

# Acute High Intensity Treadmill Exercise Increases Appetite and NPY/AgRP and TH Neuron Activity in Untrained Female Mice

K. Free<sup>1,2</sup>, T. Landry<sup>1,2</sup>, D. Shookster<sup>1,2</sup>, A. Chaves<sup>1,2</sup>, T. Nguyen<sup>1,2</sup>, H. Huang<sup>1,2,3</sup>  
 1 East Carolina Diabetes and Obesity Institute, East Carolina Heart Institute, 115 Heart Drive Rm 4108, Greenville, NC, United States  
 2 Department of Kinesiology, East Carolina University, 115 Heart Drive Rm 4108, Greenville, NC, United States  
 3 Department of Physiology, East Carolina University, 115 Heart Drive Rm 4108, Greenville, NC, United States



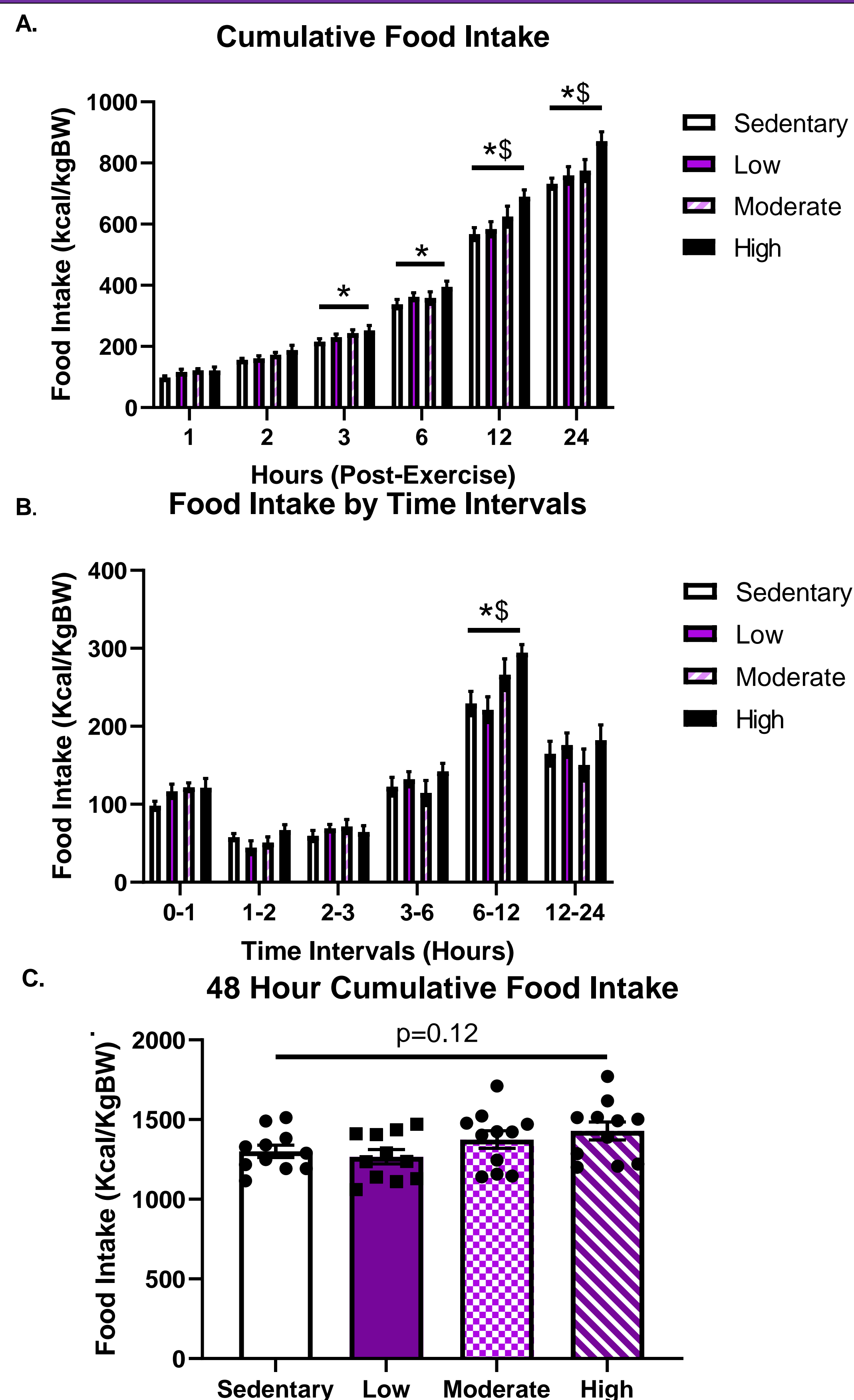
## Background/Hypothesis

- Exercise is commonly prescribed as a means for weight loss, however, exercise programs have mixed success rates.
  - Exercise intensities differentially modulate appetite and appetite-regulating neurons in the hypothalamus.
