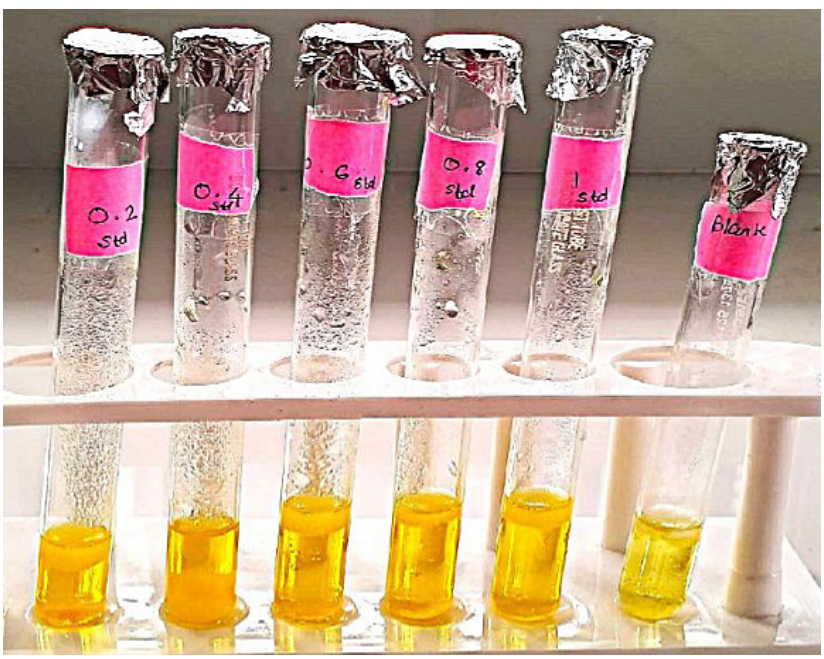

Fig 2. Alpha-Amylase Inhibition Assay of Standard (Acarbose) of *Jacquemontia pentanthos*

