

Evaluating the lipogenic effects of saccharine and sucralose on lipid accumulation in fatty acid exposed hepG2 cells

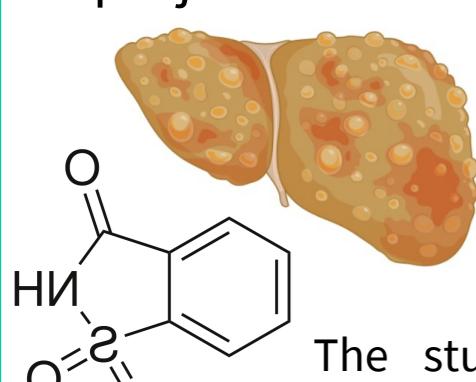
Abstract

This research project explores the effects of sucralose and saccharine on hepatic steatosis, a key feature of non-alcoholic fatty liver disease (NAFLD). Using HepG2 cell lines, the outcome indicated that neither sweetener consistently accelerates oleic acid-induced lipid accumulation. While some previous studies indicate metabolic advantages of sucralose, particularly when compared to sucrose, conflicting research suggests negative impacts on glucose tolerance and other aspects of human health, demonstrating a need for further understanding. Variability in experimental outcomes raises concerns regarding study replication and reproducibility, with potential factors including cell growth dynamics, oleic acid toxicity, and staining techniques. Additionally, it is highlighted the importance of considering effect size, conducting viability assays, and exploring dose-response relationships in future research. Despite the conflicting evidence, low-calorie sweeteners may offer potential metabolic health benefits, but further research is essential to clarify their effects on NAFLD development.

Aim: Do sucralose and saccharine enhance lipid accumulation in HepG2 cells when exposed to oleic acid, contributing to the progression of NAFLD?

Introduction

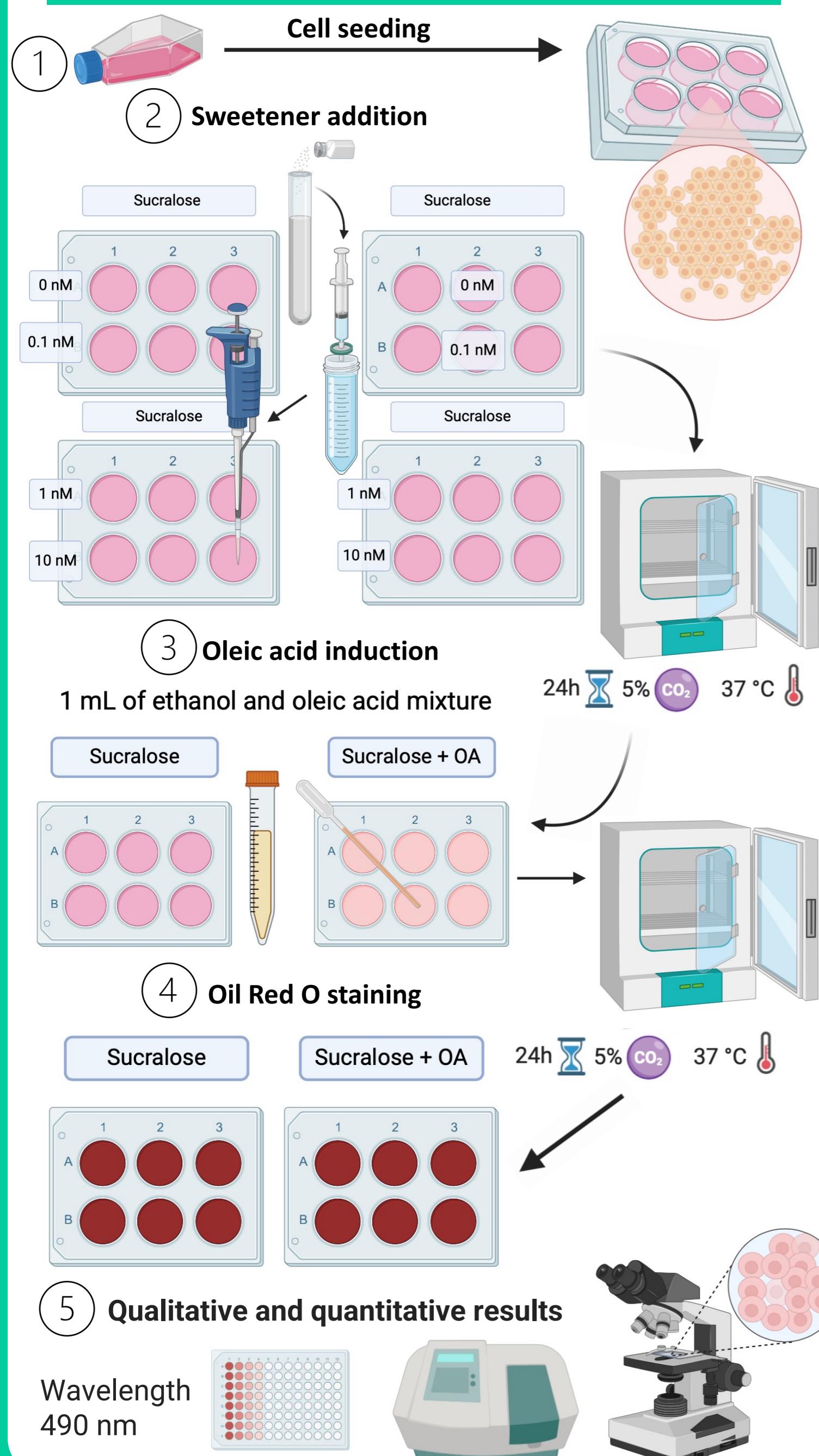
Approximately 25% of the world's population suffers from NAFLD, projected to rise by 50% by 2030¹.