  - This study examines the effects of different acute treadmill exercise intensities on appetite regulation in female mice.
- Hypothesis: Higher exercise intensities will yield increased food intake in female mice, due to increases in NPY/AgRP neuron activity in the arcuate nucleus.**

## Methods

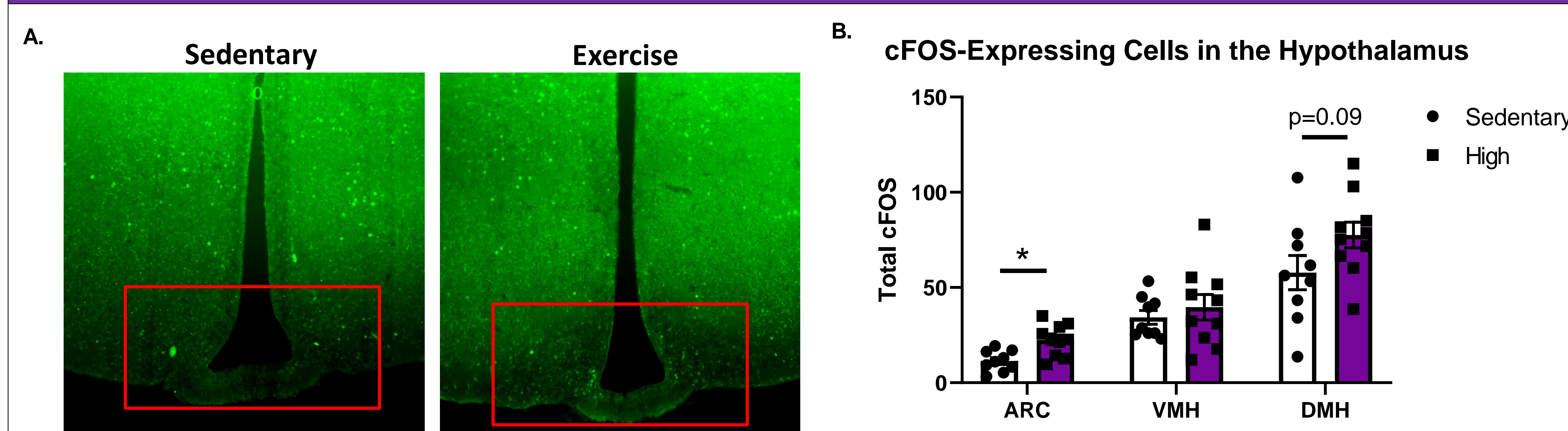
- 11 8-week old untrained, fasted female mice participated in a randomized-cross-over trial of sedentary, low, moderate, and high intensity acute treadmill exercise with food intakes measured at 1, 2, 3, 6, 12, 24, and 48 hours post-exercise.
- Immunohistochemical detection for cFOS to determine changes in NPY/AgRP, POMC, TH, and SIM1 neuron activity in response to exercise was performed.
- An additional cohort of mice were perfused with PBS and formalin 3 hours post-exercise, and brains were extracted.

