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Effects of Fatty Acids from Coconut and Olive Oil on Expression of the HMG1 Gene and Feeding Behavior in *Tetrahymena thermophila*

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Effects of Fatty Acids from Coconut and Olive Oil on Expression of the *HMG1* Gene and Feeding Behavior in *Tetrahymena thermophila*

Introduction

- The unicellular, eukaryotic ciliate *Tetrahymena thermophila* (*T. thermophila*) is a popular model organism in molecular biology.
- *HMG1* is the gene that codes for HMG-CoA Reductase, which functions in the biosynthetic pathways of sterols in *T. thermophila*.
- Inclusion of external fatty acids in *T. thermophila* environment has previously been shown to decrease cholesterol levels.
- Coconut oil is highly saturated whereas olive oil is relatively low in saturation.
- **Hypothesis:** If *T. thermophila* are exposed to saturated fats and unsaturated fats, they will exhibit a respectively higher and lower expression of *HMG1* and they will selectively ingest unsaturated versus saturated fats when observed during a feeding behavioral assay.

Methods

- **Primer synthesis:** Primers for *HMG1* were designed using IDT Oligoanalyzer software.
- **Culturing:** *T. thermophila* cultures were maintained in NEFF media. Upon experimentation, all cultures were transferred into SPP media. One experimental group was exposed to 5% coconut oil by volume and the other was exposed to 5% olive oil by volume.
- **RNA extraction:** RNA was extracted using Qiagen's RNeasy Mini Kit.
- **Reverse transcription:** cDNA was synthesized using RevertAid.
- **qPCR** was performed using PowerUp SYBR Master Mix and primers targeting *HMG1* and *BTU1*
- **Feeding Habits** were analyzed by a Feeding Assay using 1% India Ink.

