Investigating the Effects of Sex and Obesity on Perivascular Adipose Tissue

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Introduction

Cardiovascular disease (CVD) is the leading global cause of death in both men and women. Obesity is a major risk factor for CVD that continues to become more prevalent. Additionally, there are sex-dependent mechanisms of CVD development that require further study. In Fall 2021, I began working in the Vascular Kinetics Lab as a research intern under Dr. Ryan Sapp, whose project focuses on understanding how perivascular adipose tissue (PVAT) is impacted by biological sex and high fat diet-induced obesity.

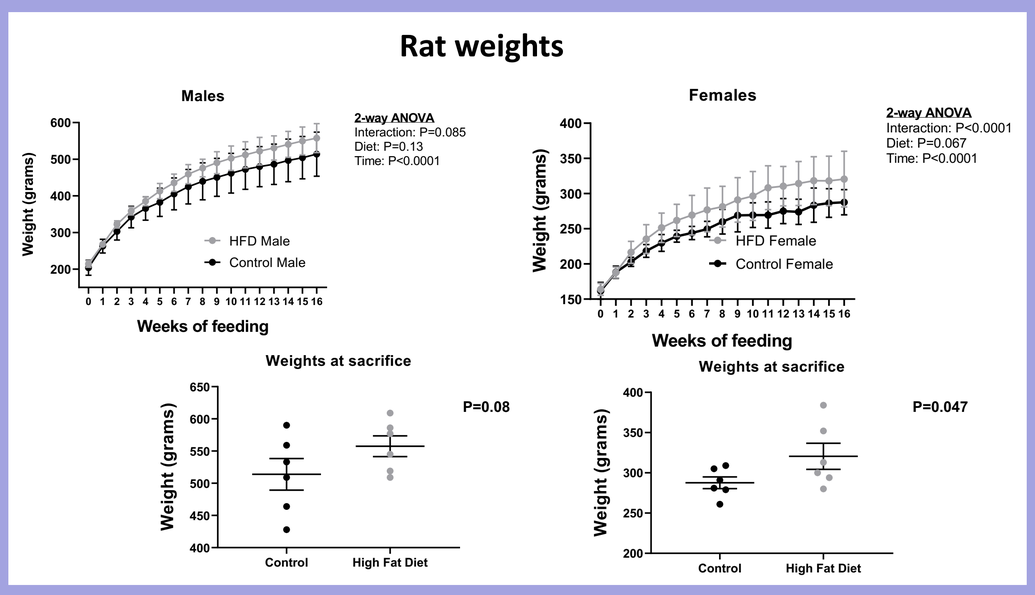

Figure 1:

Body weights of control diet and high fat diet (HFD) fed female and male rats over 16 weeks of feeding (pictured at the top) and at sacrifice (pictured at the bottom).

Site Information:

Vascular Kinetics Lab
4224 A. James Clark Hall, University of Maryland
8278 Paint Branch Dr.,
College Park, MD 20742

Lab PI: Dr. Alisa Clyne

Lab Mission: Use engineering methods to understand how integrated biochemical and biomechanical factors contribute to cardiovascular disease.

Project Goal: To determine the sex-dependent effects of high fat diet on PVAT.

Impact-Personal:

From my experience, I have developed valuable lab technical skills that I will expand upon as I continue future experimentation in the lab. I have also gained valuable insight into the varying applications research can have in the bioengineering field and how these relate to my interests at this point in my academic career.

Activities:

- I processed and cultured PVAT obtained from the thoracic aorta of the rats. The PVAT was weighed, diced, and cultured in media in a 6-well plate for 24 hours at 37ºC, 5% CO2.
- After 24 hours the conditioned PVAT media was collected and frozen for use in future experiments.