Sucralose intake was linked to increased levels of blood LDL cholesterol, hepatic fatty acids, and genes related to lipogenesis, consistent with earlier research².

The study for replication showed that sucralose increased lipid build-up and raised levels of lipogenesis-related proteins in vivo and vitro models³.

Methods



Results

Oleic Acid did increase absorbance levels compared to untreated cells.

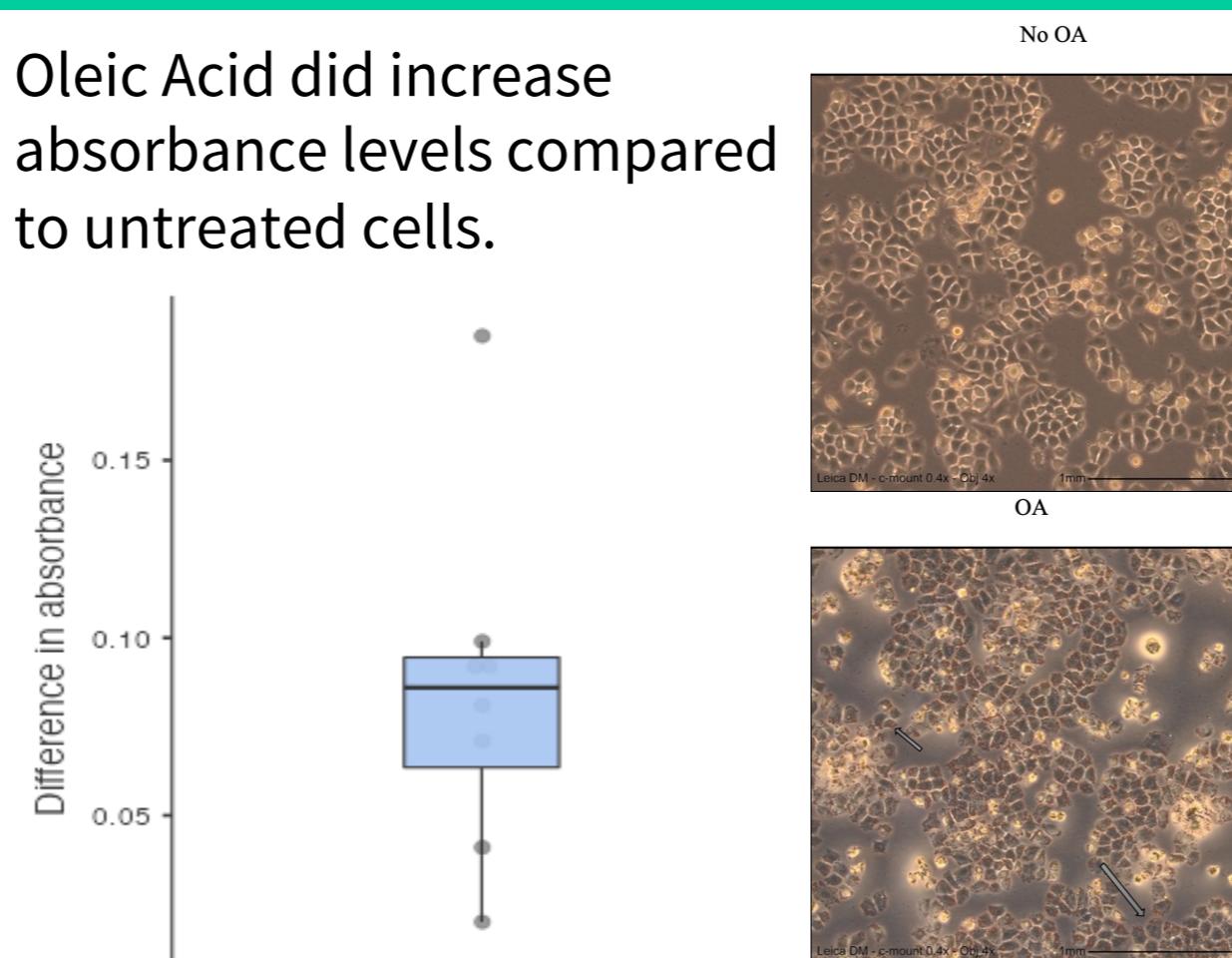


Figure 1: OA difference in absorbance and ORO pictures

Higher oleic acid concentrations (0.5 to 3 mM) did not linearly increase ORO staining. The peak absorbance occurred at 0.5mM concentration.

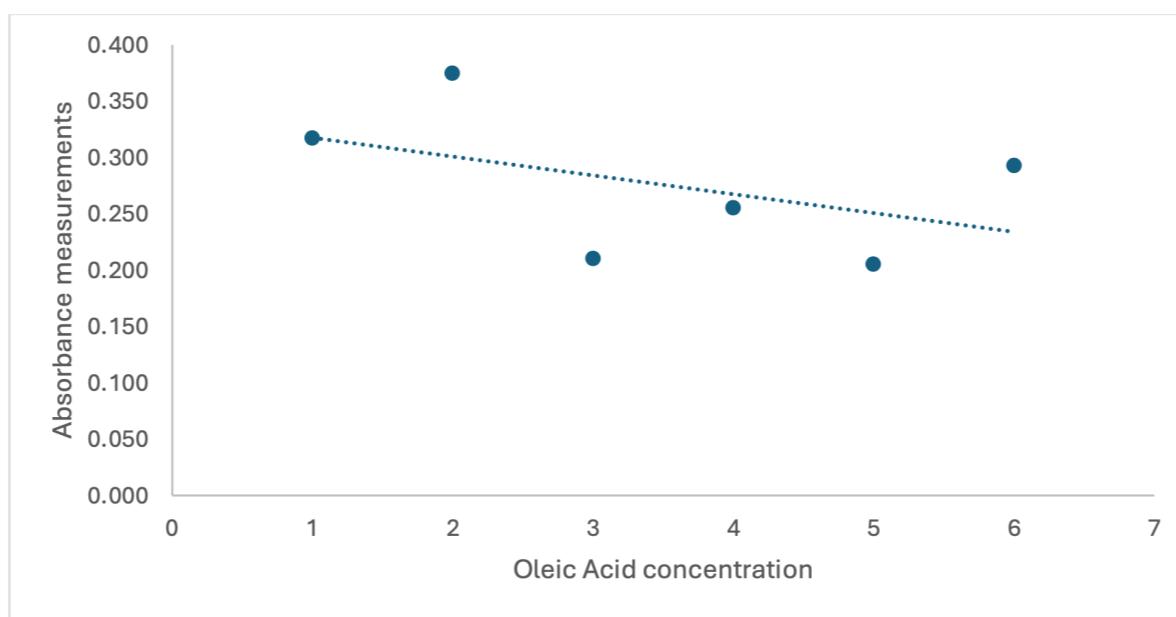


Figure 2: OA different concentrations

Sucralose concentrations did not show any significant difference in lipid accumulation.