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Results

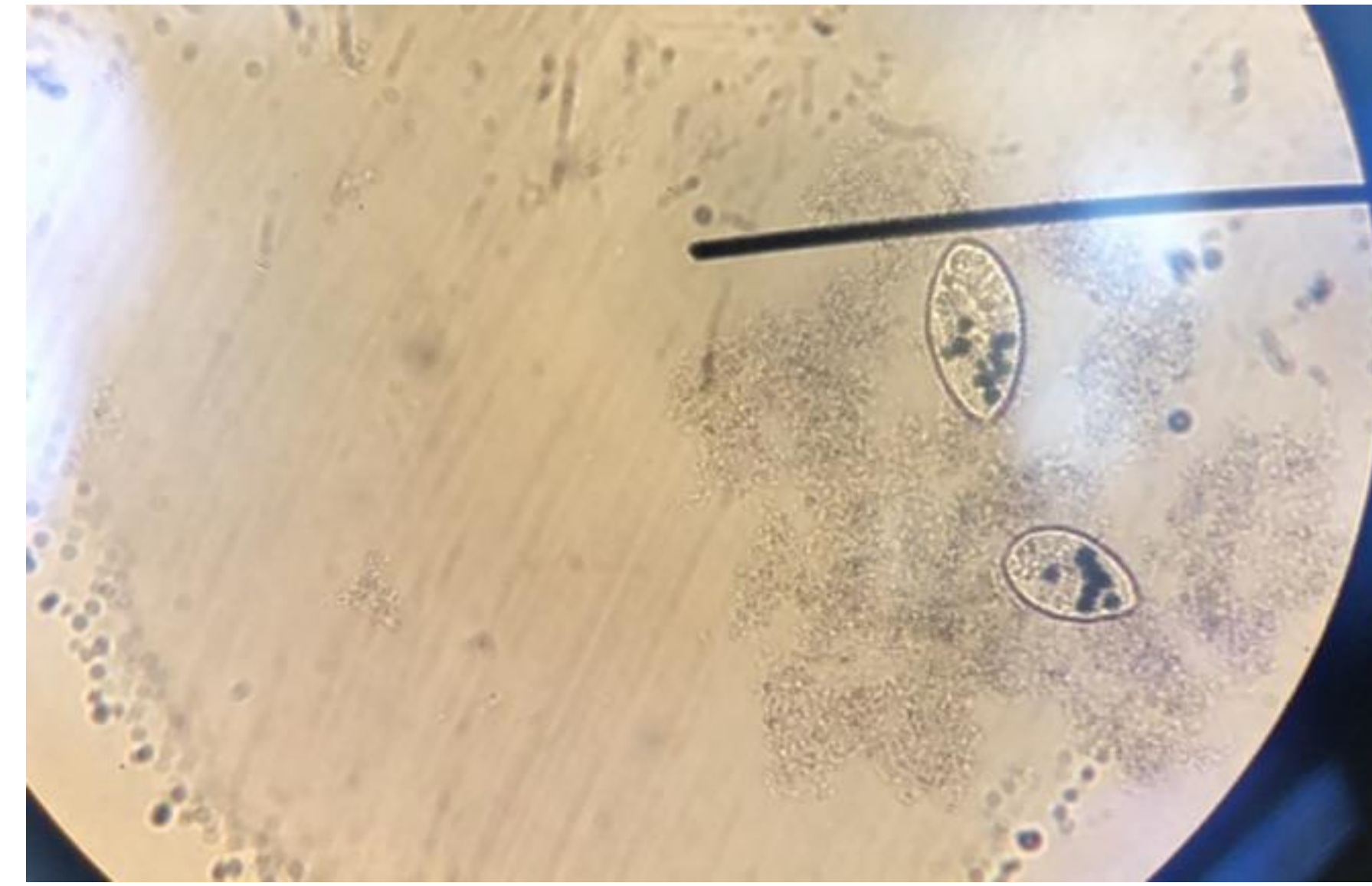


Figure 1: Feeding assay of olive oil-exposed *T. thermophila*.

