# Cytotoxic, Anti-inflammatory and Adipogenic Effects of Selected Flavonoids on Cell Lines

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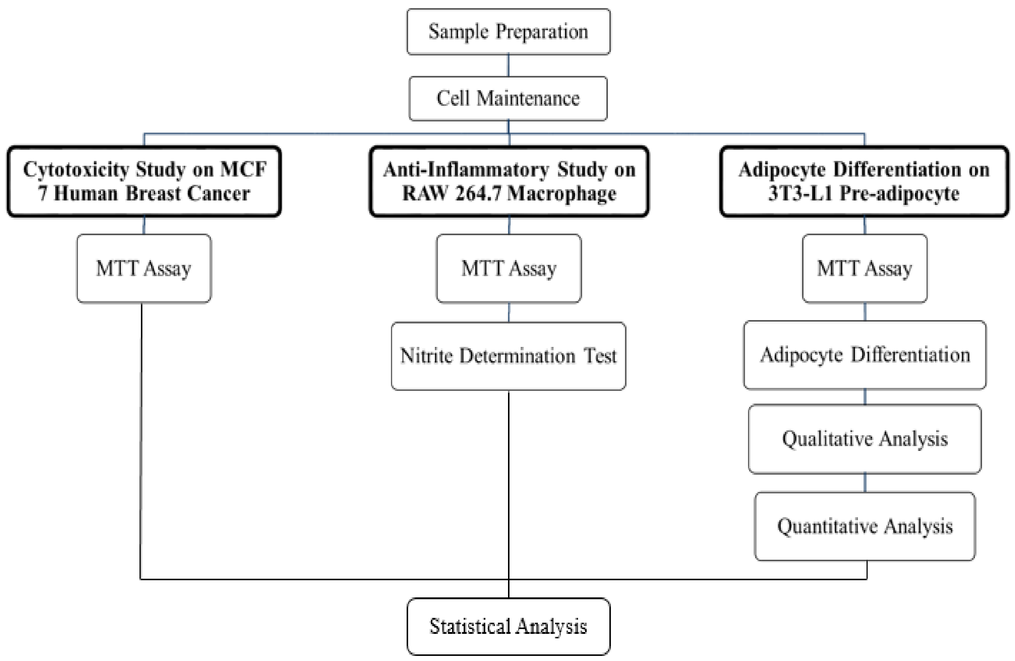
## Introduction

In this research study, the selected natural-occurring flavonoids which are inophyllum D, calanone, and isocordata oblongic acid from *Calophyllum symingtonianum* as well as morelloflavone from *Garcinia prainiana* have been chosen to be studied for their bioactivities that may provide potential therapeutic value to the human being. Several *in vitro* effects of these selected compounds which have been studied were cytotoxic effects against MCF 7 human breast cancer cells, anti-inflammatory activity on RAW 264.7 macrophages and adipogenic effects on 3T3-L1 pre-adipocytes. It was expected that the finding of this study may provide significant implication in the discovery of the potential new alternative therapeutic approaches on many current dreaded diseases, such as cancers, diabetes and inflammatory diseases. Positive results were highly anticipated since flavonoids are widely known for their various biological activities that may provide therapeutic benefits to human being such as anti-inflammatory, anti-oxidant, anti-tumor and anti-bacterial properties (Harborne & Williams, 2000).

## Objectives

1. To evaluate cytotoxic activity of selected flavonoids against MCF 7 human breast cancer cells.
2. To evaluate anti-inflammatory effects of selected flavonoids on RAW 264.7 macrophages.
3. To evaluate adipogenic effects of selected flavonoids on 3T3-L1 pre-adipocytes.

