EXPERIMENTAL BIOLOGY AND LIPID METABOLISM

Comparative In Vitro Adipolytic Effects of Siling Labuyo (Capsicum frutescens L.), Siling Haba (Capsicum annuum L.), and Siling Kampana (Capsicum annuum L.) Extracts on Porcine Adipose Tissue

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Published November 2026

Abstract

Obesity is considered as one of the morbid health concerns in the world today given that this is linked with cardiovascular diseases, type 2 diabetes, hypertension, and a number of other metabolic disorders. With the recent surge in plant-based approach, a number of Capsicum species have been tested for bioactive compounds that may potentially have effect on the body's lipid metabolism. One of the more commonly known compounds is capsaicinoids. This study compared the varying adipolytic effects of Capsicum frutescens L. (Siling Labuyo), Capsicum annuum L. (Siling Haba), and Capsicum annuum L. (Siling Kampana) on the in vitro porcine adipose tissue. Fresh samples of the pepper were washed, dehydrated, pulverized to an almost fine powder, and extracted with 70% ethyl alcohol. The extract was filtered and concentrated, and aliquots of the concentrate were applied on equal portions of porcine adipose tissue and incubated. The change in tissue mass was then determined. Data obtained were analyzed using descriptive statistics. This gave mean percentage weight reduction of 23.33 for Siling Haba, 20.00 for Siling Labuyo, and 10.00 for Siling Kampana, showing a difference in the apparent effect of extracts from the three peppers on porcine adipose tissue. This provides some preliminary data for the potential investigation of the adipolytic property of the three varieties of peppers.

Keywords: Capsicum annuum; Capsicum frutescens; ethanolic extract; in vitro study; obesity; porcine adipose tissue; siling haba; siling kampana; siling labuyo

1 Introduction

Obesity is a growing global health concern associated with cardiovascular diseases, type 2 diabetes, hypertension, and other metabolic disorders. This has encouraged research into plant-based compounds with potential biological activities.

Capsicum species, commonly known as chili peppers, contain bioactive compounds such as capsaicinoids, which have been investigated for their possible involvement in lipid metabolism. However, limited research has compared the potential effects of locally available chili pepper varieties on adipose tissue.

This study evaluates the potential adipolytic effects of ethanolic extracts of Siling Labuyo (Capsicum frutescens L.), Siling Haba (Capsicum annuum L.), and Siling Kampana (Capsicum annuum L.) on porcine adipose tissue.

2 Identify, research and collect

2.1 Idea

The study was developed from existing research on the potential biological activities of Capsicum species, particularly their capsaicinoid content and possible relationship with lipid metabolism.

Previous studies examining pepper extracts and adipose tissue provided the basis for investigating locally available chili pepper varieties. The researchers selected three varieties to compare their observed effects on porcine adipose tissue under laboratory conditions.

An experimental design was used to compare three pepper-extract treatments. The experiment was conducted under laboratory conditions in San Miguel, Bulacan, Philippines.

2.2 Preparation of pepper extracts

Fresh, mature, and undamaged peppers were purchased from a local market, washed, and had their stems removed. Each variety was sliced and dehydrated at 70 °C for 12 hours. The dried samples were cooled and ground separately into fine powders. For each variety, 20 g of powder was mixed with 250 mL of 70% ethanol and macerated for 24 hours at room temperature. The mixtures were filtered through cheesecloth and laboratory filter paper. The filtrates were concentrated in a water bath at 45–50 °C, avoiding boiling, and stored in labeled containers until use.

2.3 Materials and methods

2.3.1 Preparation and treatment of porcine adipose tissue

Fresh porcine subcutaneous adipose tissue was obtained from a local meat shop and refrigerated until preparation. It was cut into nine approximately equal samples, each with an initial recorded mass of 3.0 g. The samples were assigned to three treatment groups, with three replicates per group: Siling Labuyo (T1), Siling Haba (T2), and Siling Kampana (T3). Each sample was placed in a labeled test tube containing 10 mL of its corresponding pepper extract and fully submerged. The tubes were covered with aluminum foil and incubated at room temperature for 48 hours. After incubation, each tissue sample was removed with clean forceps, gently blotted for approximately 5–10 seconds to remove surface liquid, and immediately reweighed using the same electronic weighing scale.

2.3.2 Data collection and analysis

Weight difference was calculated by subtracting final weight from initial weight. Percentage weight reduction was calculated by dividing the weight difference by the initial weight and multiplying by 100. The values of all nine samples were recorded. Descriptive statistics were used to summarize the three replicates per treatment. Because only three replicates were available and all replicates within each treatment had identical recorded values, no inferential test was used to claim statistical significance.

2.3.3 Safety and waste disposal

Laboratory coats, gloves, and face masks were used during the procedure. Pepper extracts were handled carefully to avoid irritation, and ethanol was kept away from ignition sources. Biological and chemical wastes were placed in designated containers and disposed of according to laboratory procedures. Equipment and work surfaces were cleaned and disinfected after use.

