

## SHORT COMMUNICATION

### PREFERENCE TESTS WITH RODENTS TO ASSESS HOUSING CONDITIONS

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#### Introduction

Guidelines have been formulated by the European Community (EC 1986) to cover housing conditions for laboratory animals. These guidelines are based essentially on common practice of housing laboratory animals and on limited data concerning relations between housing conditions and either animal growth or development of pathologies. Further information on this subject is required to optimize housing conditions of laboratory animals.

One method of research to gain such knowledge is the use of preference (choice) tests. Preference tests have been used to assess housing conditions of various animal species, such as farm animals (Dawkins 1976, Van Rooijen 1982) and laboratory animals (Weiss *et al* 1982, Baumans *et al* 1987). Animals are offered various housing conditions and their relative preference or avoidance is determined. It is assumed that preference for a certain housing condition indicates a move towards fulfilment of the animal's ethological needs and thus an increase in its welfare. However, as indicated below, results of preference tests should be interpreted with great caution.

#### Interpretation of the outcome of preference tests

Relative preference for a given housing system is usually expressed in quantitative terms, ie the relative duration of dwelling in that system. However, information about the animal's behaviour is essential to interpret dwelling profiles. Activity patterns can be determined for this purpose. Dwelling profiles and activity patterns should be interpreted against the basics of the species- and strain-specific behaviour. Using this approach, results of preference tests may provide information about causal relationships between welfare of animals and housing conditions.

Reliable choice tests can only be performed with animals showing explorative behaviour. With the use of preference tests consisting of four cages connected by passage tubes, the number of passages per 24 hours can be more than 100 for rats and more than 1000 for mice. By definition, preference for a specific housing variable can

only be valid after the animal has explored all possible alternatives.

Choice tests with mice or rats are usually performed using one animal per system. *Mice and rats are typically social species, living in hierarchically structured groups. The dominance of some individuals over conspecifics probably interferes with the free choice behaviour of the animals when put together in the preference test. Possibly, the dominant animal would be the only one able to make a free choice between all alternatives. Thus the animals are tested individually. This may limit the value of the data when extrapolating to a socially living group of these species. Moreover, solitary housing of the animals during the test period could be stressful and thereby cause biased results.*

Behaviour of rodents, and possibly also their preferences for differing housing conditions can be influenced by bioperiodicity. Activities of rats and mice display a circadian rhythm, thus a choice test should cover at least 24 hours. To obtain more accurate preference data, more than one complete biorhythmic cycle should be run.

Early experience of animals may also influence choice behaviour. If possible this bias should be corrected by appropriate experimental design.

Choice behaviour can be biased by positional factors in the experimental room such as noise, light or air flow. These factors can be different for each test cage of the choice system, and thereby influence choice behaviour. By systematically turning the choice system during experimentation, or turning between each experiment with another animal, the effects of positional factors will average out, and the relative preference measured then is unbiased. This should be proven by demonstrating that for a choice test with identical housing conditions, group mean preferences are similar for each condition.

In a preference test, the animals can only display relative preference or avoidance. The experimenter determines which conditions will be varied in the test system. The animals can merely choose between these pre-set alternatives. Preference expressed by the animals can actually imply a low degree of avoidance. Again, it is clear that knowledge of the basics of species- and strain-specific behaviour is essential to interpret the outcome of preference tests.

Finally, it should be realized that unequivocal preference for a specific housing condition is not necessarily associated with improved welfare in the long term. Preference may reflect short-term rather than long-term gains in health and well-being.

Below, we present some preliminary results of our preference tests with mice and rats.

