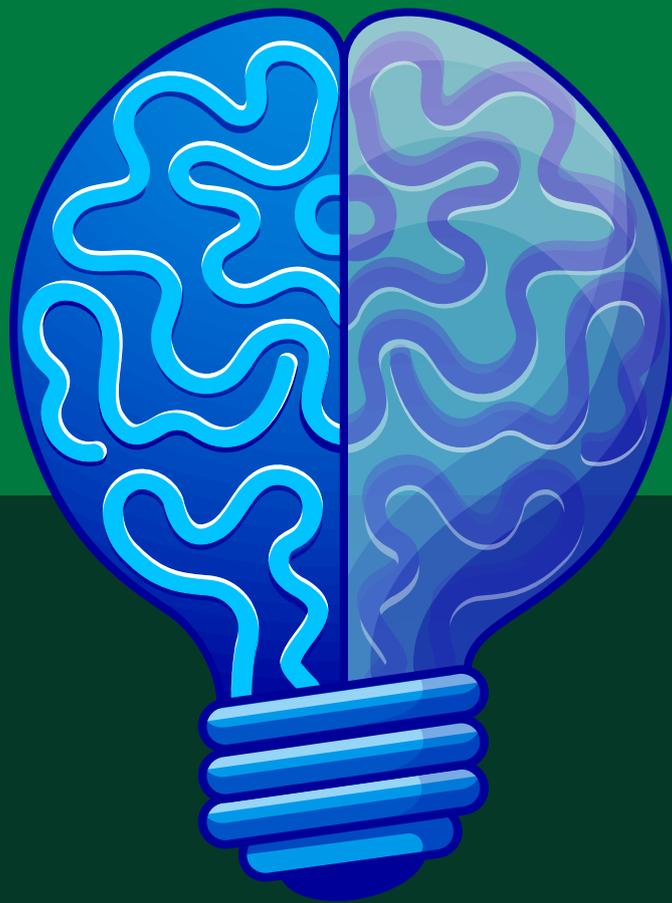


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PERAK BRANCH

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BIOLOGY ~ CHEMISTRY ~ PHYSICS

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Preface

The Scientific Project Colloquium offers a platform for publishing Diploma Science final year projects (FYP). The objective is to effectively distribute research findings throughout all scientific disciplines. The primary objective of including final year projects into the course curriculum is to encourage students to put their theoretical knowledge into practical applications.

We would like to express our gratitude to our primary establishment, the Faculty of Applied Sciences and Universiti Teknologi MARA, Perak Branch, for their invaluable assistance.

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PHYTOCHEMICAL SCREENING AND ANTI-OBESITY ACTIVITY OF ZINGIBERACEAE RHIZOME ETHANOLIC EXTRACT

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Abstract: The prevalence of obesity as a global health concern has prompted increasing interest in plant-based therapeutics with bioactive potential. This study aimed to comparatively evaluate the phytochemical profiles and anti-obesity activities of *Zingiber officinale*, *Curcuma longa* and *Alpinia galanga* rhizomes ethanolic extracts. Qualitative screening technique was used to determine their phytochemical constituents and pancreatic lipase inhibition assay was used to determine their anti-obesity capacities. All three extracts revealed abundant phytoconstituents, with variation in intensity, suggesting diverse bioactive potentials. Anti-obesity results indicated that *Z. officinale* ethanolic extract exhibited moderate pancreatic lipase inhibitory effect, while *C. longa* and *A. galanga* showed low but consistent activity across the assays (dose dependent response). These findings suggest that rhizomes from the Zingiberaceae family possess anti-obesity potential at differing levels. Further investigations on isolation of active compounds and animal trials are recommended.

Keywords: *Zingiber officinale*, *Curcuma longa*, *Alpinia galanga*, Pancreatic lipase, Spices, Secondary metabolites

INTRODUCTION

Globally, the prevalence of obesity is rising alarmly in both industrialized and developing nations (Ahmed and Mohammed, 2025). An imbalance between energy intake and expenditure leads to obesity. A range of obesity medications that affect energy expenditure or appetite have been utilized in the past; however, they have all been shown to have major adverse effects. For example, the US Food and Drug Administration ordered the removal of anti-obesity synthetic drug, lorcaserin, from the market due to a safety clinical trial that revealed a higher incidence of cancer (Zheng, 2025). Currently, a number of plants have been examined for their anti-obesity properties, but because of their significant cytotoxicity, very few of them are used in practice.

