

Providing Enrichment Tools to Rodents that are Food-Chewers

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One of the more significant developments in laboratory animal care over the past several years is the attention being paid to "psychological well-being." Once only considered for nonhuman primate species, efforts are now being made to assess the psychological well being of other species in the animal facility, including rodents. It is known that animals that are "stressed" are altered physiologically, and may provide aberrant research results. Indications are that this assessment may need to include more psychological and sociological considerations such as loneliness, boredom, and disruption.

An unusual behavior noticed in some mouse colonies is mice chewing up food pellets but not eating them, letting the remaining food fall into the bedding. At our institution, we call mice displaying this behavior " food chewers." Food chewers create extra work for technicians because the ground-up food increases the amount of material in the cage, requiring more frequent cage changes. This extra material can also make contact with the sipper tube portion of the water bottle, causing it to leak and flood the cage. When mice are housed in auto-ventilated caging, chewed up food can interfere with the ventilation systems by blocking the airflow into the cages, decreasing the fresh air exchanges that mice should receive. It is possible that food-chewing behavior is stress related. These mice may need to have more psychological and sociological enrichment tools to help reduce this atypical, but not uncommon mouse behavior. Our assumption was that food-chewing behavior is a rodent display of boredom and the specific objective of this study was to see if offering alternative enrichment measures in their cage could reduce food-chewing behavior in laboratory mice. Our proposal was to provide mice that are food chewers with Gumabones® (Bio-Serve, Frenchtown, NJ) or Alpha-dri®/bed-o'cobs® (Shepherd Specialty Paper, Watertown, TN/The Andersons, Maumee, OH). Gumabones are nylabones designed specifically for rodents. Alpha-dri/bed-o'cobs is a cellulose and corncob bedding mixture. It is designed to help absorb and control ammonia levels, last longer with fewer changes, and be dust free, and is it considered an ideal bedding for environmental enrichment. The concept is that the mice will be busy separating the corncob from the cellulose material, and using the cellulose portion to create a nest. It is our hope that these in-cage provisions will limit food-chewing behavior, and thus improve the circumstances for both the mice and the animal care staff. For the mice, these enrichments may decrease animal distress so that reliable data will be obtained for the laboratory researchers. Reduced food chewing behavior will also make the technician's job easier, as labor will be reduced and services will be more cost effective.

Two trials were done, Trial 1 and Trial 2. Trial 1 had a total of 24 boxes of which 14 boxes were single housed mice and 10 boxes were groups of 3 mice.

Each box went through three different environmental arrangements: Regular corncob bedding, addition of a Gumabone to the box with corncob bedding, and Alpha-dri/bed-o'cobs. Each box started with 300 grams of rodent chow and 100 grams of regular bedding or 75 grams of Alpha-dri/bed-o'cobs. The amount of food left in the feeder and the total amount of food and waste left in the bedding were measured every time the cage was changed. In our institution, technicians change the ventilated cages every 14 days or as needed to ensure humane conditions and comfort of the animals. The purpose of the 1st trial was to see how much food the mice chewed between measurement collections. During the period of 4/14/05 – 6/10/05 the first set of the first trial was performed using just the regular corncob bedding without any enrichment tools. During this set with corncob only, boxes had dirty bedding from other cages added. This occurred from 5/13-5/27, and was an effort to initiate food chewing behavior. Once the behavior started, it never stopped even when clean boxes were used. From 6/10/05 – 8/1/05 the second set used regular corncob bedding with the addition of a Gumabone in each cage. From 8/1/05 – 9/2/05, the third set was performed using the Alpha-dri/bed-o'cobs bedding. Once the information was collected, weekly averages were determined and comparisons were made between the three environmental conditions.

The second trial had 18 boxes, 9 boxes were single housed mice and 9 boxes were housed in groups of 3. Each row, on the rack, held 6 boxes. Three of those 6 boxes had single housed mice and 3 held group housed mice. Each row experienced one of three different environmental enrichment tools. The environmental conditions were rotated and changed each week, for 3 weeks so that each cage experienced each of the three environments. Each box had pre-measured bedding and food each day and information was collected daily for 4 days. Room humidity was also recorded to see if humidity levels might play a role in food chewing activity.