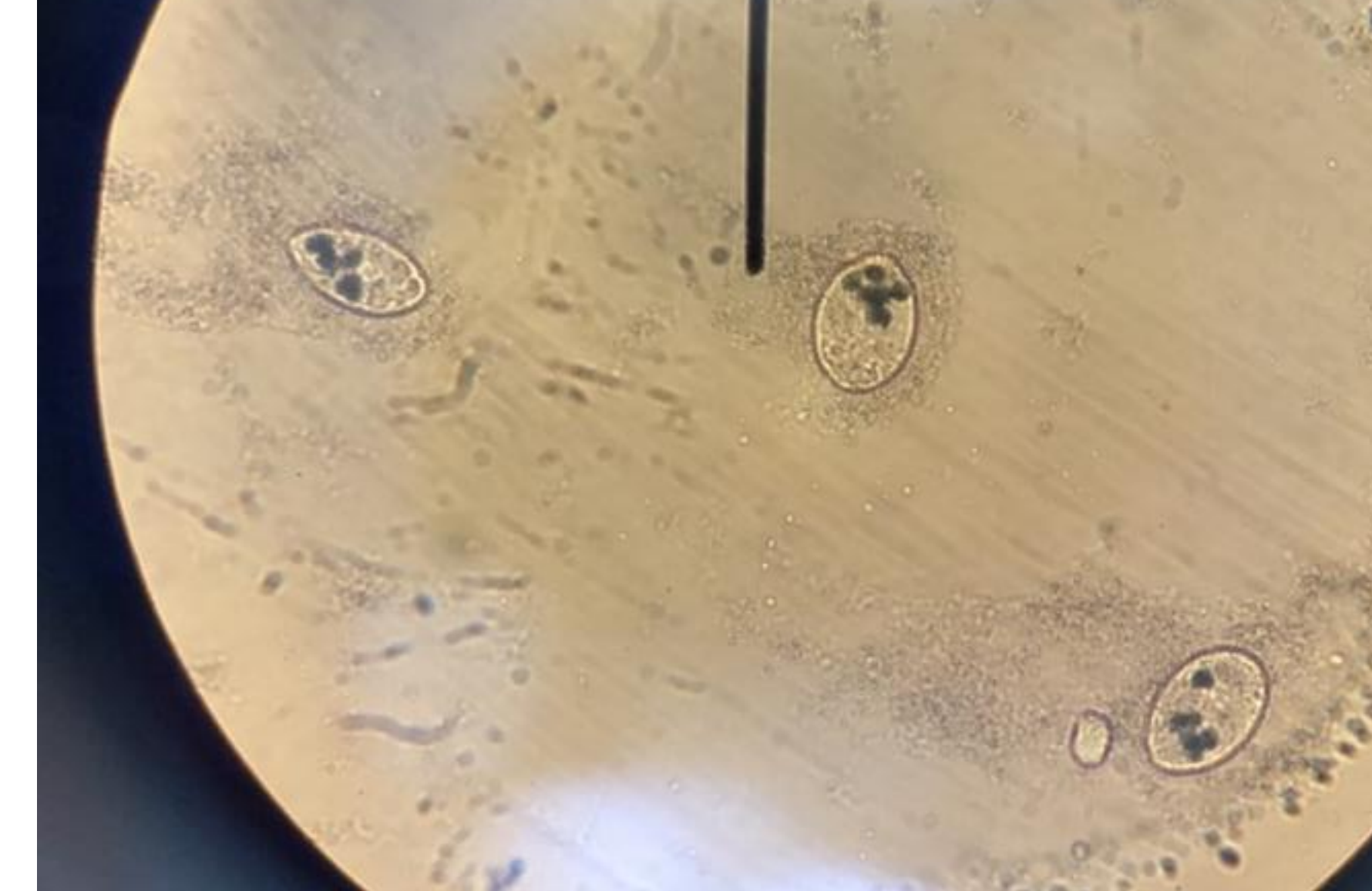


Figure 2: Feeding assay of coconut oil-exposed *T. thermophila*.

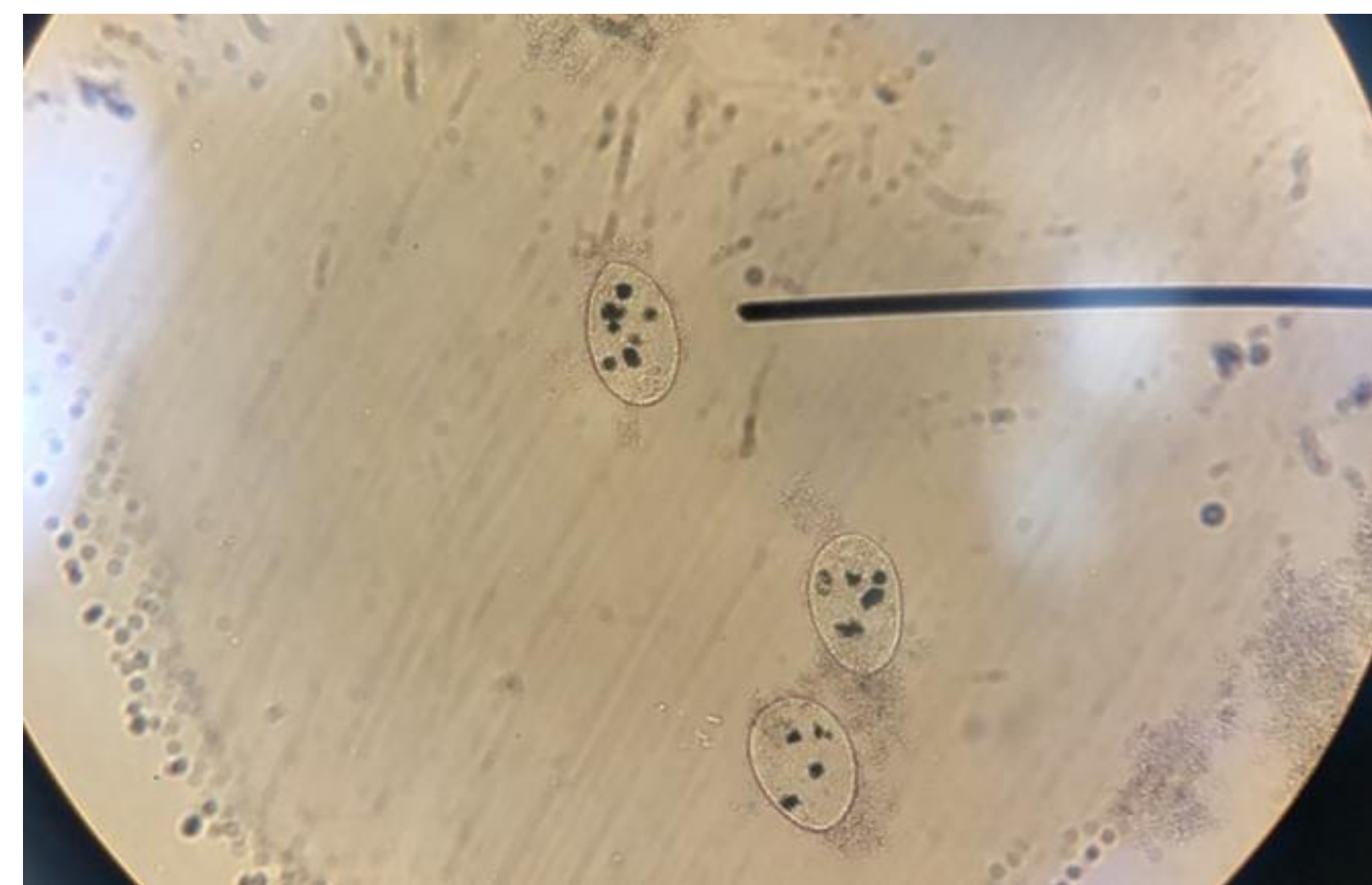


Figure 3: Feeding assay of control *T. thermophila*.