The Zingiberaceae family, commonly known as the ginger family, is one of the largest families of monocotyledonous flowering plants. There are approximately 52 genera and 1300 species in the Zingiberaceae family, which includes *Zingiber officinale* Roscoe, *Curcuma longa* Linn and *Alpinia galanga* Linn (Poojita and Nandha, 2025). They were extensively dispersed throughout the continents of America, Africa and Asia. The rhizome of Zingiberaceae is a rich source of different classes of compounds that belong to a wide variety of chemical metabolites, such as polyphenols, alkaloids and terpenes (Wable et al., 2025). Members of this family have been widely used in traditional medicines, culinary practices and sources of natural bioactive compounds. They also exhibit significant pharmacological activities such as antioxidant, anti-inflammatory, anti-microbial and metabolic regulatory activities (Paudel et al., 2025).

Given their ethnopharmacological importance and promising bioactivities, several studies have been conducted to investigate the anti-obesity potential of Zingiberaceae species. However, comparative studies evaluating the phytochemical composition and relative anti-obesity efficacy of this family remain limited. Therefore, in the present study, the comparative analysis of phytochemical constituents and the anti-obesity of *Zingiber officinale*, *Curcuma longa* and *Alpinia galanga* rhizomes ethanolic extracts were *in-vitro* evaluated using pancreatic lipase inhibition assay.

METHODOLOGY

Plant materials and ethanolic extraction

Zingiber officinale, *Curcuma longa* and *Alpinia galanga* rhizomes were obtained from local garden. Taxonomic authentication was carried out by the Herbarium of Universiti Pendidikan Sultan Idris, Malaysia. The plant materials were coarse powdered and macerated with 80% ethanol. The extracts were collected every 72 hours for

three times and were concentrated by using rotary evaporator (Yulianti et al., 2025). Concentrated crude extracts were kept in the refrigerator at 4 °C in sealed containers for further use.

Qualitative phytochemical screening

The qualitative screening for phenols, flavonoids, saponins, tannins, alkaloids, terpenoids, triterpenes glycosides and steroids were performed by using standard protocols as previously described (Latha et al., 2025).

Pancreatic lipase inhibition assay

The assay was carried out as previously described (Mohanty and Yadav, 2025). Two hundred µl of orlistat as a synthetic drug or plant extracts (0, 25, 50 and 100 µg/ml) were incubated with 100 µl of pancreatic lipase solution and 700 µl of Tris-HCL solution (pH 7.4) for 15 min at 25 °C. Then, 100 µl of p-nitrophenylbutyrate in dimethyl formamide was added and the mixture was further incubated for 30 min at 37 °C. Lipase inhibition activity was measured at 405 nm using a UV-visible spectrophotometer. The percentage of lipase inhibition was calculated according to the following formula:

$$\text{Inhibition (\%)} = [1 - (B - b) / (A - a)] \times 100$$

Where A is the activity of the enzyme without the inhibitor, a is the negative control without the inhibitor, B is the activity of the enzyme with the inhibitor, and b is the negative control with the inhibitor.

Statistical analysis

All data are subjected to one-way ANOVA and values of p<0.05 were considered statistically significant.

FINDINGS

The phytochemical screening of *Zingiber officinale*, *Curcuma longa* and *Alpinia galanga* rhizomes ethanolic extracts are summarized in Table 1. Results revealed the presence of key secondary metabolites including phenols and flavonoids, although with varying intensities. The ethanolic extracts of *Zingiber officinale*, *Curcuma longa* and *Alpinia galanga* rhizomes ethanolic extracts also showed the presence of saponins, tannins, alkaloids and terpenoids, but showed negative result for the presence of triterpenes glycosides and steroids. Previous authors reported that phenols, flavonoids and terpenoids influence lipid metabolism, inhibit fat absorption and enhance energy expenditure (Subas et al., 2025).

Table 1 Phytochemical constituents of *Z. officinale*, *C. longa* and *A. galanga* rhizomes ethanolic extracts.