The mice chosen for this study were of CD-1 stock. CD-1 mice were chosen because they are well known food-chewers at our institution. These mice are used for our sentinel and pathogen-screening program. If food-chewing behavior could be reduced, the technicians would have to open the cages less frequently, thus limiting the possibility of any cross-contamination. The use of soiled bedding to stimulate food-chewing behavior was based on the fact that this activity was seen in the sentinel mice, which receive soiled bedding as a means for their exposure to colony animals.

The data from the first trial revealed that the activity of food chewing was actually greater with the environmental enrichment tools than without them. (see Figures 1, 2, and 3) The single-housed mice displayed a gradual increase in food-chewing behavior over the eight-week period with corncob bedding only. Food chewing then increased over the eight-weeks with a Gumabone present. When the Alpha-dri/bed-o'-cobs bedding mixture was used, the behavior was reduced slightly, but not down to the levels observed in the initial set. The group-housed mice also displayed the gradual increase in food chewing behavior during the

initial months with the corncob bedding. When Gumabones were added, these mice also experienced an increase in food chewing, with a gradual increase initially, and then a dramatic increase at the end of the eight-week period. Conversion to the Alpha-dri/bed-o'cobs mixture diminished the increased food chewing behavior seen at the end of the Gumabones study period, but only for the first few weeks.

During Trial 2, information on the room humidity was collected and compared to the levels of food chewing to determine if humidity might affect this behavior. This assessment was made because it had previously been noticed that food-chewing behavior was more apparent during the summer months than in the preceding spring or subsequent fall months. Based on the results of Trial 2, it appears that food-chewing behavior does, in fact, correlate with room humidity (see Figure 4). As the humidity decreased over the three-week period, so did the abnormal chewing behavior, regardless of the enrichment status of the cage. Because of this development, it was difficult to determine if either of the two enrichment tools independently made a difference in the behaviors. It appeared that some mice had an individual preference between the enrichment tools, (see Figures 5 and 6). For example, only the Alpha-dri/bed-o'cobs reduced Single-B's chewing behavior, whereas both enrichment tools reduced Single-I's behavior. Unfortunately any conclusions beyond the concept of individual preference are mere speculation because of the overall decline of food-chewing behavior with time (but consistent with the decrease in relative humidity).

When comparing both trials as a whole, it appeared that the Gumabone was the least favorite housing option by mice in both single-housed and group-housed boxes. They appeared to chew more food overall for both trials when the Gumabone was present. The elevation in food-chewing behaviors at the end of the eight-week period, as seen for example in the group-housed mice in Trial 1, may indicate some effective, but only short-term enrichment. The surprising low food chewing behavior in both single and grouped housed mice at the beginning of Trial 1 may be due to them receiving "enrichment" from the novelty of their new surroundings. It may also be related to humidity, as indicated in the results of Trial 2, since the first 8 week period was from May-June, as compared to the June-September time frame for the sets with the environmental enrichment tools. More research needs to be done to understand and reduce food-chewing behavior; our results indicate that humidity should be observed closely, and that the Alpha-dri/bed-o'cobs holds some promise.

