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***Clausena excavata*: In Vitro Inhibitory Activity Against α -Glucosidase and Pancreatic Lipase**

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Abstract: *Clausena excavata* Burm.f. is a tropical medicinal plant that has been used in traditional practice for a range of health conditions. In this study, leaf fractions of *C. excavata* prepared using methanol (MOH), ethyl acetate (EA), chloroform (CH), and petroleum ether (PT) were screened for their ability to inhibit two clinically relevant enzymes: α -glucosidase, which is associated with postprandial glucose control, and pancreatic lipase, which is involved in intestinal fat digestion. Among the fractions tested, the CH fraction produced the strongest inhibition against both α -glucosidase and porcine pancreatic lipase, with IC_{50} values of 53.5 ± 1.08 μ g/mL and 177.3 ± 0.43 μ g/mL, respectively. These findings suggest that the chloroform-soluble constituents of *C. excavata* leaves may contain compounds of interest for further anti-diabetic and anti-obesity investigation. Further chemical profiling and mechanism-based studies are required before therapeutic claims can be made to position it as a promising candidate for anti-diabetic, and anti-obesity drug development.

Keywords: Clausena, Enzyme inhibition, Leaf fractions

Introduction

Enzymes regulate many biochemical reactions in the body, and for this reason, several enzymes have become useful targets in drug discovery. Two examples that are relevant to metabolic disorders are α -glucosidase and pancreatic lipase (Aslan et al., 2019). Ty Human body's inability to maintain normal glucose concentration and insulin resistance will eventually lead to type II diabetes mellitus. Controlling post-meal elevation in glucose levels is achieved by slowing the carbohydrates digestion in the intestines. Enzymes inhibitors especially α -glucosidase, are the main players in this reaction through decreasing disaccharides conversion into monosaccharides, resulting in preventing the rapid spike in blood glucose levels after meals. That's clarifies the increasing demand α -glucosidase plant derived inhibitors (Papoutsis et al., 2021; Proença et al., 2022).

Sedentary lifestyle and imbalanced unhealthy diet causing dramatic increase in obesity levels in the communities, thus directly resulting in abnormal lipid profile (hyperlipidemia) with high-risk cardiovascular associated endocrine disorders. Reducing pancreatic lipase will decrease the amount of fat absorbed in the digestive system as this enzyme is responsible for hydrolyzing dietary triglycerides before absorption occurs. These clarify that naturally occurring product with pancreatic lipase inhibitory activity remains rich area of research concerning anti-obesity (Albaayit et al., 2025; Jaradat et al., 2017).

Clausena excavata is widely reported in folk/ traditional medicine. Its phytochemicals rich profile has attracted the research interests in many aspects (Sharifi-Rad et al., 2020; Atanasov et al., 2021), whilst its leaf

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fraction inhibitory activity against α -glucosidase and pancreatic lipase remains poor. The present study therefore examined the *in vitro* inhibitory effects of *C. excavata* leaf fractions against these two enzymes as an early screening step for potential metabolic health applications.

Method

Plant Preparation

Fresh *C. excavata* leaves were processed and extracted according to the method described by Albaayit, 2023.

Alpha-Glucosidase Inhibition Assay

The α -glucosidase assay was performed in 96-well plates. MOH, EA, CH, and PT fractions were tested at concentrations ranging from 31.25 to 250 μ g/mL. Each fraction was mixed with α -glucosidase solution (0.2 U/mL) and phosphate-buffered saline (0.1 M, pH 6.8), followed by incubation at 37 °C for 15 minutes. Absorbance was recorded before the addition of p-nitrophenyl- α -D-glucopyranoside (PNP-G), and the reaction was monitored for 30 minutes at 400 nm. Acarbose was used as the positive control (Kumar et al., 2021; Limcharoen et al., 2022).

