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Background

- Tissue regeneration can be observed in species such as starfish, amphibians, and various other invertebrates, yet little is known about the regenerative capabilities of mammals.
- Mammals are very limited in their abilities to regenerate tissue that is scar-free and fully functioning, therefore most existing information depends on studies conducted on species and organisms that are not as limited.
- One specific strain of mice, African spiny mice, exhibit enhanced capabilities of tissue regeneration, most likely due to their lowered neutrophil levels (Brant et al. 2015).
- Neutrophils are the first leukocytes that are recruited to the area of injury and serve to kill and remove pathogens and cellular debris (Rosales, Demareux, Lowell, & Uribe-Querol, 2016).
- Osaka et al. (2016) found that high-fat diets resulted in increased recruitment of leukocytes, specifically neutrophils which showed increased levels of mobilization and activation.
- High-protein diets capable of reducing inflammation levels when compared to normal diets (Kim, Park, Chun, & Kim, 2014).
- This research aimed to determine the impact that various diets had on neutrophil counts and tissue regeneration.

Methods

- 12 *Mus musculus* mice were obtained from the University of Mount Union and separated into groups of 4 based on diet (Control 23% kcal protein, Kalmbach Feeds Inc.), (High-fat 60% kcal fat, Bio-Serv), (High-protein 30% kcal protein, Bio-Serv).
- Diets were maintained for a 10-week period, after 10 weeks, experimental groups were placed on the control diet.
- Blood analysis and weights were recorded prior to experimentation and then recorded weekly for 15 weeks.
- Blood was drawn from the lateral tail vein of the mice following an example set by the Penn State Animal Resource Program.
- A blood smear was then made using rapid differential stain (Astral Diagnostics Inc.) and observed under a microscope, with a total of 100 white blood cells being counted.
- Data analysis was conducted with a repeated measures ANOVA using SPSS software (SPSS version 26, SPSS Inc., Chicago, IL).