Fig 3. Alpha-Amylase Inhibition Assay of extract of *Jacquemontia pentanthos*

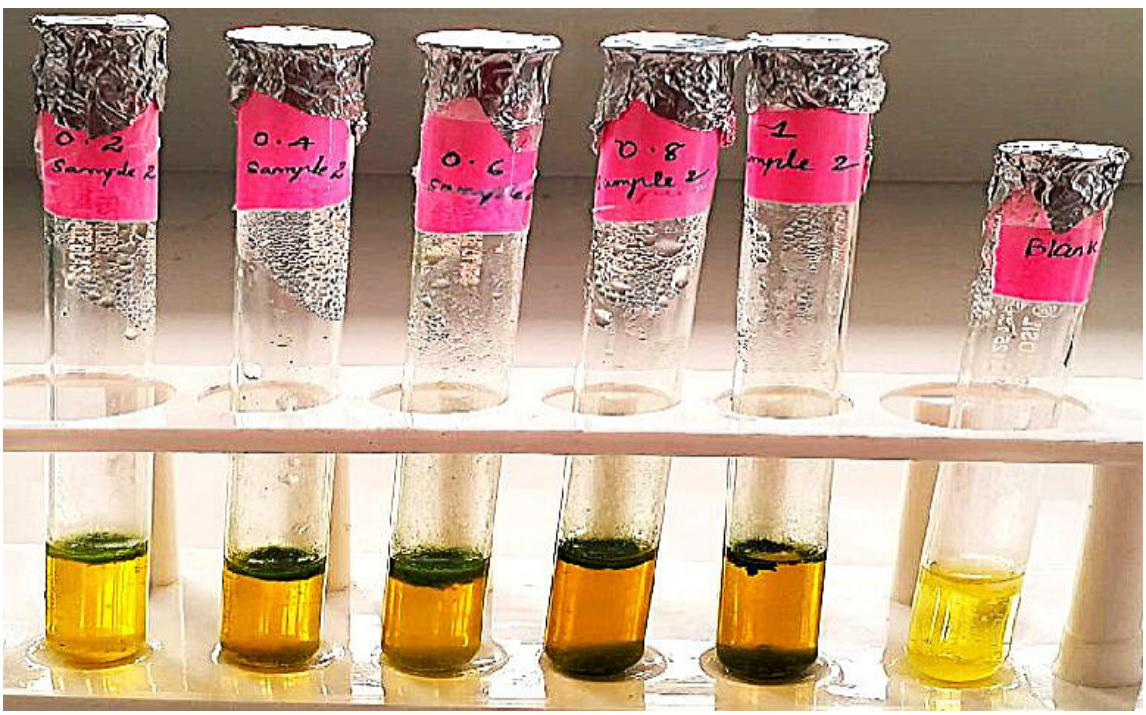

Fig 4. Alpha-Amylase Inhibition Assay of Standard (Acarbose) of *Xanthosoma brasiliense*

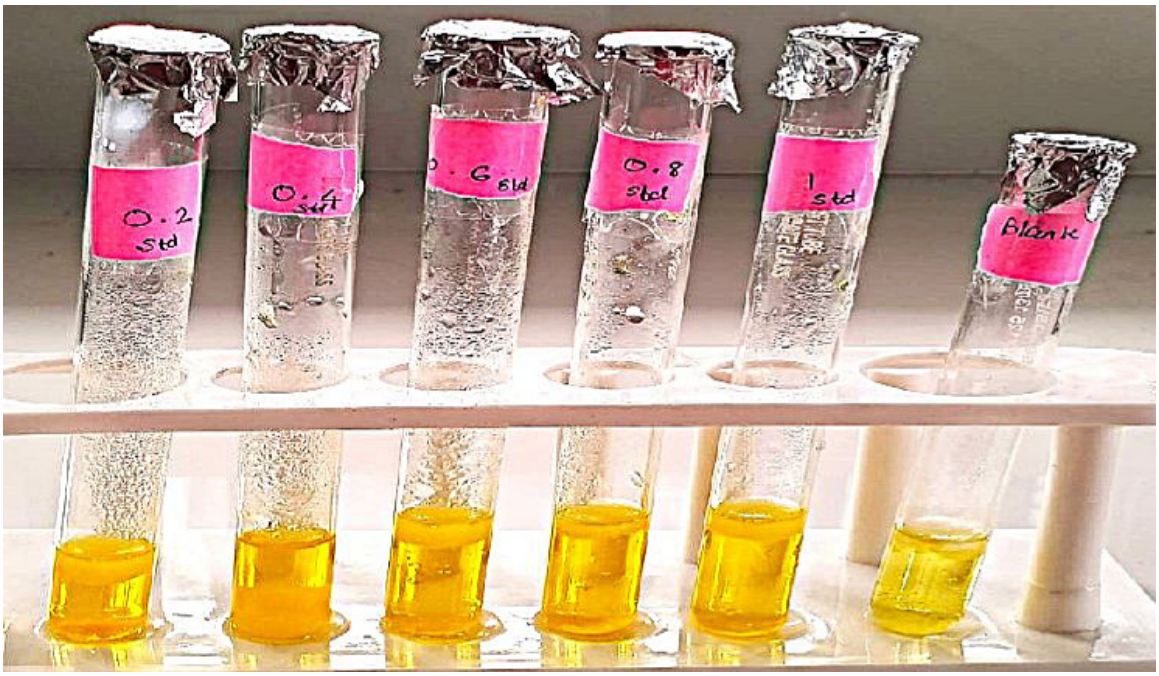

Fig 5. Alpha-Amylase Inhibition Assay of Extract of *Xanthosoma brasiliense*

samples and acarbose were determined accordingly.

IC_{50} of Standard (Acarbose) = 2.018±0.047μg/ml

IC_{50} of *Xanthosoma brasiliense* = 3.742±0.011μg/ml

IC_{50} of J*aquemontia pentanthos* = 15.38±0.027μg/ml

The α-glucosidase inhibitory activities of *Xanthosoma brasiliense* and *Jacquemontia-pentanthos* extracts are presented in Table 2, Fig (6-8). The IC_{50} values obtained for acarbose (Standard), *Xanthosoma brasiliense*,

Table2. The alpha-glucosidase inhibitory activities of *Xanthosoma brasiliense* and *Jacquemontia pentanthos* extracts

