

Environmental enrichment as factor in improving the welfare of laboratory mice

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Introduction

Welfare is the status of an animal and the quality of its existence, which consists of the satisfaction of all its needs, not only in terms of food, good health care, adequate breeding rooms, but also its requirements arising from psychological needs, manifested by species-appropriate behavior (Kończak & Bodak, 1999). The definition given indicates how many factors animal welfare depends on and what should be provided in laboratory facilities for proper maintenance of laboratory mice. One of the factors that improve animal welfare is environmental enrichment.

Enrichment is any change we make to an animal environment that is designed to stimulate cognitive, sensory, physical and social stimulation. The most commonly used enrichments in research work with rodents are shelters in the form of houses and tunnels, nesting material and reels. (Biała & Kowalczyk, 2021)

Methods

In our study, we focused on three mouse strains bred in the Animal Facility of Faculty of Biology at the University of Warsaw: C57BL6/Tar, F1(C57BL6/Tar x CBA/Tar), and SWISS/Tar:SWISS. A group of 30 mice, 15 females and 15 males, were collected from each strain. The total number of animals given for observation is 90 individuals. The age of the animals varies between 2 and 5 months. The mice were kept in group cages of 5 individuals each.

The observations were carried out for a period of 4 weeks. Every week there was a replacement of cages and enrichments with clean ones.

The environmental enrichments that were used in the observations were divided into two groups: toys and nesting material. The group of toys included: paper tubes, paper houses and wooden sticks. The nesting material group included: nesting material made from strips of aspen wood, rolls of cotton wool and rolled pieces of tissue. All enrichments were sterile and clean before use.

Used materials



Photo 1. Paper tubes

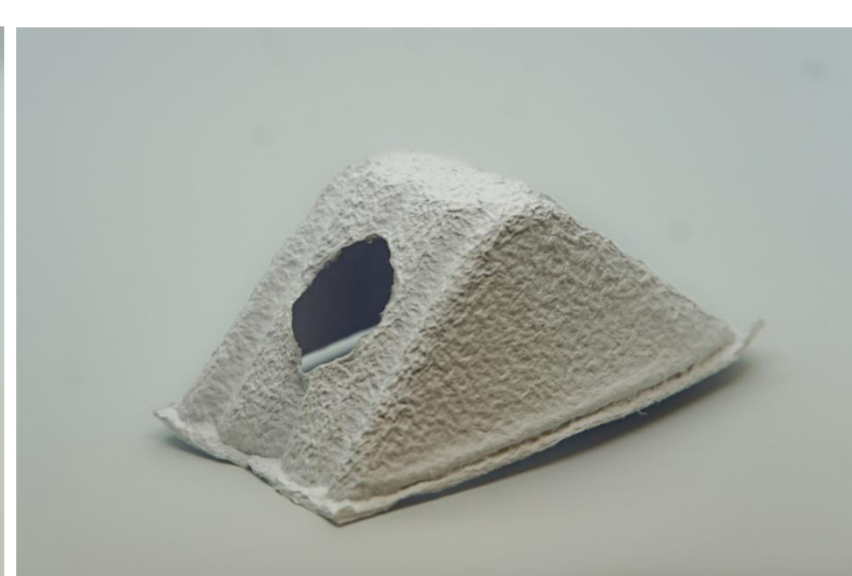


Photo 2. Paper houses



Photo 3. Wooden sticks



Photo 4. Strips of aspen wood



Photo 5. Rolls of cotton wool



Photo 6. Rolled pieces of tissue

Results

C57BL6

When viewing the cage, it was found that the paper tubes were the most exploited. They had very many gnawed holes, and some were completely destroyed. The paper houses served the mice mainly as a hiding place and were gnawed to a small extent. The least used environmental enrichment was wood sticks. There were no visible signs of chewing. For nesting materials, mice preferred strips of aspen wood. They spent a great deal of time in it and it was formed into nests. Rolled tissue was largely developed, but was not used for nest building in every cage. On the other hand, the cotton wool rollers were not torn. The mice were not interested in this type of enrichment. There were no significant differences in behavior between males and females.