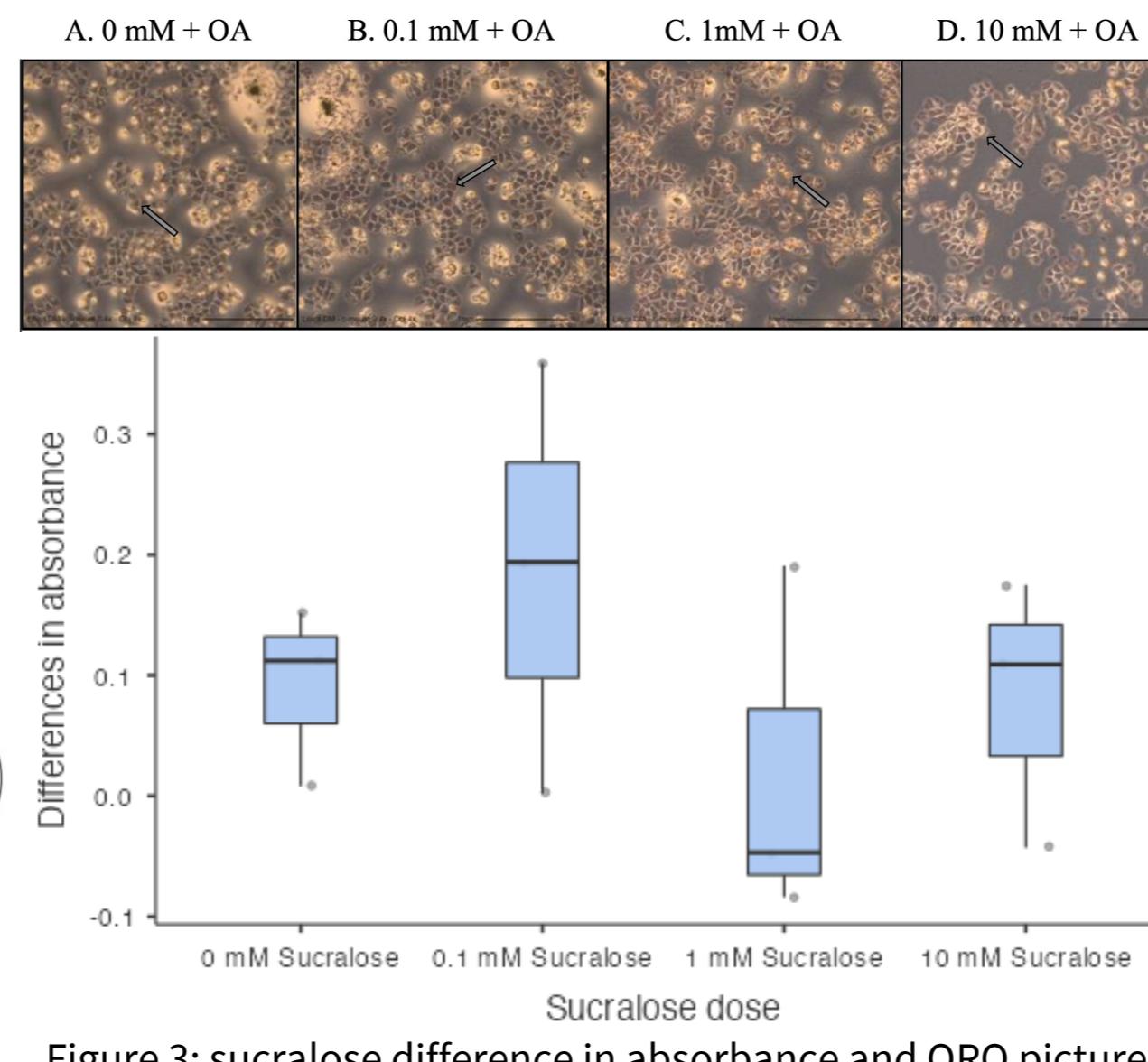


Figure 3: sucralose difference in absorbance and ORO pictures

Saccharine concentrations did not show any significant difference in lipid accumulation.