## Moderate and High Intensity Exercise Increases Food Intake in Fasted Females



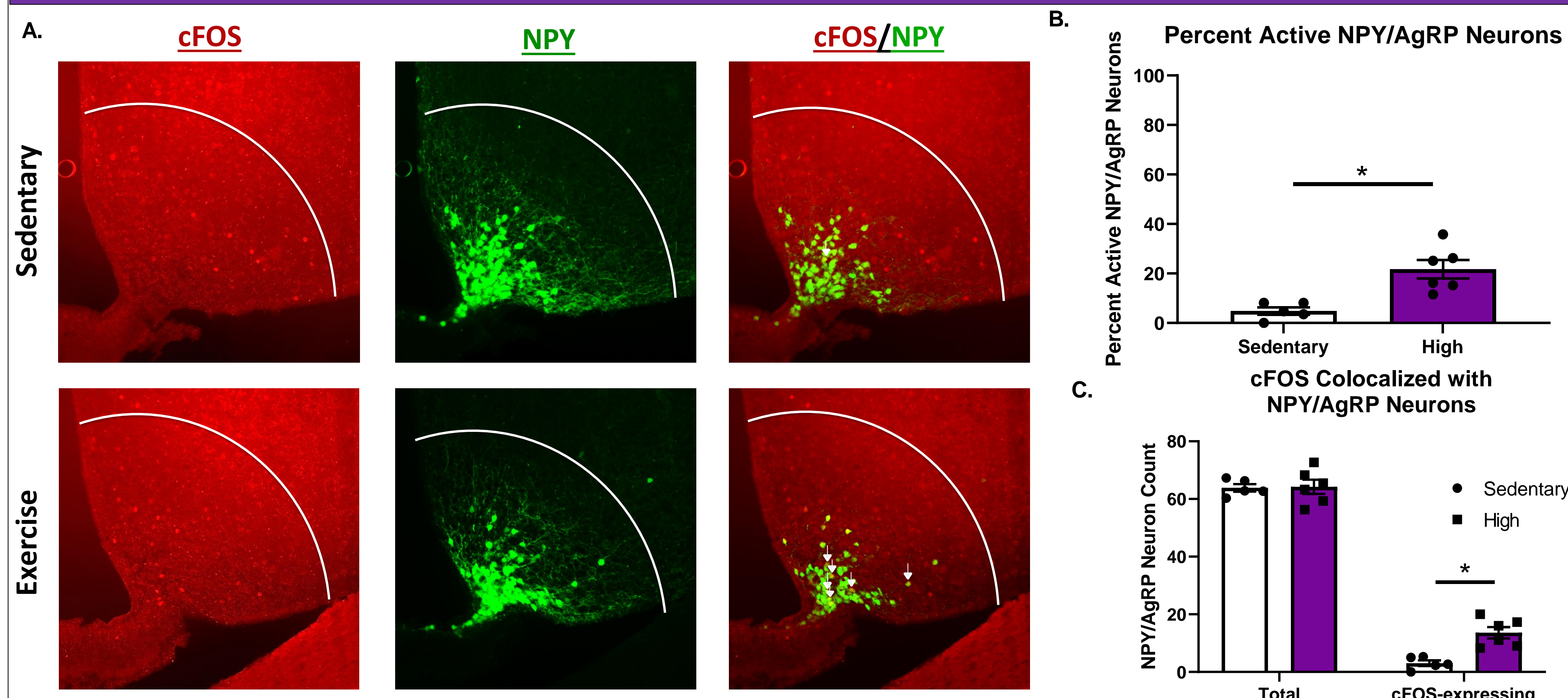
**Figure 1. Moderate and High Intensity Exercise Increase Food Intake in Female Mice.** (A) Cumulative post-exercise food intake. (B) Food intake by time intervals. (C) 48h cumulative food intake.