Results

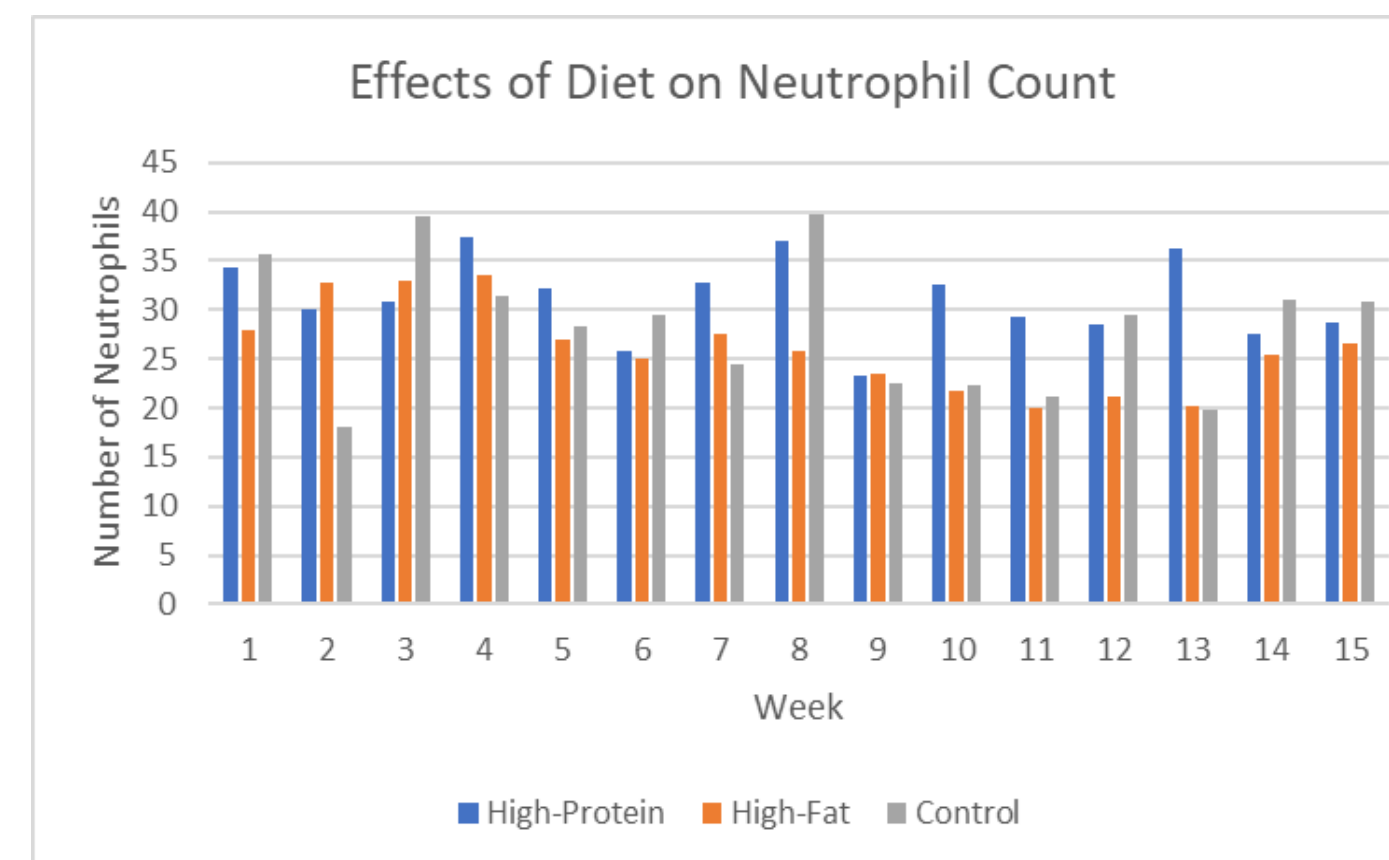


Figure 1. Effects of Diet on Neutrophil Count

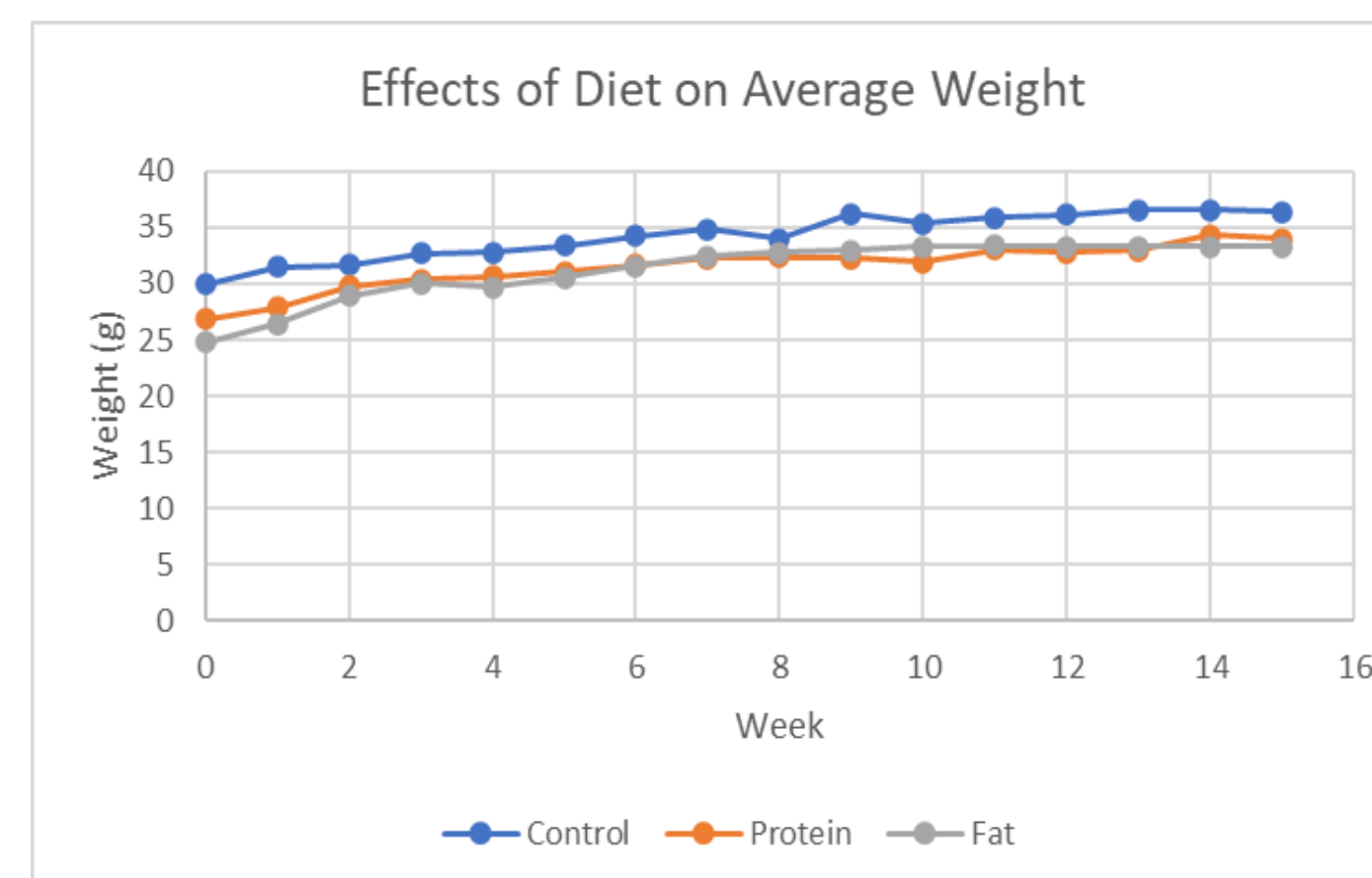


Figure 2. Effects of Diet on Average Weight

Works Cited

- Brant, J.O., Yoon, J.H., Polvadore, T., Barbazuk, W.B., and Maden, M. (2015). Cellular events during scar-free skin regeneration in the spiny mouse, *Acromys*. *Wound Repair and Regeneration*, 24, 75-88.
- Kim, K.O., Park, H., Chun, M., and Kim, H.S. (2014). Immunomodulatory effects of high-protein diet with resveratrol supplementation on radiation-induced acute-phase inflammation in rats. *Journal of Medicinal Food*, 17 (9), 963-971.
- Osaka, M., Ito, S., Honda, M., Inomata, Y., Egashira, K., and Yoshida, M. (2016). Critical role of C5a-activated neutrophils in high-fat diet-induced vascular inflammation. *Scientific Reports*, 6, 1-11.
- Rosales, C., Demareux, N., Lowell, C.A., and Uribe-Querol, E. (2016). Neutrophils: Their role in innate and adaptive immunity. *Journal of Immunology Research*, 1-2.

Discussion

- When comparing the total 15-week dietary intervention (including pre and post diet) a significant difference was observed in neutrophil percentage between the groups ($p=0.013$).
- The high-protein group ($N=4$) resulted in the highest neutrophil count ($31.08 \pm 4.13\%$), with the high-fat group ($N=4$) producing the lowest neutrophil count ($26.08 \pm 4.44\%$), and the control ($N=4$) resulted in a neutrophil count of $28.25 \pm 6.82\%$ (Figure 1).
- There was an overall increase in weight over time for each of the groups, with the high-fat group seeing the largest increase at 34% and the control group seeing the smallest increase at 22% (Figure 2).
- Neutrophil level results proved to be opposite of what was hypothesized. Since high-protein diets have been shown to decrease inflammatory responses, it was believed that a high-protein diet would decrease neutrophil levels. Elevated fat levels are associated with increased inflammation, so it was hypothesized that a high-fat diet would potentially increase neutrophil levels.
- The overall increase in weight that was observed for all groups may have resulted from a lack of competition for food. The mice had previously lived in a substantially larger population which would have provided more competition for food, therefore a switch to a smaller population size would expectedly cause an increase in weight for all groups.
- More research is needed to determine the effect diet can have on neutrophil levels. It is possible that increased levels of protein could assist in the increase production of all leukocytes. Advanced blood analysis is needed to determine the effect the various diets have on blood serum levels of protein and fat.
- To increase the power of the results a larger sample size, increased blood cell counts, and advanced blood analysis would be required. The current results are limited by a small sample size, making it difficult to confidently determine statistical significance.

Acknowledgements

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