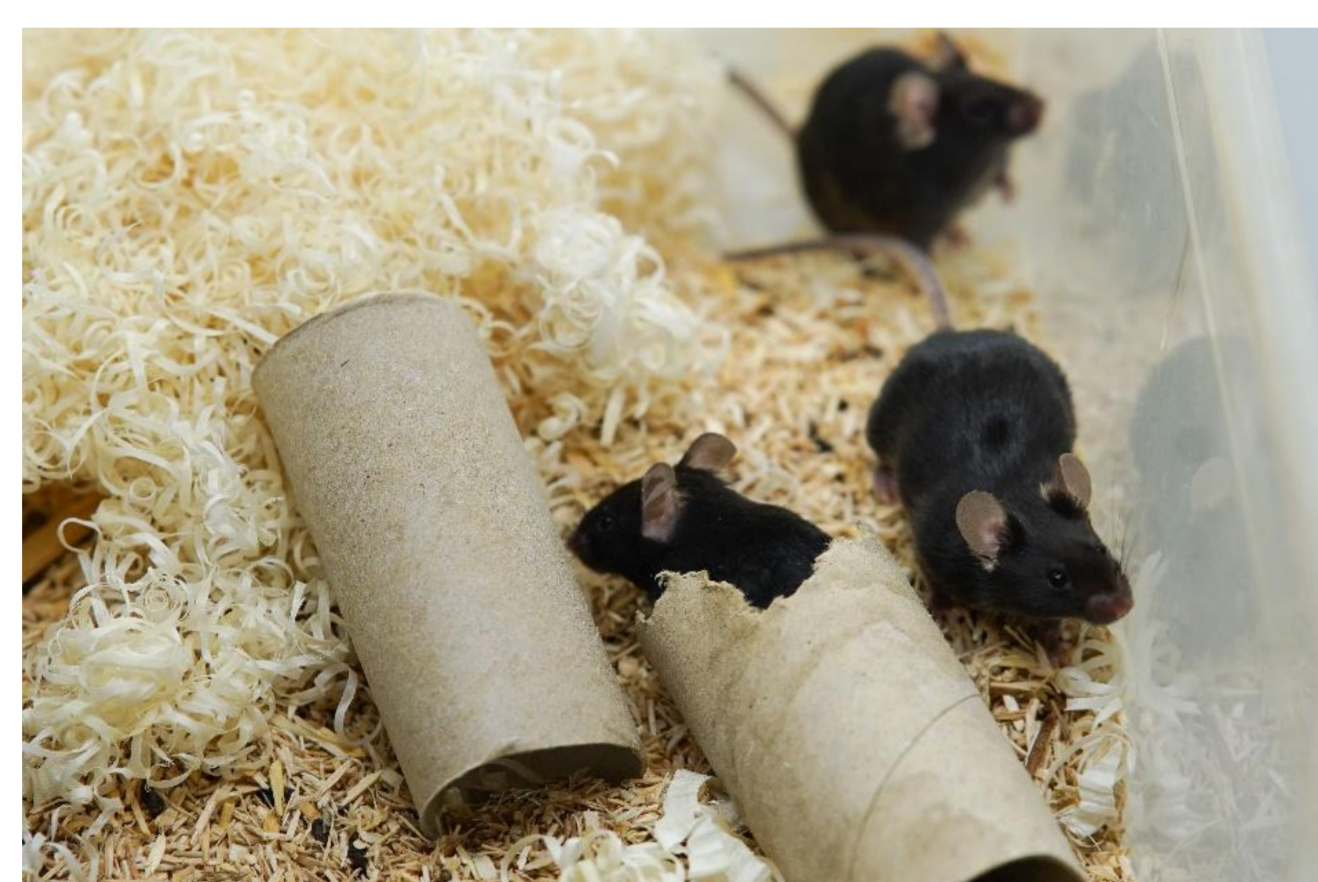


Photo 7. C57BL6 strain mice with enrichments

F1 (C57BL6 x CBA)

Among the toys, the most popular were paper tubes, which upon inspection were badly damaged and almost always in a different place in the cage than originally. The paper houses were mainly used for shelter and only slightly damaged. Mice showed the least interest in wooden sticks, which were only slightly nibbled in a few cases. F1 (C57BL6 x CBA) mice eagerly used two of the three types of nesting materials: nesting material made from strips of aspen wood and rolls of cotton wool. It was these materials that were most commonly used to build nests, by tearing or unrolling them. The animals made only limited use of the rolled pieces of tissue. There were no significant differences in behavior between males and females.

