Do Environmental Changes Reduce Food Grinding in Mice?

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Abstract

The topic of enrichment is a hot topic in the Laboratory Animal Science field. From the NC3Rs website, "…enrichment can refer to any objects or general practices that enhance the level of physical, mental or social stimulation for captive animals". Food grinding is the process where mice grind the provided food pellets into different sizes pieces ranging from dust to smaller sized pellets without ingesting the food. This poster will review the process taken to modify this behavior and how the behavior was reduced, but not eliminated, with the introduction of food-based enriched but no discernible impact by dental health.

Introduction

Food grinding behavior in mice has become a greater concern and seen more often since 2020, with no true understanding as to why. Many factors could affect this behavior such as dental health, current housing conditions, nutritional needs or boredom. Researchers believe these mice are not actually gaining nutrients and it is only a maladaptive behavior compared to nail biting in humans. Food grinding is the process in which mice, or any rodent, will chew food given but neglect to ingest any. The crumbs that are created and discarded by this behavior are called orts. The concerns are that nutritional requirements are not being met, and proper food intake cannot be recorded accurately, which is often needed for research projects. In addition, this causes an increase of overall feed required for a research program and often requires the cage to be changed more often. This causes the use of bedding and technician time to increase too. Studies have been conducted that focused on the physical cage micro- and macro-environment as well the use of non-edible and edible enrichment. The use of edible enrichment would focus on the alternative protein source as well the time required to reach the protein source. This study's hypothesis was the introduction of food-based enrichment in the form of peanuts and sunflowers would decrease or eliminate the food grinding behavior. A secondary hypothesis was that dental health could impact this behavior.

Materials & Methods

Pictures of the mice upper and lower teeth were taken at weeks 1 and 5. The male (ms01, ms02, ms03, ms04, ms05) and female (mso6, ms07) Swiss Webster mice were housed communally in the Delaware Valley University USDA Small Animal Laboratory for 9 weeks in static hanging cages with biofresh comfort bedding, a tunnel or hut, paper shreds, automatic water, and LabDiet ProLab RMH 1000. The mice were identified as grinders and added to the research protocol. Prior to providing the sunflower seeds and peanuts, the animals were observed to determine the amount of food wasting by grinding. Sunflower seeds and shelled peanuts were then provided to the experimental groups once a week at cage change. No other changes were made to bedding, housing, humidity, lighting, or existing enrichment.

Results

The results for the dental health were insignificant, but the food grinding behavior did decrease in the experimental groups by week 3 while the control group continued to exhibit the food grinding behavior through the end of the study. An unexpected finding was that the female mice generated the largest number of orts in both the experimental and control groups.

Figure 1: Examples of Food Grinding between weeks 1 and 9 in control (top left) and experimental groups