## High Intensity Exercise Alters Hypothalamic Neuron Activity



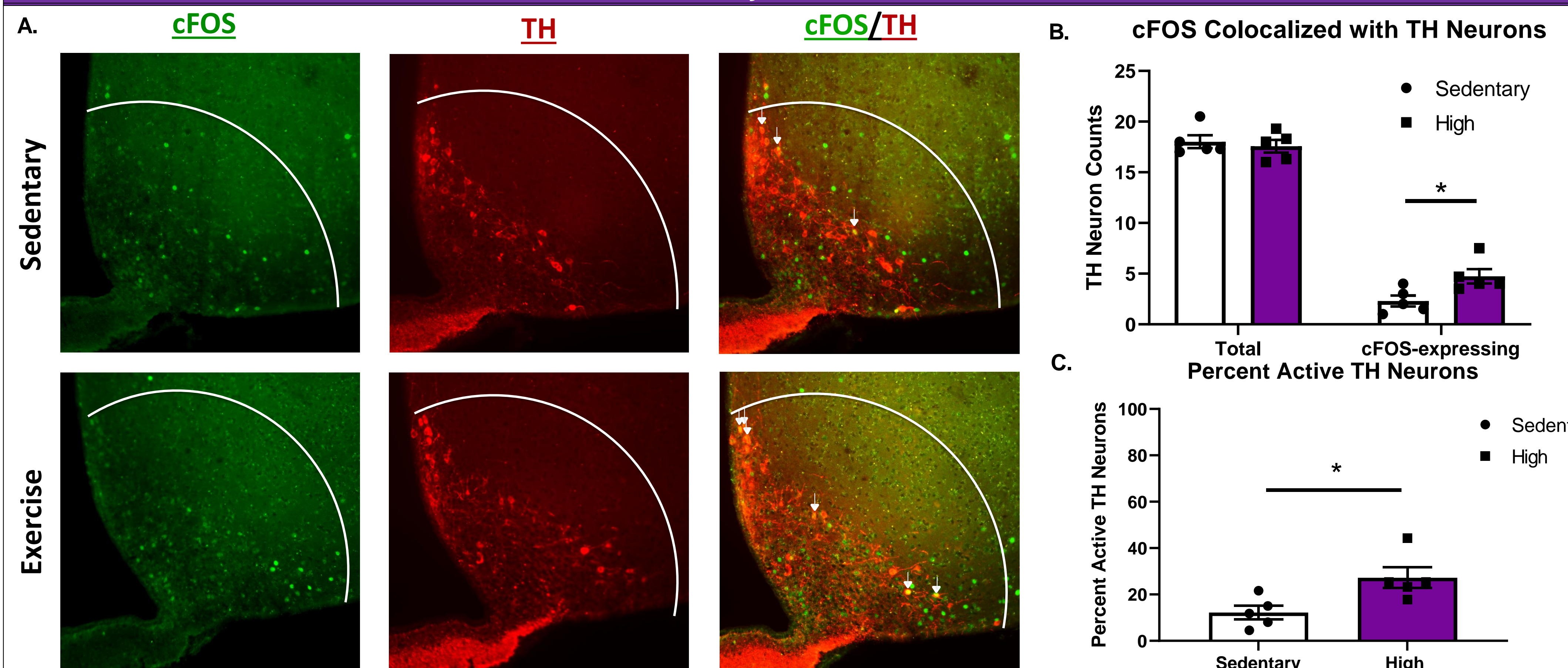
**Figure 2. High Intensity Exercise Increases Neuronal Activity in the Arcuate Nucleus.** (A) Representative cFOS stains (green) in the hypothalamus of sedentary or exercised mice. (B) cFOS counts in each region of the hypothalamus.