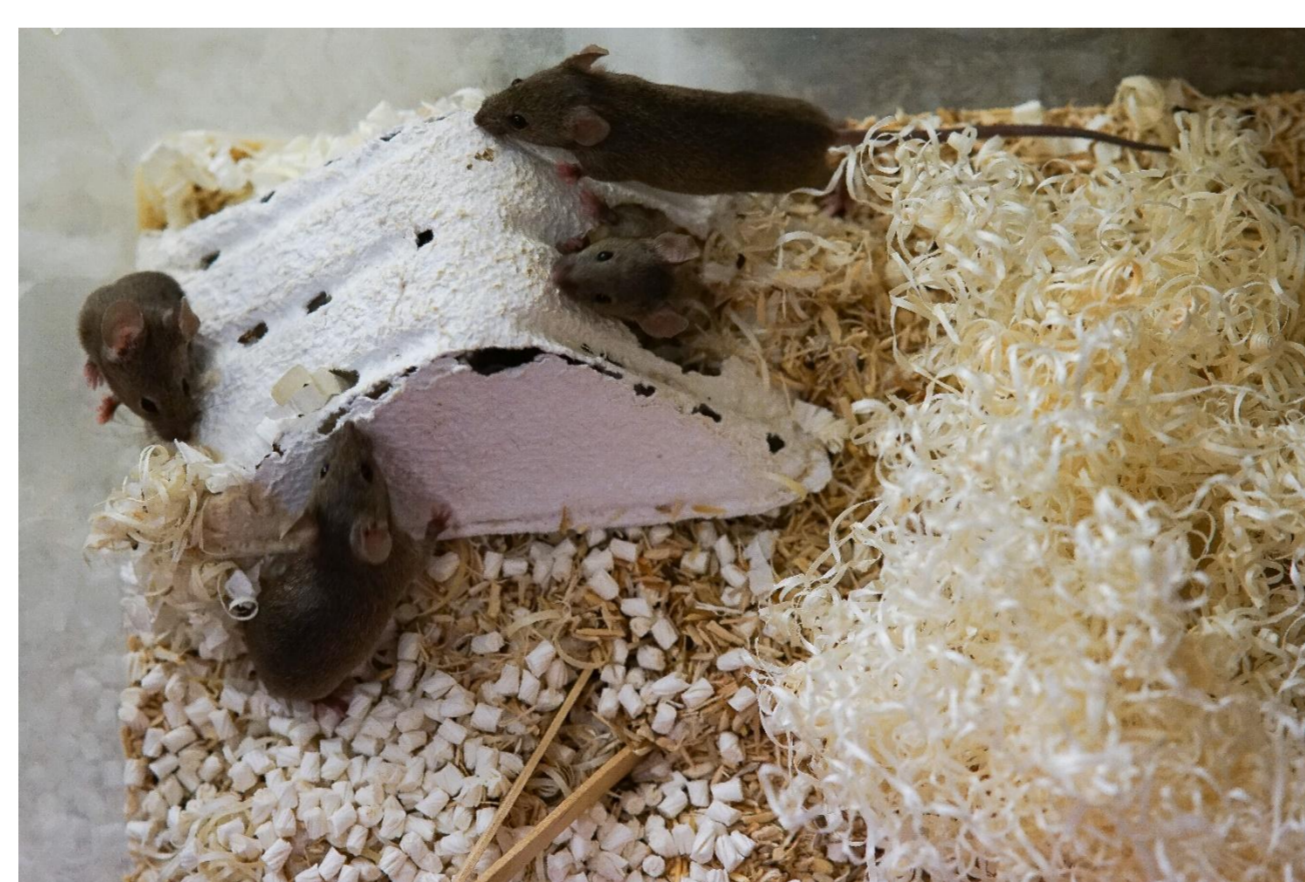


Photo 8. F1 (C57BL6 x CBA) strain mice with enrichments

SWISS

Tubes and paper houses attracted the most interest among the mice's toys. The paper houses were a resting place for the animals and they spent a lot of time there. Paper tubes were largely bitten and moved to different places in the cages. Wooden sticks were not used by the animals. Wads of cotton wool were also practically not used. The mice showed no interest in tearing the cotton wool and making nests out of them. However, rolled up paper was very attractive to the animals. Upon entering the cage, they were immediately interested and eagerly played with the enrichment. During the cage change, it was noted that both the rolled tissue and aspen wood strips were combined and formed a nest. There were no significant differences in behavior between males and females.



Photo 9. SWISS strain mice with enrichments

Conclusions

Environmental enrichments have a positive effect on maintaining high welfare of laboratory animals and improving breeding parameters. They also activate animal behavior and increase animal diversity. Animals can make activity choices and take control over the use of a given environment. The use of enrichment has also been shown to minimize the incidence of undesirable behaviors such as aggression and stereotypies. Another important aspect is the maintenance of species-typical behavior (e.g., nest building, chewing).

As a result of observations, it can be concluded that not all enrichments suit all animals. Therefore, one should always pay attention to the preferences of animals rather than animal caretakers in selecting environmental enrichments.

Acknowledgements

- Kończak, R., & Bodak, E. (1999). Dobrostan zwierząt i kryteria jego oceny. *Medycyna Weterynaryjna*, 55(03), 147-154.
- Biała, D., & Kowalczyk, P. (2021). Urozmaicenie środowiska myszy i szczurów w badaniach naukowych. *Kosmos*, 70(4), 721-730.