			Jaquemontia pentanthos		*Xanthosoma brasiliense*	
Concent-ration (μg/ml)	Average absorbance of standard (nm)	Average % inhibition of standard	Average absor-bance (nm)	Average % inhi-bition	Average absor-bance (nm)	Average % inhi-bition
0.2	0.584	41.37	0.769	22.95	0.654	34.47
0.4	0.471	52.71	0.655	34.37	0.521	47.8
0.6	0.354	64.46	0.532	46.69	0.421	57.82
0.8	0.274	72.49	0.422	57.72	0.374	62.53
1	0.147	85.24	0.324	67.54	0.211	78.86

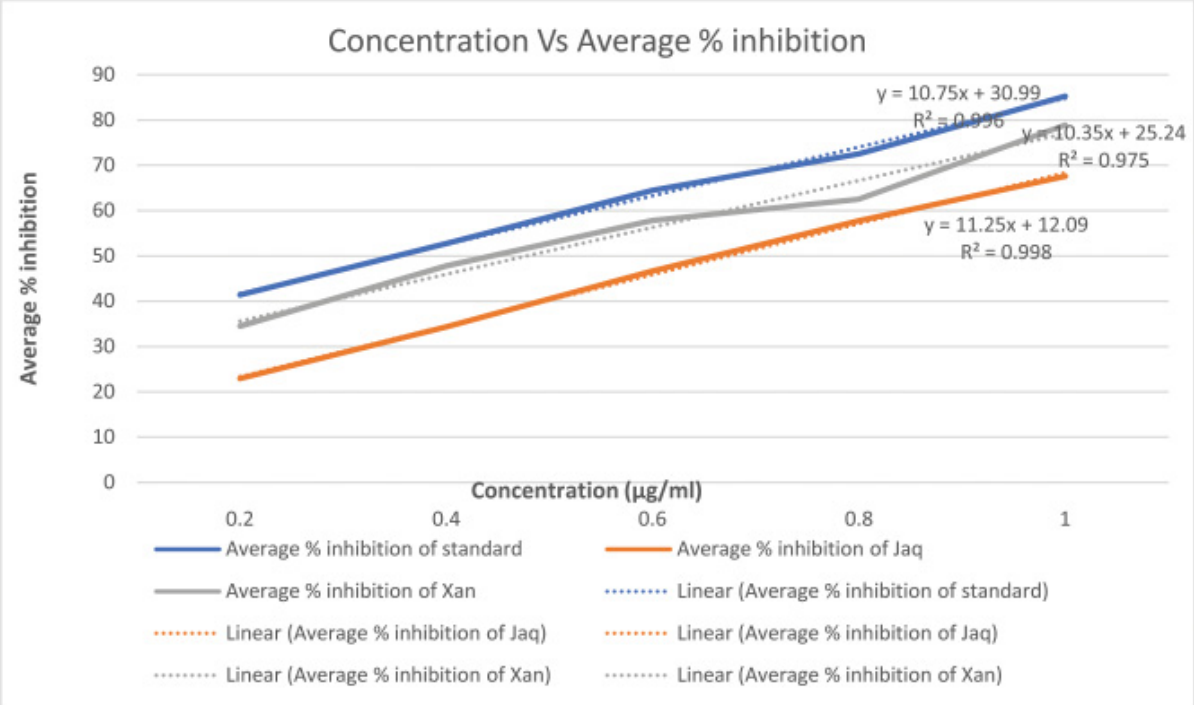

Fig 6. Concentration Vs Average percentage alpha-glucosidase inhibitory activities of *Xanthosoma brasiliense* and *Jacquemontia pentanthos* extracts

Fig 7. Alpha glucosidase Inhibition Assays of *Jacquemontia pentanthos*

Fig. 8. Alpha glucosidase Inhibition Assays of *Xanthosoma brasiliense*

and *Jacquemontia pentanthos* extracts were 1.767 ± 0.011 μg/mL, 2.392 ± 0.021 μg/mL, and 3.368 ± 0.031 μg/mL, respectively.

The percentage of α-glucosidase inhibition was calculated using the equation:

$$\text{Enzyme inhibition \%} = \frac{\text{Absorbance of control-Absorbance of sample}}{\text{Absorbance of control}} \times 100\%$$

The assay with varying inhibitor concentrations was used to identify the concentration of extract producing 50% inhibition (IC_{50}) relative to the Standard. The absorbance of the control was recorded as 0.998 nm.