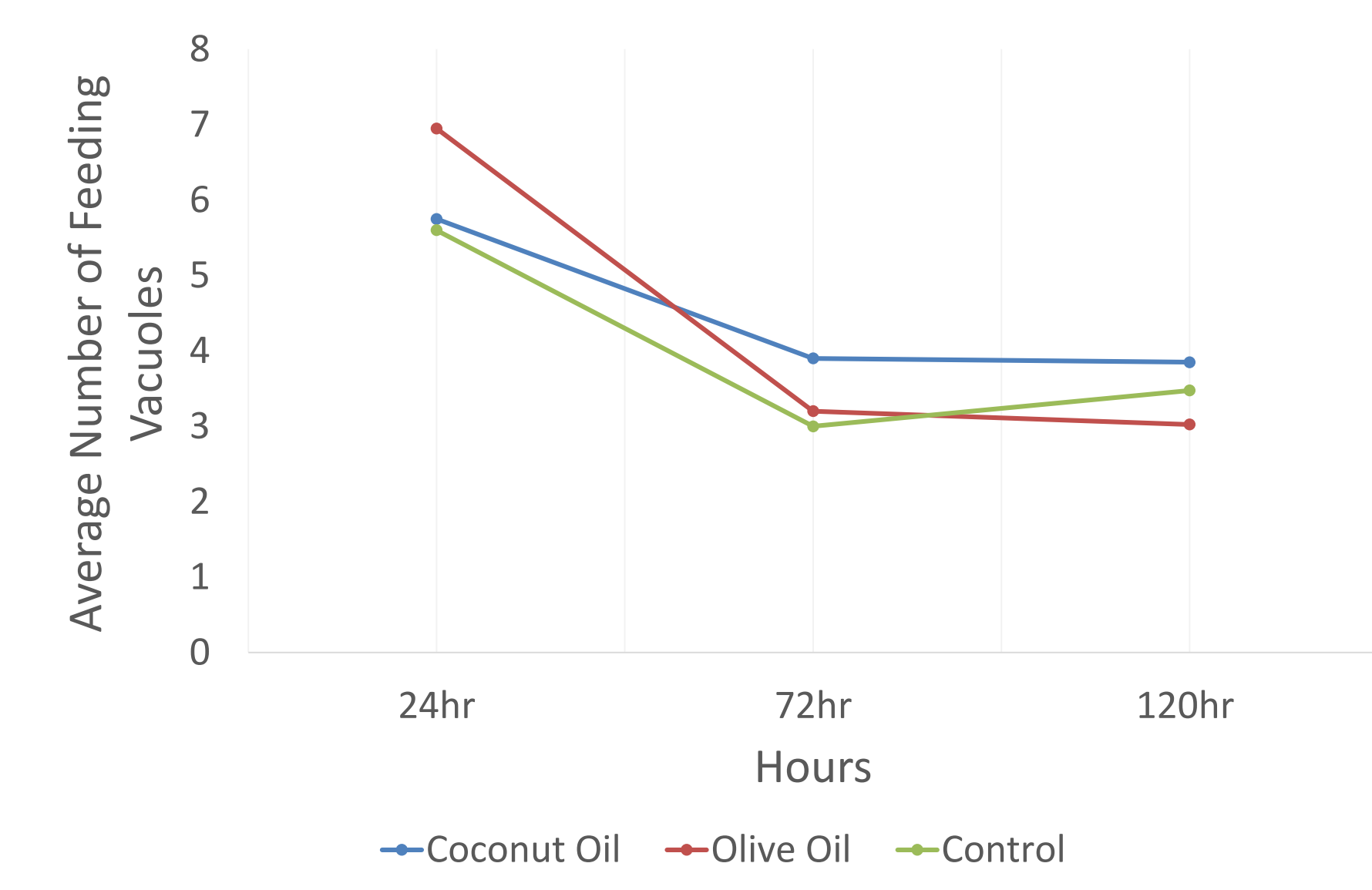


Figure 4: Average number of feeding vacuoles over a 120 hour period for the experimental and control groups. (p=0.297, n=4)