In vitro Pancreatic Lipase Inhibition Assay

Pancreatic lipase inhibition was assessed using a spectrophotometric method. The reaction mixture contained Tris-HCl buffer, test fractions of MOH, EA, CH, and PT (0.025-0.2 mg/mL), porcine pancreatic lipase (PPL), and p-nitrophenyl butyrate (pNPB) as the substrate. After incubation at 37 °C for 5 minutes, absorbance was measured at 410 nm. Percentage inhibition was calculated relative to the control, and IC₅₀ values were estimated from the concentration-response data ((Limcharoen et al., 2022; Buchholz & Melzig, 2021).

$$\text{Enzyme inhibition (\%)} = [(A \text{ control} - A \text{ sample}) / A \text{ control}] \times 100 = \frac{\text{O.D of enzyme with inhibitor}}{\text{O.D of enzyme without inhibitor}} \times 100$$

Results and Discussion

The starting point for identifying bioactive compounds is medicinal plants especially when these plants have been traditionally widely used and this usage is supported by experimental screening. *Clausena excavata* has been reported to contain flavonoids, carbazole alkaloids and coumarins in their leaves (Seca & Pinto, 2021; Arbab et al., 2020; Thant et al., 2019). Enzyme inhibitory effect observed in this study is mostly due to the contribution of these compounds even though the specific active constituents were not isolated.

Health and economic burden of chronic metabolic diseases give high relevancy to this study. Global large proportion mortalities have been reported by the world health organization mainly due non-communicable diseases such as diabetes, it is considered the major risk factor for cardiovascular, neurological, renal complications (WHO, 2021; 30). Postprandial glucose rise moderation agents are still of interest, especially at the early detection stage. Pancreatic lipase considered one of the main experimental targets in obesity screening as it controls a pivotal step in fat digestion. Pancreatic lipase hydrolyses triacylglycerols into fatty acids and 2-monacylglycerols. Intestinal fat absorption may decrease when the lipase activity is reduced, thus explains the wide usage of pancreatic lipase inhibition as an *in vitro* model in natural product research (Ado et al., 2013).

Clausena excavata chloroform leaves fraction in this study showed the highest inhibitory activity among the tested fractions. The IC₅₀ values of 177.3 $\pm$ 0.43 μ g/mL against pancreatic lipase and 53.5 $\pm$ 1.08 μ g/mL against α -glucosidase (Table 1). These findings are consistent with the previous findings confirming the higher flavonoid content in the CH fraction in *Clausena excavata* leaves (Kashyap et al., 2022; Tchamgoue et al., 2020)). Flavonoids have been associated with enzyme inhibition through non-covalent binding and, in some cases, competitive interactions with digestive enzymes (He et al., 2019; Rahim et al., 2015). Taken together, the results support further phytochemical and mechanistic evaluation of the CH fraction.

Table 1. *In vitro* enzyme inhibitory activity of the different extract of *C. excavata* leaves

	Enzyme Inhibition (IC ₅₀)				
	Methanol (MOH)	Ethyl acetate (EA)	Chloroform (CH)	Petroleum ether (PT)	^a standard
α -glucosidase	137.1 $\pm$ 7.01	113.3 $\pm$ 3.01	53.5 $\pm$ 1.08	187.7 $\pm$ 5.03	875.75 $\pm$ 2.08 μ M
Pancreatic lipase	>200	>200	177.3 $\pm$ 0.43	>200	12.7 $\pm$ 1.27 μ g/mL

^a The standard drug Acarbose was used in α -glucosidase assays, Orlistat in pancreatic lipase

Conclusion

The study concludes that *C. excavata* exhibits inhibition activity against α -glucosidase and pancreatic lipase enzyme, making a valuable insight for future therapeutic development, but the current findings should be interpreted as preliminary *in vitro* evidence rather than proof of clinical efficacy.

Scientific Ethics Declaration

* The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM journal belongs to the authors.

Conflict of Interest

* The authors declare no conflict of interest.