#### **Assessment of preference by mice for clean or soiled cages**

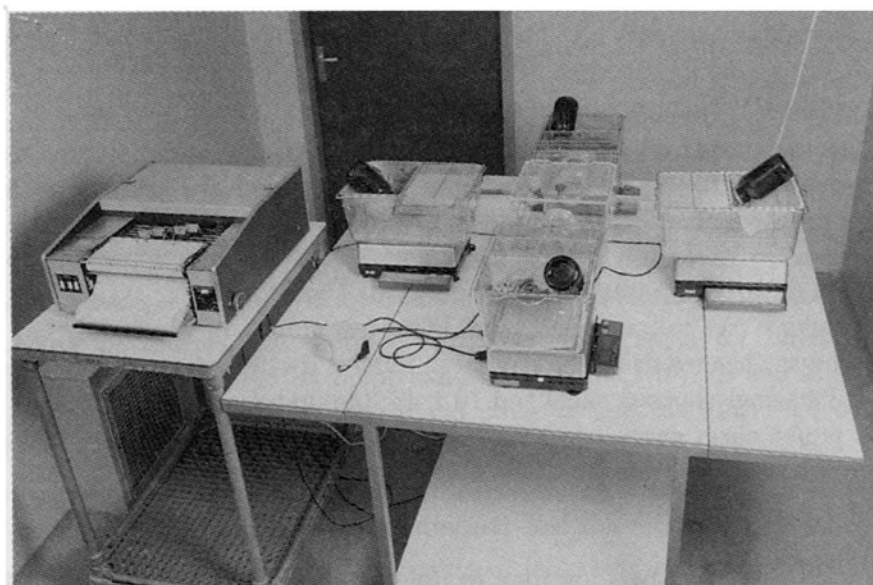
Daily versus weekly cage changing depresses body-weight gain in mice housed individually (Beynen & Van Tintelen 1990). Possibly, frequent cage changing is stressful, leading to retarded growth. It could then be hypothesized that mice would prefer soiled cages to clean cages. This hypothesis was tested with the use of a choice test consisting of two Macrolon Type I cages with a layer of sawdust as bedding. The cages were connected by a short passage tube. For control animals, both cages of the cage set were changed daily; for test animals one cage was changed daily and the other was allowed

to become soiled. The presence of each mouse in either the clean or soiled cage (for control animals this cage was also clean, that is sham-soiled) was scored four to seven times daily during the light period. The experiment was performed with four-week-old outbred, female NMRI mice, housed either singly or in groups of four animals.

Table 1 shows mean relative dwelling times for each day in the sham-soiled cage (control group) and true-soiled cage (test group) for a period of 10 days. For the entire period, day mean relative dwelling times ( $\pm$  SE) for the sham-dirtied cage in the control groups were  $53 \pm 3\%$  (singly housed mice) and  $54 \pm 8\%$  (group housed mice). These values do not differ significantly from 50 per cent. Thus, the choice system and experimental procedures can be considered valid. In the test groups, of which only one cage of the cage set was changed daily, the day mean relative dwelling times of the soiled cage were  $51 \pm 3\%$  (singly housed mice) and  $10 \pm 4\%$  (group housed mice). Thus, it appears that mice prefer clean cages when they are housed in groups, but do not have any preference when housed singly. This outcome is unexpected on the basis of our hypothesis.

**Table 1** Relative dwelling time in the sham-soiled (control group) and true-soiled cage (test group) by female mice housed either individually or in groups of four animals.

Day	Individually housed mice		Group housed mice	
	Control group (n=10)	Test group (n=10)	Control group (n=5)	Test group (n=5)
	Group mean relative dwelling time in sham- or true-soiled cage (%)			
1	60	60	67	30
2	40	53	52	9
3	55	45	54	21
4	40	30	44	12
5	63	53	50	9
6	58	53	88	2
7	43	47	57	5
8	58	63	58	6
9	62	55	41	6
10	47	55	24	4



**Figure 1** Choice test system for rats consisting of a central cage and four test cages placed on electric balances.

#### **Assessment of preference by rats for various types of sawdust bedding**

The choice test system for rats consisted of four Macrolon Type III cages and a central cage connected by passage tubes. Each test cage was placed on top of an electronic balance connected to a recorder (Figure 1). On the basis of the recordings, dwelling times per cage were calculated. When the choice system consisted of four identically equipped Macrolon Type III cages, relative dwelling times in the four cages were found, in percentages, to be  $19.6 \pm 1.8$ ;  $21.2 \pm 2.0$ ;  $23.2 \pm 2.1$ , and  $26.2 \pm 1.9$  (means  $\pm$  SE,  $n=85$ ). Thus, about 10 per cent of the total time was spent in the central cage. The choice test can be considered valid as there is no preference for any of the cages when they are identical.