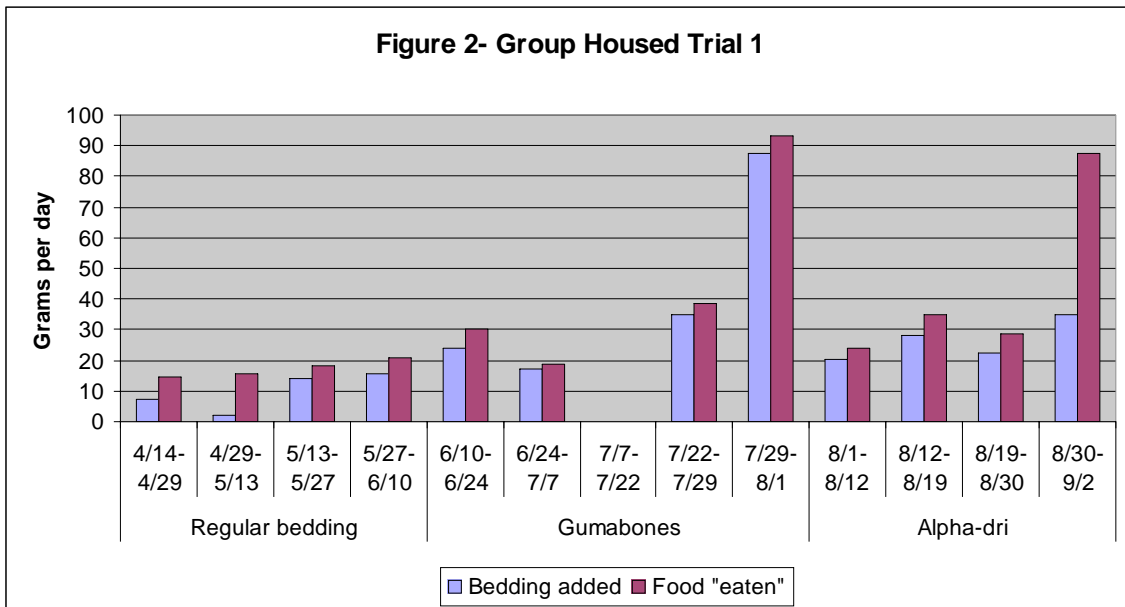
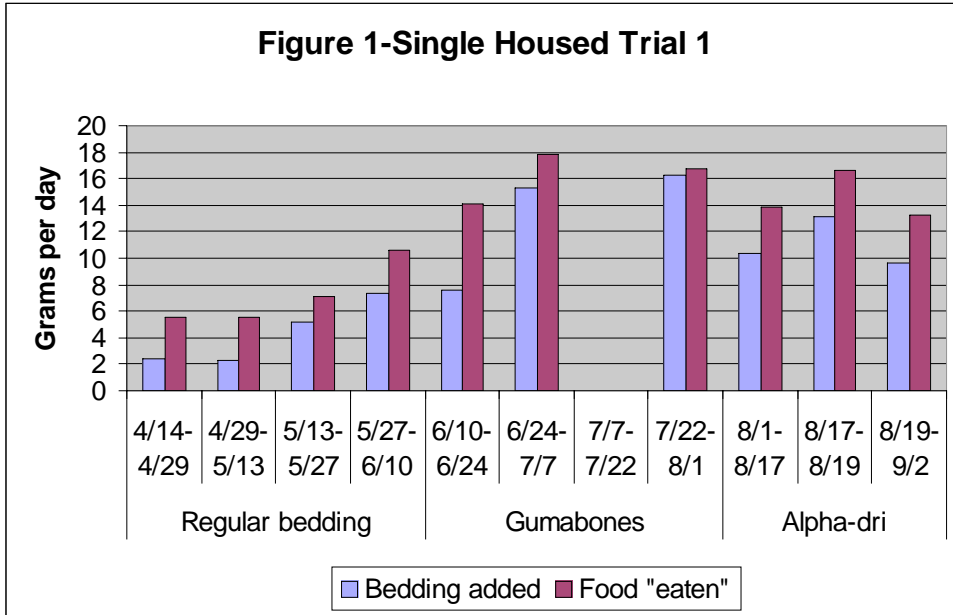