Phytochemical	<i>Zingiber officinale</i>	<i>Curcuma longa</i>	<i>Alpinia galanga</i>
Phenols	++	+	+
Flavonoids	++	+	+
Saponins	+	+	+
Tannins	+	+	+
Alkaloids	+	+	+
Terpenoids	++	+	+
Triterpenes glycosides	n/d	n/d	n/d
Steroids	n/d	n/d	n/d

Indicator: (++) high intensity detected, (+) low intensity detected, (n/d) not-detected

The inhibitory activity of Orlistat and ethanolic extract of *Zingiber officinale*, *Curcuma longa* and *Alpinia galanga* rhizomes against pancreatic lipase are shown in Figure 1. Ethanolic extract of *Z. officinale* rhizome exhibited moderate pancreatic lipase inhibitory activity, and significantly lower (p<0.05) compared to Orlistat, a synthetic drug that served as a positive control. Among the Zingiberaceae, *Z. officinale* exhibited the strongest pancreatic lipase inhibitory activity (p<0.05), followed by *C. longa* and *A. galanga* rhizomes ethanolic extracts. The results also showed that all three extracts inhibited the activity of pancreatic lipase in a dose-dependent response at differencing levels.

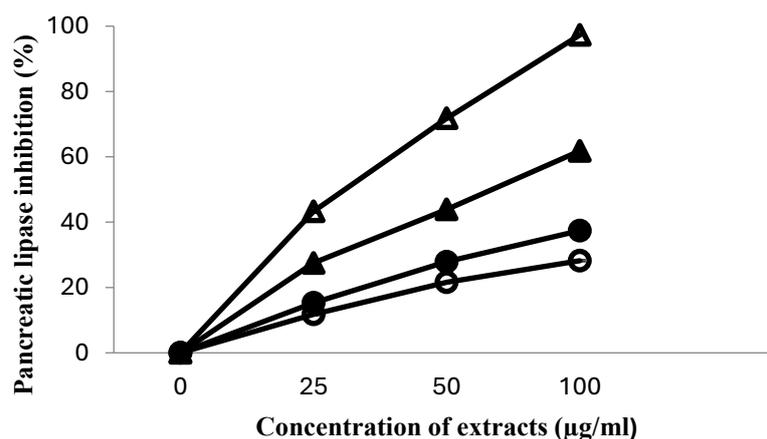


Figure 1 Pancreatic lipase inhibition activity of Orlistat (Δ) and ethanolic extract of *Zingiber officinale* (\blacktriangle), *Curcuma longa* (\bullet) and *Alpinia galanga* (\circ) rhizomes.

Previous findings attributing gingerols and shogaols in *Z. officinale* to anti-obesity activity via lipid metabolism regulation (Preciado-Ortiz et al., 2025). Gingerols are the major phenolic compounds in fresh ginger, while shogaols are formed when gingerols undergo dehydration, often during processing or storage (Samota et al., 2024). Even though in the current study, *C. longa* demonstrated low pancreatic lipase inhibitory activity, previous author reported that *C. longa* exhibited strong antioxidant activity which may contribute indirectly to obesity management by reducing oxidative stress associated with adipogenesis (Marina et al., 2025). *A. galanga* also showed relatively lower inhibitory activity but maintained consistent effect across assays, suggesting synergistic contributions of its phytochemicals. Overall, the observed variations in pancreatic lipase inhibitory activity among the three species are closely related to differences in phytochemical composition and intensity, particularly the abundance of flavonoids, phenolics and terpenoids.

CONCLUSIONS

The comparative analysis *Zingiber officinale*, *Curcuma longa* and *Alpinia galanga* rhizomes ethanolic extracts revealed that all three species are rich in bioactive phytochemicals with potential anti-obesity effects. Among them, *Z. officinale* demonstrated the strongest pancreatic lipase inhibitory activity, followed by *C. longa* and *A. galanga*. These findings highlight the therapeutic promise of Zingiberaceae rhizomes as natural anti-obesity agents and provide scientific support for their traditional use and suggest their potential role in the development of safe plant-based interventions for obesity management. Further studies focusing on the isolation of active compounds, mechanistic pathways and animal trials are warranted to validate and optimize their applications.

COMPLIANCE OF ETHICAL STANDARDS

Not applicable.

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Tarikh : 20 Januari 2023

Prof. Madya Dr. Nur Hisham Ibrahim
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Sekian, terima kasih.

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Saya yang menjalankan amanah,

Setuju.

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