## ARC NPY/AgRP Neuron Activity is Elevated 3h Post-Exercise



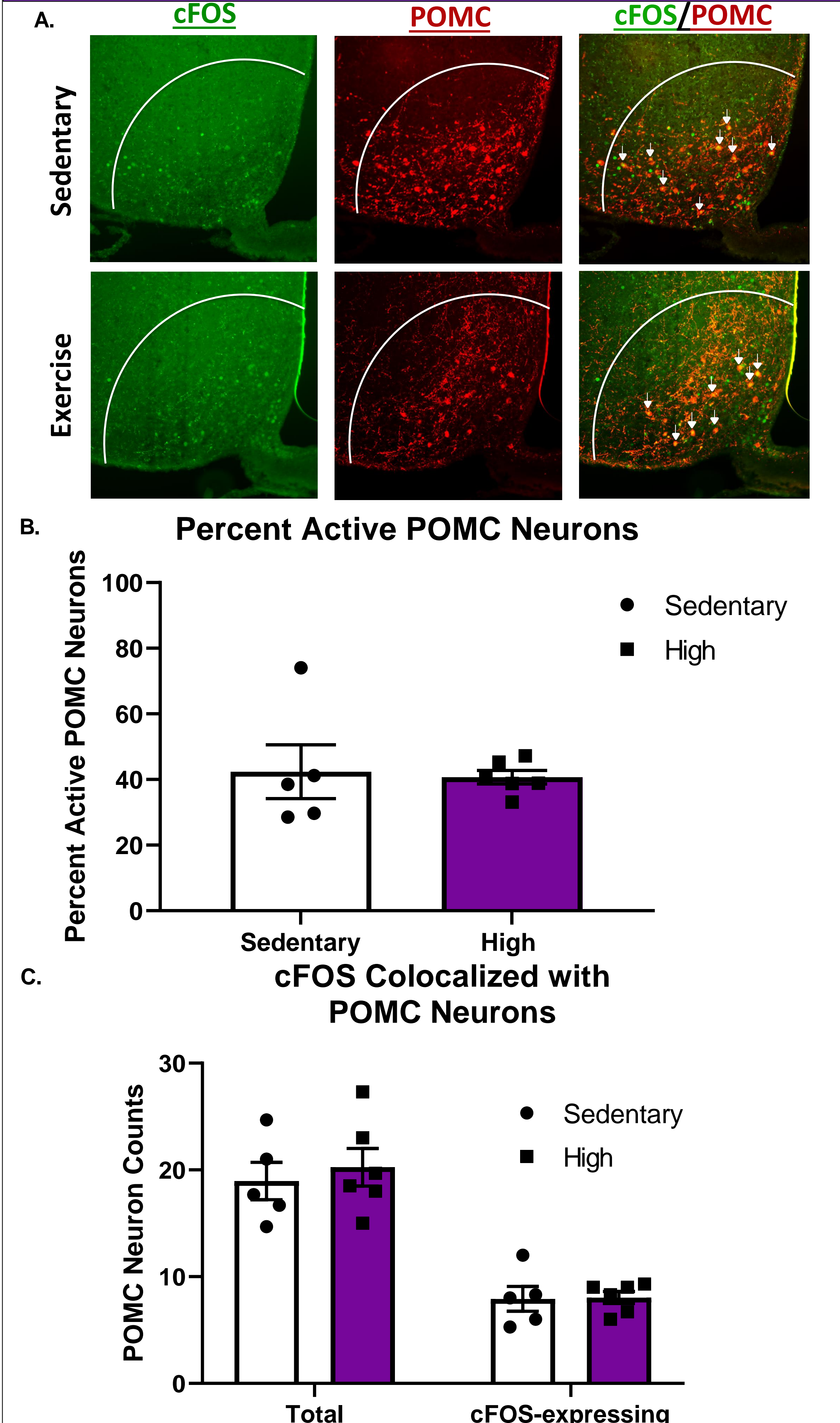
**Figure 3. High Intensity Exercise Increases NPY/AgRP Neuron Activity.** (A) Representative images of cFOS (red) and NPY/AgRP neurons (green) in sedentary or exercised mice. (B) Percent active NPY/AgRP neurons. (C) Total and cFOS-expressing NPY/AgRP neurons.

## ARC TH Neuron Activity is Elevated 3h Post-Exercise



**Figure 4. High Intensity Exercise Increases TH Neuron Activity.** (A) Representative images of cFOS (green) and TH neurons (red) in sedentary or exercised mice. (B) Total and cFOS-expressing TH neurons. (C) Percent active TH neurons.

## POMC Neuron Activity is Unchanged 3h Post-Exercise



**Figure 5. High Intensity Exercise has no Effects on POMC Neuron Activity.** (A) Representative images of cFOS (green) and POMC neurons (red) in sedentary or exercised mice. (B) Percent active POMC neurons. (C) Total and cFOS-expressing POMC neurons.

## Conclusions

- These results indicate that moderate and high intensity exercise increase 24 hour food intake post-exercise in female mice.
- NPY/AgRP and TH neuron activity is elevated 3 hours post-exercise, explaining the increases in food intake
- The increases in food intake following moderate and high intensity exercise possibly explains the low success rates of exercise-focused weight loss programs.
- Low intensity exercise may be a useful exercise regimen due to the absence of compensatory increases in appetite.

## Future Directions

- Observing trained female mice to determine the effects long-term exercise has on appetite regulation.
- Studying female mice in the fed energy status versus the fasted energy status to determine if varying the energy status has an effect on appetite regulation.
- Determine the role specific workouts may have on appetite regulation, such as high intensity interval training.