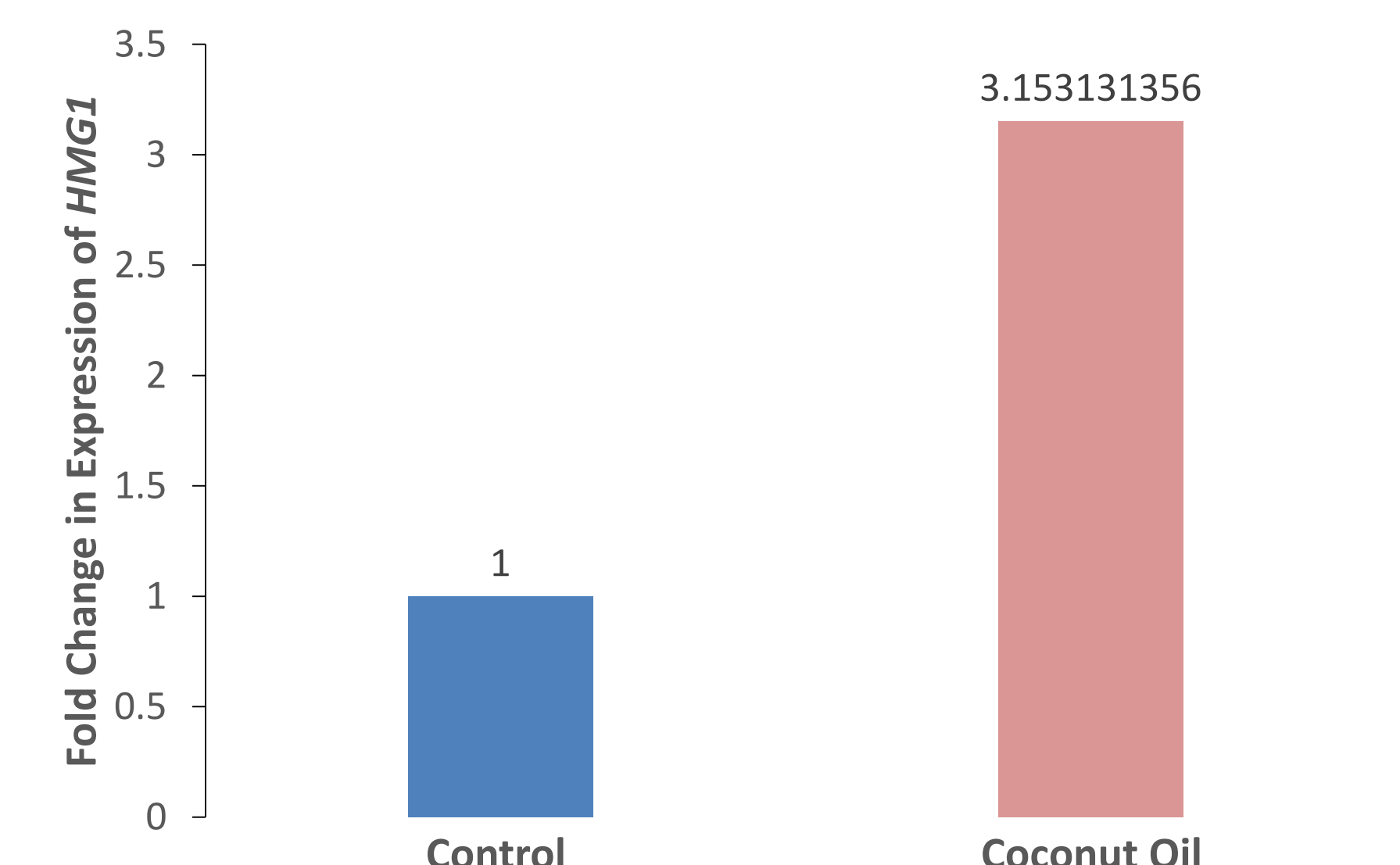


Figure 5: Fold change of *HMG1* in control versus coconut oil experimental groups (p=0.040976, n=4).