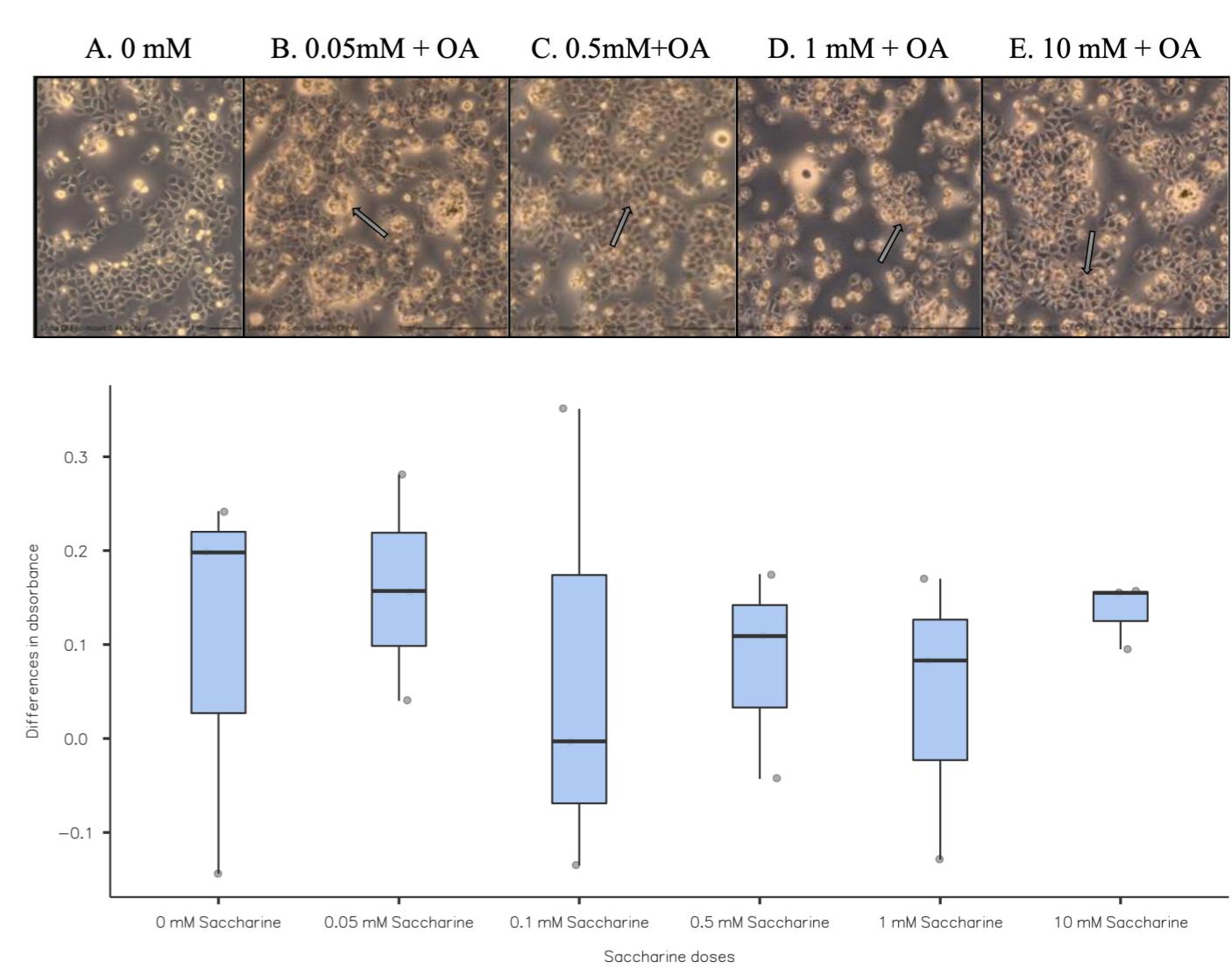