IC_{50} of Standard (Acarbose) = 1.767±0.011μg/ml

IC_{50} of *Xanthosoma brasiliense* = 2.392±0.021μg/ml

IC_{50} of J*aquemontia pentanthos* =3.368±0.031μg/ml

Xanthosoma brasiliense demonstrated stronger antidiabetic activity than *Jacquemontia pentanthos* in both α-amylase and α-glucosidase inhibition assays. While *Jacquemontia pentanthos* showed moderate to notable activity, its potency was lower than that of *Xanthosoma brasiliense*. Overall, the findings indicate that both plant extracts possess antidiabetic potential, with *Xanthosoma brasiliense* exhibiting more pronounced inhibitory effects on α-amylase and α-glucosidase. These results highlight the possibility of using these plant extracts as natural antidiabetic agents.

The use of plants in diabetes treatment has a long history, and modern research continues to validate their therapeutic roles. Plant-derived bioactives can exert antidiabetic effects through several mechanisms, including promoting insulin secretion and glucose uptake, suppressing glucose production and intestinal absorption, and alleviating oxidative stress and inflammation.

Diabetes mellitus is a metabolic disorder and a growing global health threat. Insulin plays a central role in regulating carbohydrate, lipid, and protein metabolism, and its deficiency disrupts these essential processes. The enzymes α-amylase and α-glucosidase are key in carbohydrate breakdown to glucose. α-Amylase catalyzes the hydrolysis of starch into simpler sugars, which are then converted to glucose prior to absorption (Abhijit *et al.*, 2014). Inhibiting α-amylase can help lower postprandial hyperglycemia. α-Glucosidase, present in the small intestine, breaks down disaccharides into glucose, thereby facilitating monosaccharide absorption. Its inhibition reduces glucose uptake and can be a valuable strategy in controlling diabetes (Anuradha Devi and Mallikarjuna, 2016).

One effective approach to diabetes management is the suppression of glucose absorption. Targeting digestive enzymes that convert complex carbohydrates into absorbable sugars can help modulate post-meal blood glucose levels. Among these, α-glucosidase and α-amylase are considered primary targets (Mechchate *et al.,* 2021).

The current study assessed the effects of *Xanthosoma brasiliense* and *Jacquemontia-pentanthos* extracts on α-amylase and α-glucosidase activity. Both extracts exhibited significant inhibition of these enzymes. Since enzyme inhibition delays carbohydrate digestion and absorption, it can reduce postprandial blood glucose levels, making these extracts promising candidates for natural antidiabetic therapy.

Bioactive constituents such as flavo noids, phenolic acids, and saponins present in the extracts are likely contributors to the observed inhibitory effects. However, further research is needed to isolate and identify the specific active compounds responsible.

This work provides preliminary evidence for the antidiabetic potential of *Xanthosoma brasiliense* and *Jacquemontia pentanthos*. Additional studies are essential to validate these results and explore the feasibility of using these extracts as natural agents for diabetes management.

CONCLUSION

This comparative investigation demonstrated the antidiabetic potential of *Xanthosoma brasiliense* and *Jacquemontia pentanthos* extracts. *Xanthosoma brasiliense* showed strong inhibition of α-amylase (IC_{50} : 3.74 ± 0.011 μg/mL) and α-glucosidase (IC_{50} : 2.392 ± 0.021 μg/mL), while *Jacquemontia pentanthos* exhibited notable inhibition of α-glucosidase (IC_{50} : 3.368 ± 0.031 μg/mL) and moderate inhibition of α-amylase (IC_{50} : 15.38 ± 0.027 μg/mL). These results suggest that both plants hold potential as natural antidiabetic agents, offering a possible complementary or alternative strategy for diabetes management. By targeting carbohydrate-hydrolyzing enzymes, the extracts may aid in controlling postprandial blood glucose levels. The outcomes of this study have meaningful implications for translational research, supporting the potential of *Xanthosoma brasiliense* and *Jacquemontia pentanthos* as sources for developing innovative, plant-derived antidiabetic therapeutics.

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