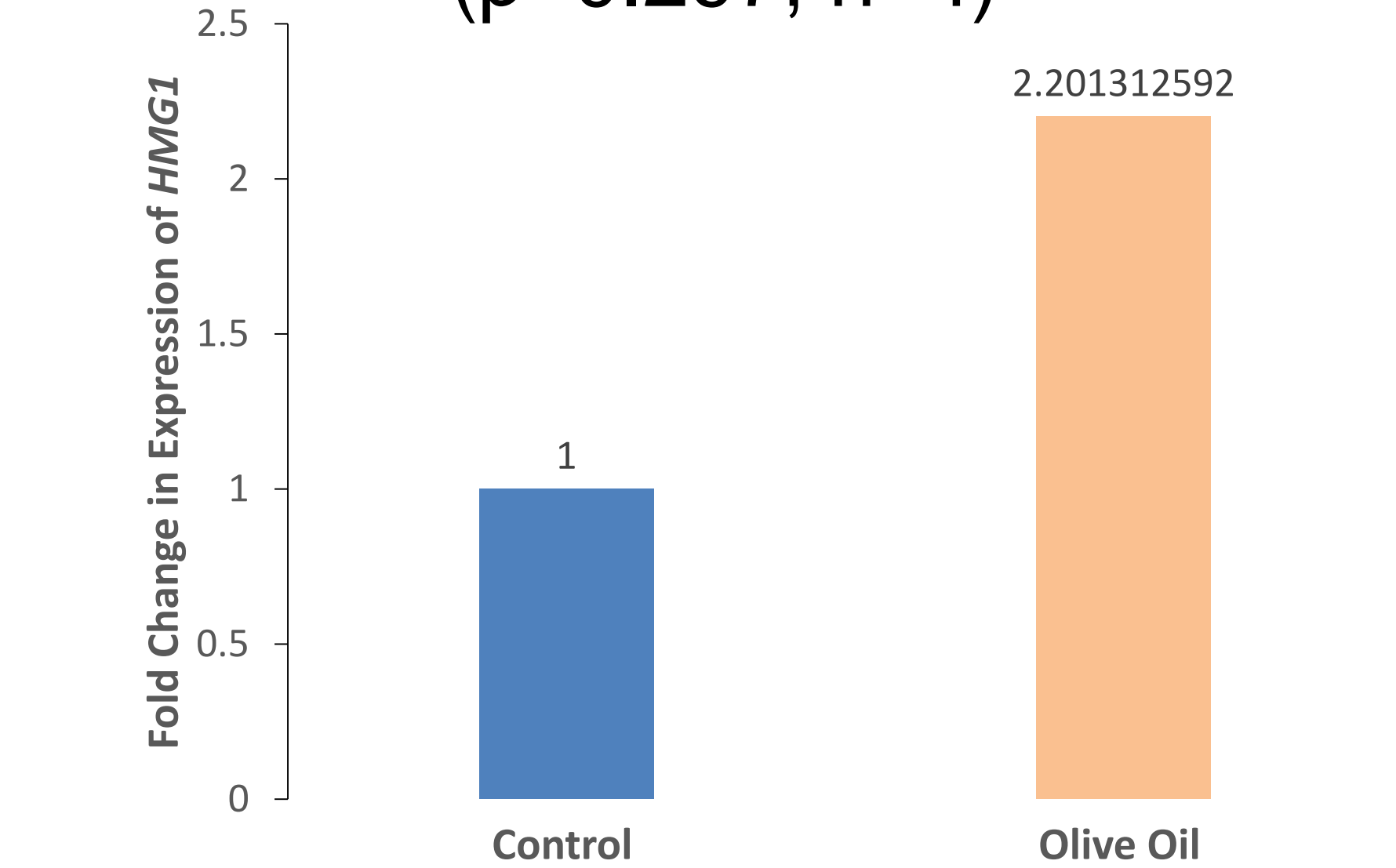


Figure 6: Fold change of *HMG1* in control versus olive oil experimental groups (p=0.119467, n=4).

Conclusions

- The feeding assay was inconclusive, each group exhibited similar feeding behaviors (p-values > 0.297).
- There was a significant difference in expression of *HMG1* between coconut oil-exposed and control in *T. thermophila*. (p=0.04976)
- There was no significant difference in expression of *HMG1* between olive oil-exposed and control in *T. thermophila*. (p=0.119467)
- The results disagreed with our hypothesis on gene expression under the influence of saturated fats but failed to produce statistically relevant evidence for unsaturated fats.
- The feeding assay results disagreed with our hypothesis on selective feeding behavior.

References

- Phan, Jasmine; Kane, Connor; and Otto-Hitt, Stefanie, "Effects of Fatty Acids from Avocados on Expression of the HMG1 Gene in Tetrahymena thermophila" (2018). *Life and Environmental Sciences Course-based Research Projects*. 9.
- Sanil, R.; Jyothi, M.; Shashidhar, S., "HMG CoA reductase and hepatocytic hyperlipidemia in various oil fed rats" (2009). *International Journal of Biotechnology & Biochemistry*, 5(1),

Acknowledgements

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