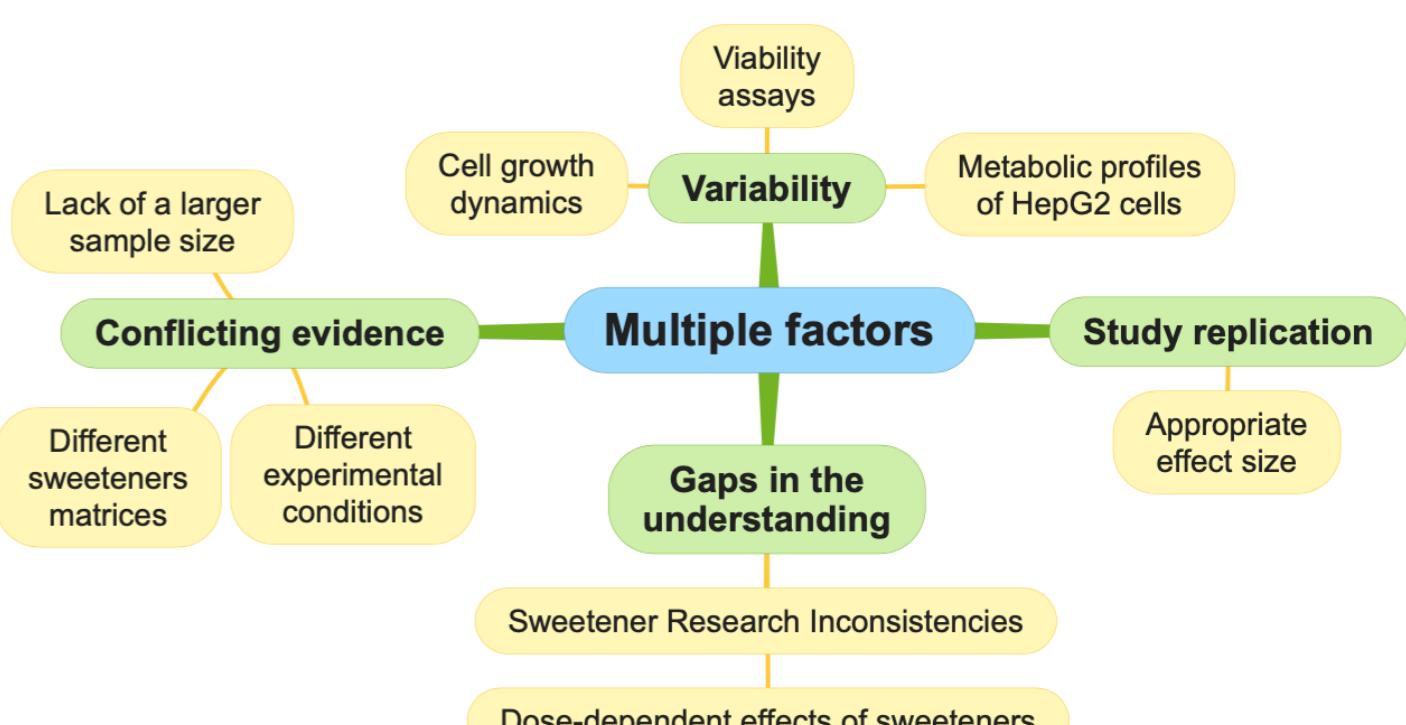


