Exploring the use of Timothy Hay with Litter Quality and Nesting Scores in Swiss Webster Mice

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Abstract:

This study looked closely at changes in the environment affected litter quality and nesting scores of Swiss Webster Mice. Conducted over six weeks, the mice were housed under two different setups, individually ventilated Blue Line Tecniplast cages (IVC) or static hanging cage (static) rack, and provided a predetermined amount of timothy hay (Oxbow) to look at if these 2 variables affected the litter quality and nesting scores. The study recorded the amount of food consumed (Lab Diet 5LL2-Prolab® RMH 1800), weighed and photographed the pups, and scored and photographed the nests as well as tracking litter data. While nesting scores did not differ greatly between the two racks, animals with any amount of timothy hay had higher success of producing litters. Also, the IVC rack helped to decrease cannibalism and had larger litters compared to the static rack plus did not consume/waste as much food as the static rack.

Introduction:

Swiss Webster Mice (SW Mice) are a strain of mice that are commonly used in laboratories in the United States because they are a great all-purpose strain. They are an outbred strain of mice, which means they are bred with mice that are not closely related to their parents. SW mice are mainly used in reproductive studies because they are great as recipient and pseudo pregnant mothers because of their superior nurturing abilities. With this strain of mice, the gestation period is about 21 days, which is the same amount of time they are with the doe before being weaned. This study was a randomized block study as the mating pairs were selected at random and placed on to two different housing racks. The pairs were checked daily to make sure proper care and protocols were being followed. Among daily checks, nesting scores were also taken before cage changes and 12 – 16 hours after cage changes. They are scored on a scale of 1 – 5. Figure 1 reviews how the score is determined. The hypothesis of this study was that if Timothy Hay was given to the mating pairs, then it would increase the nesting scores and litter quality no matter the housing setup. A secondary hypothesis was that the IVC rack would also enhance litter quality. This study was approved by Delaware Valley University's IACUC committee.

Figure 1: Nesting Scores

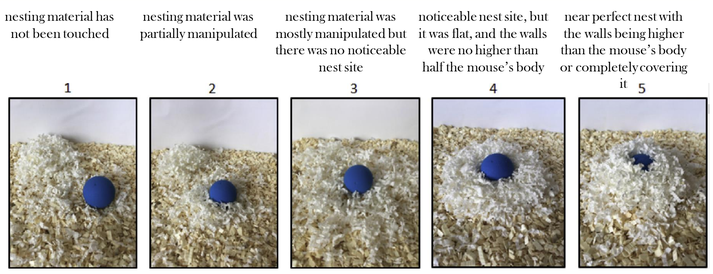

Figure1: Nesting scores as depicted in paper by Zoe Windsor, 2019.

Acknowledgments:

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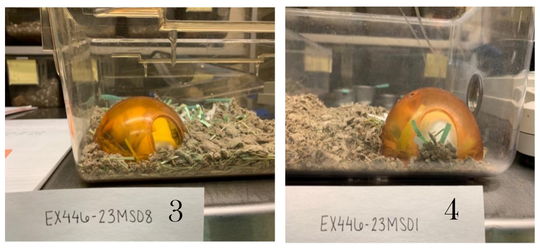
Methods:

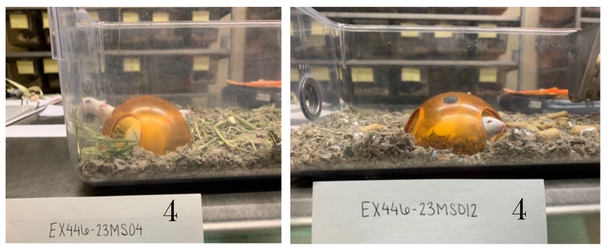
Using random assignment, the 1 male: 1 female mating pair was set up with a certain amount of hay. The amounts of Timothy Hay given was none, ¼ cup, ½ cup, ¾ cup, 1 cup, or 1 ½ cups. Using color coding, each cage was given about ¼" - ½" of bedding (amount varied due to housing setups), shredded paper, plastic hut, 205 - 220 grams of food, water, and the corresponding amount of timothy hay. Initial nesting scores were taken 12 – 16 hours upon initial setup. Cage changes occurred once a week and before the changes occurred, nesting scores were taken again and the food was weighed to see how much was consumed. After three weeks from pairing, the litters started to arrive. Once litters were born, pictures were taken of the pups every three days to track of their health and growth. The bucks were taken away from the does and babies 4 – 5 weeks into the study. The pups were weaned at 21 days of age. They study was completed on April 18th, 2023.

Figure 2: Interpreting Nesting Scores

Pre-Cage Change



Post-Cage Change



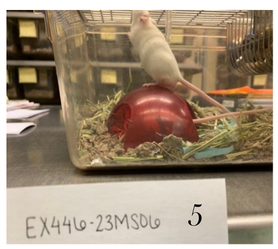


Figure 2: This shows actual nesting scores during the project. The number next to the cage card number is the nesting score assigned based on the guide in Figure 1.