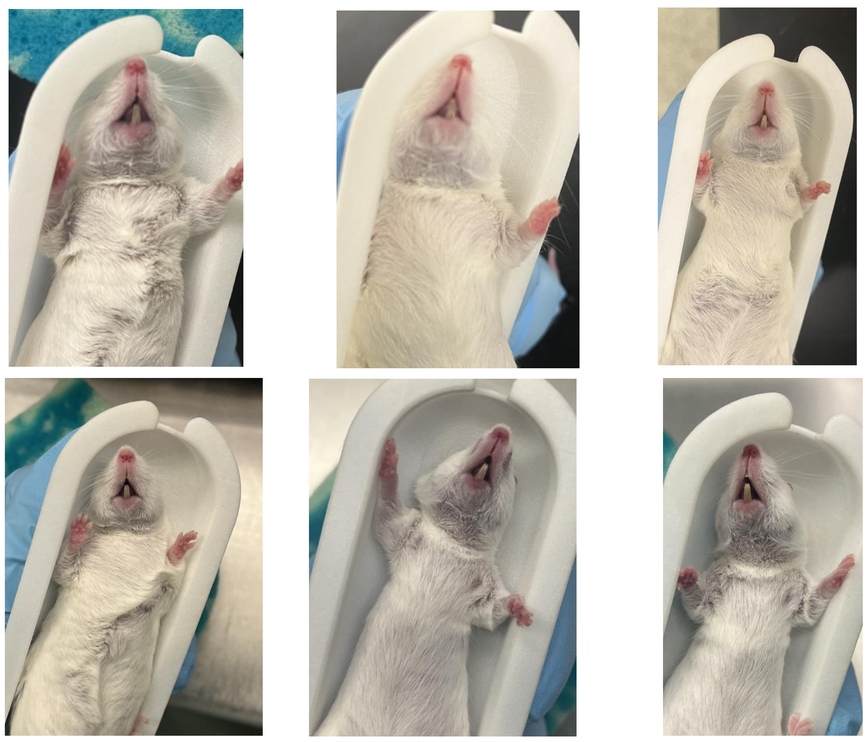

Figure 2: Examples of dental health during the experiment with no changes seen

References

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2. Pritchett-Corning, K. R., Keefe, R., Garner, J. P., & Gaskill, B. N. 2013. Can seeds help mice with the daily grind?. Laboratory animals, 47(4), 312–315. https://doi.org/10.1177/0023677213491403
3. NC3R's Enrichment Database. https://nc3rs.org.uk/3rs-resource-library/evaluating-environmental-enrichment accessed November 24 2024.

Figures

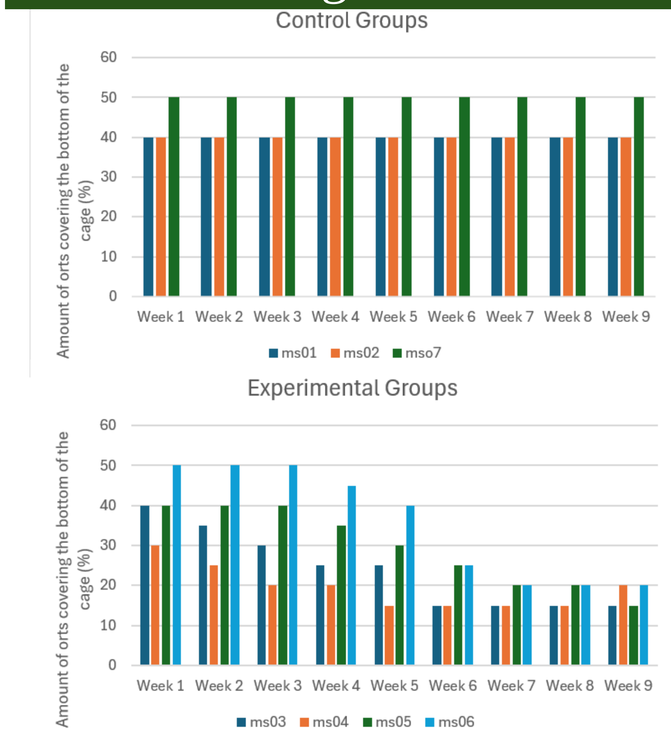

Figure 3: Food Grinding seen over the research period

Discussion

By week 3, the experimental groups exhibited less food grinding that subsequently decreased the overall amount of food provided by the cages. Meanwhile, the control cages continued to required additional food pellets provided every 3-4 days. The mice were observed to eat the sunflower seed hours but struggled to access the peanuts. There were signs of chewing on the shells, but the mice were unable to penetrate fully to reach the peanuts. As time went on, the mice interacted with the peanut shells less and less. No changes were seen in dental health over the course of the experiment.

Conclusion

This study showed that a reduction of food grinding can occur with the introduction of sunflower seeds and peanut shells. The assumption is the impact was mostly from the sunflower seeds since the mice could not access the peanut, but this cannot be proven since the mice were seen chewing on the shell. Additional research could focus on the use of only one of these edible enrichments, the frequency of providing the items, and if edible enrichment negatively impacts the overall weight of the animals. While the animal sex was not a factor for this study, it was shown that it could have impact on the level of food grinding. Future studies could focus on this more. While the micro- and macro- caging environment was not the focus of this study, additional research could be conducted by changing the caging type from hanging to static microisolator and/or individually ventilated caging (IVC). Additionally, researchers could attempt the introduction of different non-edible enrichment