3 Write down your studies and findings

3.1 Results

Each treatment consisted of three replicates, and every sample had an initial recorded weight of 3.0 g. The three replicates in each treatment produced identical recorded final weights: 2.4 g for Siling Labuyo, 2.3 g for Siling Haba, and 2.7 g for Siling Kampana. The corresponding weight reductions were 0.6 g (20.00%), 0.7 g (23.33%), and 0.3 g (10.00%), respectively.

Table 1. Mean recorded weight and percentage reduction of porcine adipose tissue (n = 3 per treatment).

Treatment	Replicates	Initial Wt. (g)	Final Wt. (g)	Weight Difference (g)	% Weight Reduction
Siling Labuyo	3	3.00 ± 0.00	2.40 ± 0.00	0.60 ± 0.00	20.00 ± 0.00
Siling Haba	3	3.00 ± 0.00	2.30 ± 0.00	0.70 ± 0.00	23.33 ± 0.00
Siling Kampana	3	3.00 ± 0.00	2.70 ± 0.00	0.30 ± 0.00	10.00 ± 0.00

Values are mean ± standard deviation. All three replicates within each treatment had the same recorded value; therefore, the calculated standard deviations are 0.00. Percentage reduction = [(initial weight − final weight) / initial weight] × 100.

3.2 Comparison of treatments

Siling Haba produced the highest observed percentage weight reduction (23.33%), followed by Siling Labuyo (20.00%) and Siling Kampana (10.00%). The difference between the highest and lowest treatment means was 13.33 percentage points. Thus, the treatments showed different recorded changes in tissue mass under the conditions of this experiment.

3.3 Possible factors associated with the observed differences

The differences may be related to variations in the chemical composition of the pepper varieties. Capsicum peppers can contain different levels of capsaicinoids, phenolic compounds, and flavonoids, and these constituents have been investigated for possible effects on lipid metabolism (Akhter et al., 2024; Takeda and Dai, 2022; Ali et al., 2025). However, this study did not measure the phytochemical composition or capsaicinoid concentration of the extracts. The specific compounds responsible for the observed differences therefore cannot be identified.

3.4 Interpretation and limitations

The recorded reduction in tissue weight should not be treated as direct confirmation of adipolysis. Lipolysis involves triglyceride breakdown and the release of glycerol and free fatty acids, neither of which was measured. Changes in recorded mass may also have resulted from moisture loss, tissue handling, or other changes during incubation. Accordingly, the findings demonstrate differences in recorded tissue-weight reduction, not proven biochemical fat breakdown.

Although three replicates were performed for each treatment, all three produced identical recorded values within their respective groups. This resulted in a standard deviation of zero, but it does not establish statistical significance or prove that the results would be reproduced in a larger sample. The small number of replicates and the limitations of the weighing method restrict the strength of the conclusions.

Overall, Siling Haba showed the greatest observed reduction, followed by Siling Labuyo and Siling Kampana. These results provide preliminary comparative data and indicate which extracts may

warrant further investigation. More precise weighing, additional independent replicates, extract characterization, and direct biochemical assays are needed to determine whether the observed changes reflect lipolytic activity.

4 Get peer reviewed

The manuscript presents a relevant investigation into the potential biological activities of locally available Capsicum varieties. The comparison of Siling Labuyo, Siling Haba, and Siling Kampana provides an interesting starting point for examining their possible effects on porcine adipose tissue. However, several aspects require clarification and improvement before the manuscript can be considered scientifically complete. Comments and Recommendations:

1. The researchers should clearly explain how the three replicates per treatment were measured and how their results were summarized.
2. The statistical analysis should include the actual One-Way ANOVA results, including the F-statistic and p-value, to establish whether significant differences exist among treatments.
3. The researchers should clarify whether the observed reduction in tissue weight resulted from potential lipid breakdown or other factors, such as moisture loss.
4. The discussion should provide stronger connections between the observed results and previous studies involving Capsicum compounds and lipid metabolism.
5. The conclusion should avoid claiming confirmed adipolytic activity because the experiment measured changes in tissue weight rather than directly measuring biochemical indicators of lipolysis.

Overall Evaluation: The study presents preliminary findings with potential value for further investigation. However, clarification of the experimental procedures, statistical results, and limitations is recommended to strengthen the scientific reliability of the manuscript.

5 Improvement as per reviewer comments

Future studies should: Use more precise weighing instruments to detect smaller changes in tissue mass. Increase the number of replicates to improve data reliability. Standardize tissue sample size, weight, and handling conditions. Investigate the phytochemical composition of the three pepper varieties. Examine different extract concentrations to determine possible dose-dependent effects. Measure glycerol and free fatty acid release to directly investigate potential lipolytic activity. The findings should not be interpreted as evidence that the extracts can treat human obesity.

6 Conclusion

Siling Haba demonstrated the highest observed percentage weight reduction in porcine adipose tissue (23.33%), followed by Siling Labuyo (20.00%) and Siling Kampana (10.00%). However, these differences were not statistically significant. Therefore, Siling Haba showed the highest observed potential effect under the experimental conditions, but its superiority over the other varieties cannot be conclusively established. Further research involving more precise weighing equipment, standardized tissue samples, and biochemical measurements of glycerol and free fatty acids is recommended to verify potential adipolytic activity.

Acknowledgment

The authors acknowledge the guidance and support of their research adviser and the assistance provided during the laboratory work.

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