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References

- Albaayit, S. F. A. (2023). Ethyl acetate extract of *Clausena excavata* promotes growth inhibition of Burkitt's lymphoma cell line via apoptotic activities. *Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas*, 22(3), 350–359.
- Albaayit, S. F. A., Maharjan, R., Abdullah, R., Noor, M. H. M., Ullah, S., Al-Azzawi, S., & Al-Khazraji, H. H. J. (2025). Antileishmanial, insecticidal, anti-leukemic, phytotoxicity and anti-pancreatic lipase effects of ethanolic extracts of *Moringa peregrina* seed. *Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas*, 24(2), 225–235.
- Arbab, I. A., Abdul, A. B., Aspollah, M., & Abdullah, R. (2020). Phytochemical screening, antioxidant and cytotoxic profiles of *Clausena excavata* leaf extracts. *Biomedical Research and Therapy*, 7(5), 3740–3748.
- Aslan, H. E., Demir, Y., Özasan, M. S., Türkan, F., Beydemir, Ş., & Küfrevioğlu, Ö. I. (2019). The behavior of some chalcones on acetylcholinesterase and carbonic anhydrase activity. *Drug and Chemical Toxicology*, 42(6), 634–640.
- Atanasov, A. G., Zotchev, S. B., Dirsch, V. M., & Supuran, C. T. (2021). Natural products in drug discovery: Advances and opportunities. *Nature Reviews Drug Discovery*, 20(3), 200–216.
- Buchholz, T., & Melzig, M. F. (2021). Medicinal plants traditionally used for the treatment of obesity: A review of their lipase inhibitory potential. *Planta Medica*, 87(04), 271–286.

- He, C., Liu, X., Jiang, Z., Geng, S., Ma, H., & Liu, B. (2019). Interaction mechanism of flavonoids and α -glucosidase: Experimental and molecular modelling studies. *Foods*, 8(9), 355.
- Jaradat, N., Zaid, A. N., Hussein, F., Zaqqouq, M., Aljammal, H., & Ayeshe, O. (2017). Anti-lipase potential of the organic and aqueous extracts of ten traditional edible and medicinal plants in Palestine: A comparison study with orlistat. *Medicines*, 4(4), 89.
- Kashyap, D., Sharma, A., Tuli, H. S., & Bishayee, A. (2022). Flavonoids as promising anti-cancer and metabolic agents: Mechanisms and future perspectives. *Cancer Cell International*, 22(1), 45.
- Kumar, P., Nagarajan, A., & Uchil, P. D. (2021). Analysis of enzymatic activities and cell viability using microplate assays. *Cold Spring Harbor Protocols*, 2021(6), 107607.
- Limcharoen, T., Pouyfung, P., Ngamdokmai, N., Prasopthum, A., Ahmad, A. R., Wisdawat, W., Prugsakij, W., & Warinhomhoun, S. (2022). Inhibition of α -glucosidase and pancreatic lipase properties of medicinal plant leaves. *Nutrients*, 14(19), 3909.
- Papoutsis, K., Zhang, J., Bowyer, M. C., & Scarlett, C. J. (2021). Plant-derived α -glucosidase and α -amylase inhibitors for managing postprandial hyperglycemia. *Trends in Food Science & Technology*, 109, 120–133.
- Proença, C., Freitas, M., Ribeiro, D., & Fernandes, E. (2022). Alpha-glucosidase inhibition by flavonoids: An updated structure-activity relationship review. *Journal of Enzyme Inhibition and Medicinal Chemistry*, 37(1), 1208–1227.
- Rahim, A. T. M., Takahashi, Y., & Yamaki, K. (2015). Mode of pancreatic lipase inhibition activity in vitro by some flavonoids and non-flavonoid polyphenols. *Food Research International*, 75, 289–294.
- Seca, A. M. L., & Pinto, D. C. G. A. (2021). Plant secondary metabolites as bioactive agents: Successes and future prospects. *International Journal of Molecular Sciences*, 22(1), 263.
- Sharifi-Rad, J., Dey, A., & Abdolshahi, A. (2020). Medicinal plants as sources of bioactive agents: A comprehensive review of recent advances. *Frontiers in Pharmacology*, 11, 581898.
- Tchamgoue, A. D., Tchokouaha, L. R. Y., Agbor, G. A., & Tarkang, P. A. (2020). Flavonoid-rich plant extracts and their role in modulating carbohydrate-hydrolyzing enzymes. *BMC Complementary Medicine and Therapies*, 20(1), 182.
- Thant, T. M., Aminah, N. S., Kristanti, A. N., Ramadhan, R., Aung, H. T., & Takaya, Y. (2019). Cytotoxic carbazole alkaloid from the root of *Clausena excavata* on HeLa cell line. In *Proceedings of the 1st International Conference on Chemical Science and Technology Innovation (ICOCSTI 2019)* (pp. 141–144). SciTePress.
- World Health Organization. (2021, December 31). *Noncommunicable diseases*. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>

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