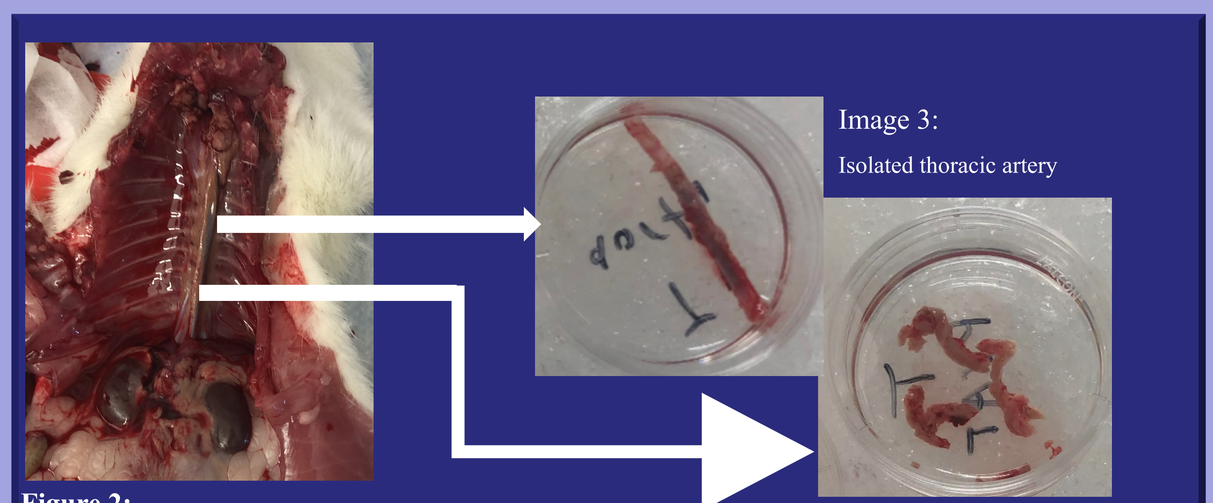

Image 3:
Isolated thoracic artery

Image 4:
Isolated PVAT from thoracic artery

Figure 2:

Chest cavity of mice during surgery showing the PVAT surrounding the thoracic aorta. PVAT was removed from the aorta.

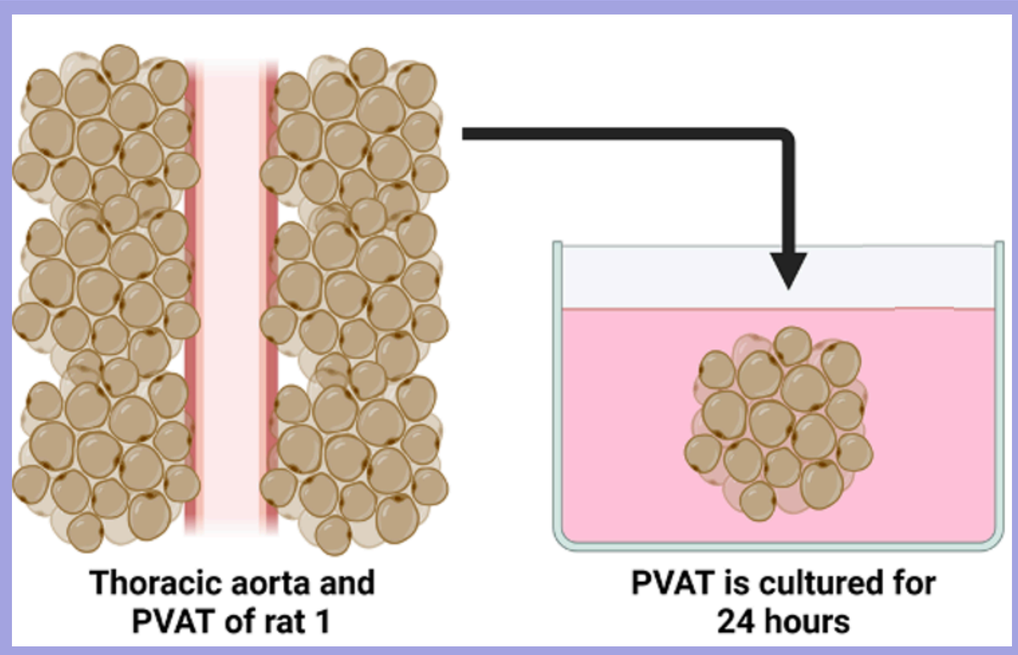

Figure 3:

PVAT removed from the thoracic aorta was diced into small pieces and cultured in media (DMEM) for 24 hours.

Discussion:

PVAT has a huge impact on the cardiovascular system. It influences vascular homeostasis which serves to regulate various vascular functions such as contractibility properties and inflammatory responses. By feeding the rats a high fat diet we were able to analyze the impacts induced obesity has on underlying gene pathways that contribute to PVAT dysfunction. The collected PVAT conditioned media secretes gene and protein factors in which we can use to analyze the effects of HFD and biological sex on vascular cells.

Future Work:

Moving forward, I will be working with the PVAT conditioned media that I previously collected from the HFD and LFD males and females. The PVAT conditioned media contains secreted factors. By treating the endothelial cells with the conditioned media, I will be able to test how these secreted factors impact vascular cells. More specifically, I will be culturing rat aortic endothelial cells and treating them with the cultured media to test its impacts on the gene and protein expression of vascular cells.

Acknowledgments:

I would like to thank my supervisor Ryan Sapp for his assistance and incorporating me into his projects and Dr. Alisa Clyne for welcoming me into her research lab to explore my interests. I would also like to thank Dr. Holtz and Dr. Merck for two incredible years in the Science and Global Change Program.