Figure 3: Litter Quality & Growth for Cage EX446-23 MS09

Figure 3A: Showing pups at 3 days old, at this point their ear flap is starting to come away from the head.

Figure 3B: Showing pups at 9 days old, at this point they have thicker fur, and the females may start to show nipples.

Figure 3C: Showing pups at 12 days old, their eyes are now open, and they pups start to eat solid food.

Figure 3D: Showing pups are 18 days old, they are less dependent on mom and can soon be on their own.

Figure 3E: Showing pups at 21 days old, they are now weaned from mom and can be on their own.

Figure 4: Food Consumption

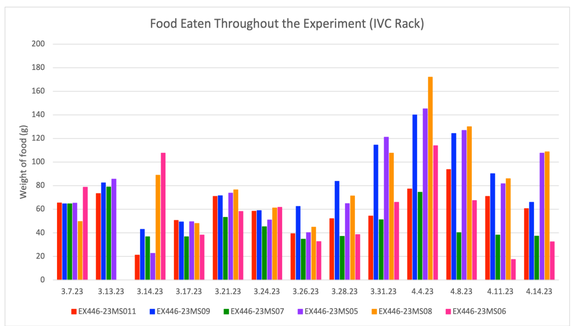


Figure 4A: Showing the amount of food each experimental unit on the IVC Rack consumed over the period of the entire study.

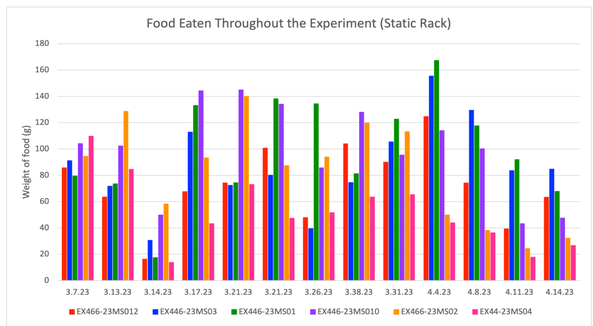


Figure 4B: Showing the amount of food each experimental unit on the Static Rack consumed over the period of the entire study.

Results:

The data regarding nesting scores showed that the average nesting scores for the IVC rack was 3.60 and the average nesting scores for the static rack was 3.89 with the nesting scores improving over time. It was also noted that once the males were removed, the nesting scores were not only better, but consistent suggesting the males negatively impacted the nesting quality. There were two nests visible in some cages consistently between weeks 3 and 4 and the periodically in the other weeks of the study. The data regarding Timothy Hay showed that the cages with ¼ c., ½ c., ¾ c., and 1 c. had litters. It was noted that cages MS09, MS05, MS08, MS03, MS01, and MS02 had babies during the study that were weaned at 21 days. In addition, cages MS09, MS07, MS08, MS03 and MS01 had babies during the study but were not weaned at 21 days, these babies were excluded from the experiment but noted they were born. Litter size on the IVC rack ranged from 6 – 11 pups and litter size on the static rack ranged from 7 – 10 pups. Cage MS02 cannibalized entire litter so no babies were weaned. The data regarding the food intake showed that the breeders on the static rack had an average food consumption of 82.37 grams of food roughly every 2 – 4 days. Breeders on the IVC rack had an average food consumption of 69.17 grams of food roughly every 2 – 4 days.

Discussion & Application:

It can be determined that the nesting scores of the breeders did not differ much between the two racks and the experimental units on each rack themselves. It can be determined that giving Timothy Hay in quantities of ¼ c., ½ c., ¾ c., and 1 c. were the most successful for having litters. It was noted that with the data gathered, the IVC rack tended to be more tolerant of runts in the litter when compared to the static rack's tolerance to runts. It can be determined that the IVC rack helps to decrease cannibalism. Cannibalism was observed on the static rack for cage MS02, between days 9 and 12, 6 of the 7pups were eaten and the last pup only made it to 16 days old. This is rare for mice to eat their young at such an old age, but it was recorded that the last baby looked sick. The mother was euthanized at the end of the study due to health issues and her back starting to curve. There was also data showing that breeder mice on the IVC rack tended to have larger litter's the second time around whereas the static rack tended to have similar size litters to the first litter they had. With the data gathered about their food consumption the IVC rack did not consume/waste as much food as the static rack. It can be noted that the three cages on the IVC rack, MS09, MS05 and MS08 that had litters had the highest averages for food consumed. The same cannot be said about the static rack as the three cages that had litters, MS03, MS01 and MS02 did not consume the highest average of food, MS010 consumed more than MS02 as it did not have a litter.

Conclusion:

With all the data presented and the background knowledge gathered, this research project did show that Timothy Hay does help nesting scores and litter quality. With further studies, there can be a more focused look at determining the best amount of Timothy Hay, but this was not possible within the time constraints. This was a great pilot study, but further experimentation will be needed to further determine the full beneficial effects of Timothy Hay has on nesting scores and litter quality in Swiss Webster Mice as well. Also, further studies could look at variations of nesting scores and litter quality further between IVC racks and the different types of static caging as well as the impact of bedding types and additional enrichment such as huts, nestlets, and more.