Figure 3- Both Groups, Trial 1

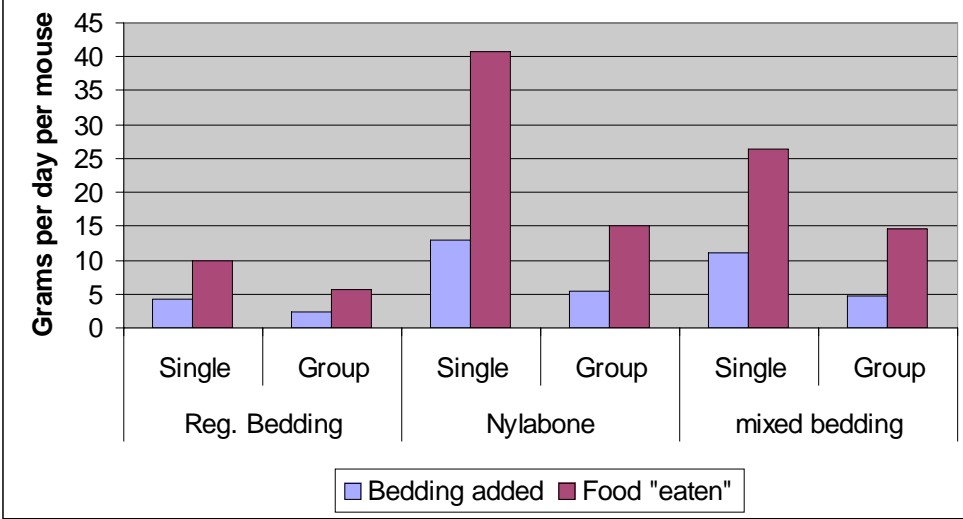


Figure 4- Comparing Humidity during Trail 2

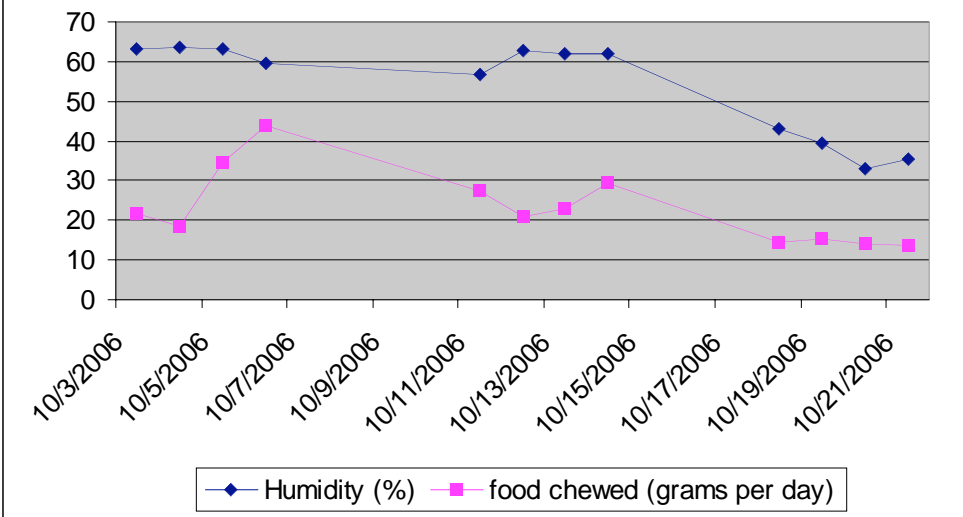


Figure 5- Single housed, Trial 2

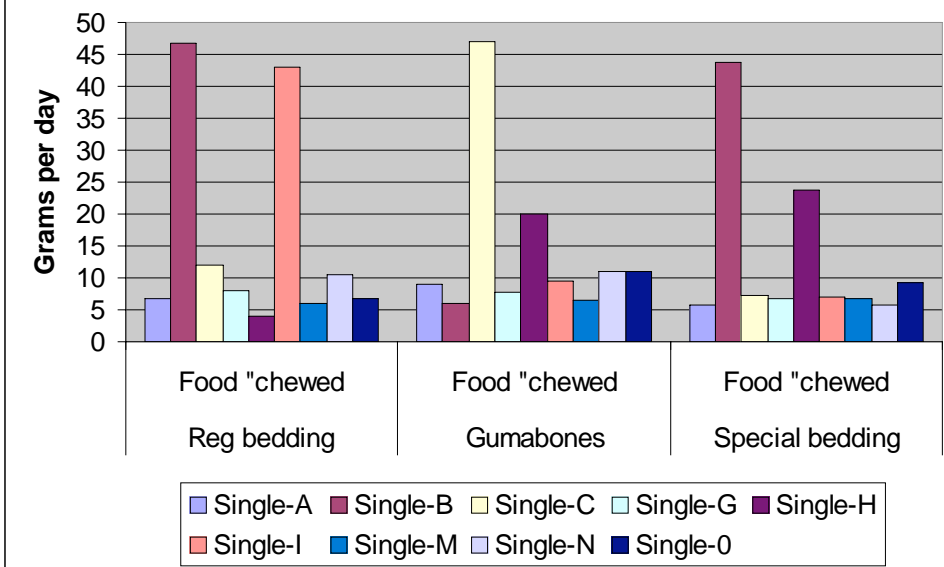


Figure 6- Group housed, Trial 2