## Methodology




## Results

### Cytotoxic Effects on MCF 7 Human Breast Cancer

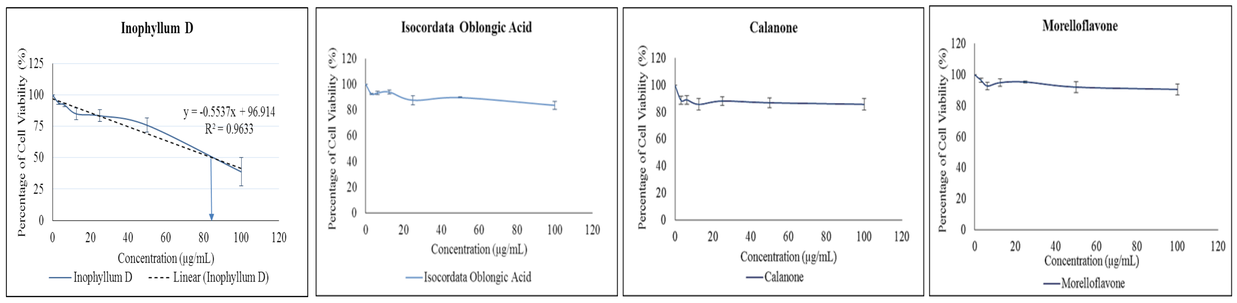



**FIGURE 1** Cytotoxic effects of selected flavonoids on MCF 7 human breast cancer cells by MTT assay.

### Anti-Inflammatory Effects on RAW 264.7 Macrophage

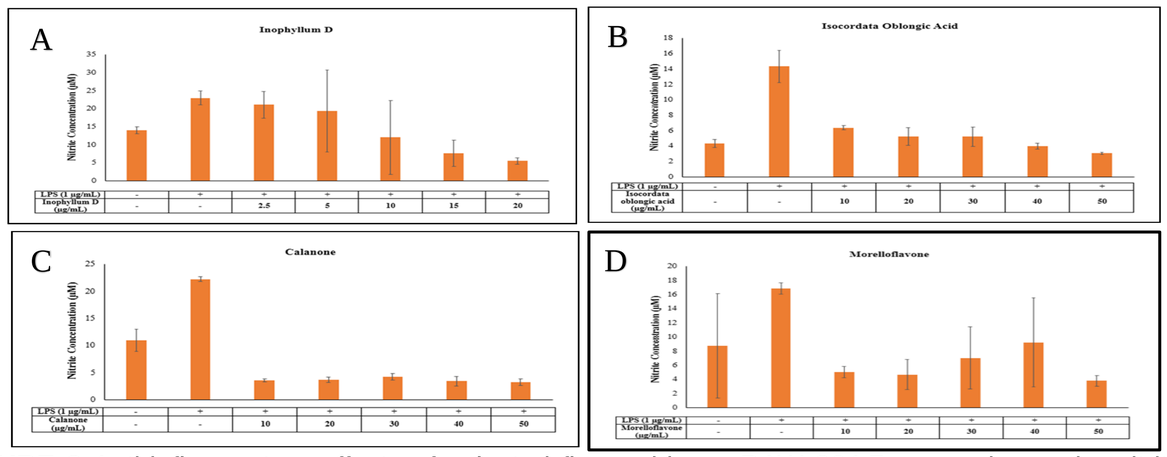
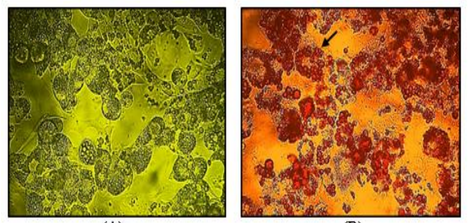



**FIGURE 2** Anti-inflammatory effects of selected flavonoids on RAW 264.7 macrophages by nitrite determination test. The data shown were nitrite concentration against experimental groups for (A) inophyllum D, (B) isocordata oblongic acid, (C) calanone and (D) morelloflavone.

### Adipogenic Effects on 3T3-L1 Pre-adipocyte

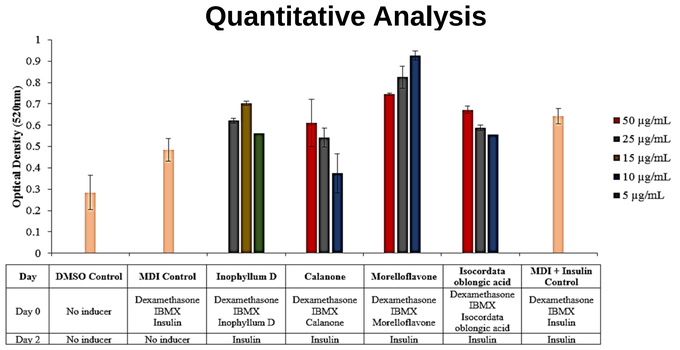
#### Qualitative Analysis



(A) (B)

**FIGURE 3** Mature adipocytes at day 10. (A) Mature adipocyte before Oil Red O staining. (B) Mature adipocyte after Oil Red O staining. Lipid droplets (red color) were seen in (B) as indicated by the arrows. Cells were viewed under 400x magnification.

#### Quantitative Analysis




| Day | DMSO Control | MDI Control | Inophyllum D | Calanone | Morelloflavone | Isocordata oblongic acid | MDI + Insulin Control |
|---|---|---|---|---|---|---|---|
| Day 0 | No inducer | Dexamethasone IBMX Insulin | Dexamethasone IBMX Inophyllum D | Dexamethasone IBMX Calanone | Dexamethasone IBMX Morelloflavone | Dexamethasone IBMX Isocordata oblongic acid | Dexamethasone IBMX Insulin |
| Day 2 | No inducer | No inducer | Insulin | Insulin | Insulin | Insulin | Insulin |

Experimental groups and composition of inducer agents in adipocyte differentiation

**FIGURE 4** Effects of calanone, morelloflavone, isocordata oblongic acid and inophyllum D on 3T3-L1 pre-adipocyte.

## Conclusion

Inophyllum D was the only compound that exhibited significant cytotoxic effect against MCF 7 human breast cancer with $IC_{50}$ of 84 µg/mL. Further, calanone exhibited the most potential anti-inflammatory effect which then followed by morelloflavone, isocordata oblongic acid and inophyllum D successively. Last but not least, all the selected flavonoids exhibited enhanced adipogenic effects on 3T3-L1 pre-adipocytes.

## References

Harborne, J. B., & Williams, C. A. (2000). Advances in flavonoid research since 1992. *Phytochemistry*, *55*(6), 481-504.