Figure 4: sucralose difference in absorbance and ORO pictures

Conclusion

Sucralose and saccharine showed inconsistent effects on lipid accumulation.



Sweeteners like sucralose and saccharine may have potential benefits for metabolic health, but their effects on NAFLD require clarification.

References/Acknowledgements

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References:

1. Eguchi, Y. et al. (2020) 'Epidemiology of non-alcoholic fatty liver disease and non-alcoholic steatohepatitis in Japan: A focused literature review', *JGH Open*, 4(5), pp. 808–817. doi:10.1002/jgh3.12349.
2. Park, S., Sethi, S., & Bouret, S. G. (2019). Non-nutritive Sweeteners Induce Hypothalamic ER Stress Causing Abnormal Axon Outgrowth. *Frontiers in Endocrinology*, 10, 876. doi: 10.3389/fendo.2019.00876. [Online] Available at: <https://pubmed.ncbi.nlm.nih.gov/31920985/>
3. Wu, H.-T., Lin, C.-H., Pai, H.-L., Chen, Y.-C., Cheng, K.-P., Kuo, H.-Y., Li, C.-H., & Ou, H.-Y. (2022). Sucralose, a Non-nutritive Artificial Sweetener Exacerbates High Fat Diet-Induced Hepatic Steatosis Through Taste Receptor Type 1 Member 3. *Frontiers in Nutrition*, 9, 823723. doi: 10.3389/fnut.2022.823723. PMID: 35685876. PMCID: PMC9171434.