We carried out a preliminary study using this apparatus to assess preferences for various types of bedding material. During the pre-experimental period of two days, the test cages were identical and had removable wire mesh floors. Then, for the two day experimental period, each test cage contained one of four types of sawdust bedding. The bedding materials were classified according to particle size (small, medium, large, extra large). For each rat, the difference in relative dwelling time per cage after replacement of the wire mesh floor by one of the types of bedding was calculated. The results in Table 2 indicate that the rats preferred the large sized bedding particles but avoided the medium sized particles. Replacement of the wire mesh floor by bedding of either small or extra large particle size had no clear impact on dwelling time. These data are difficult to interpret because they seem inconsistent. This may be due to preferences being related



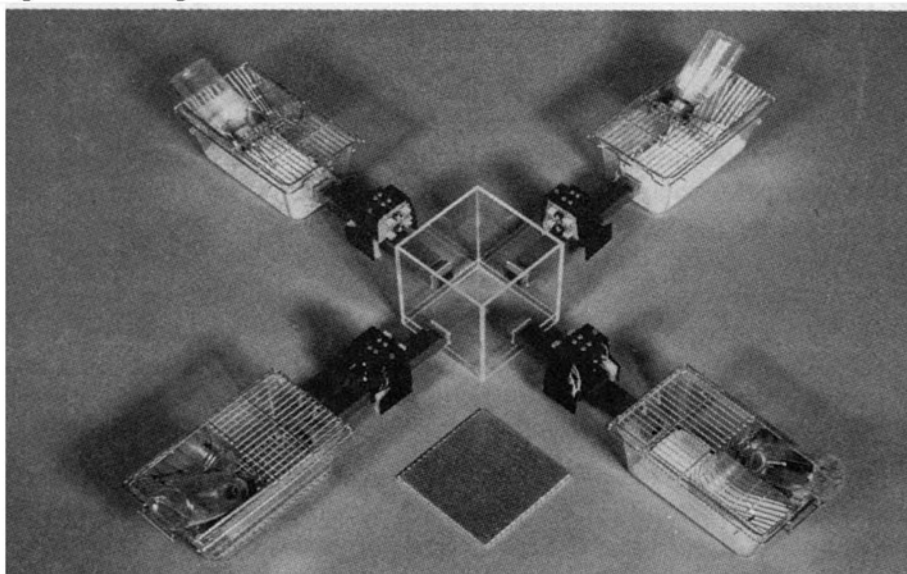
to some characteristic of the bedding material other than particle size. The present study does not provide solid information to enable selection of bedding material for housing rats. However, it is clear that rats may prefer certain types of bedding. Further investigations are necessary to provide information that can be implemented in practice.

**Table 2** Mean change in relative cage occupancies by rats after replacement of a wire mesh floor by various types of bedding material (n=24).

Particle size of bedding material	Change of relative dwelling time (%)
<i>Small</i>	+ 4
<i>Medium</i>	- 12
<i>Large</i>	+ 13
<i>Extra large</i>	- 8

#### Assessment of preference by mice for various types of bedding/flooring material

For mice, the choice system shown in Figure 2 was used. The system consisted of a central cage and four Macrolon Type I test cages. Passage tubes contained photocells and all movements were photo-electrically detected and recorded on a computer. This allowed dwelling profiles to be calculated. Detailed behaviour was studied with the help of videotaped recordings.



**Figure 2** Choice test system for mice consisting of a central cage and four test cages with recording photocells in the passage tubes.

We tested the validity of this system in an experiment with identical test cages. The observed dwelling times in the test cages, in percentages, were  $22.0 \pm 2.9$ ;  $24.2 \pm 3.5$ ;  $22.4 \pm 3.4$ , and  $22.0 \pm 3.1$  and in the central cage  $9.4 \pm 0.9\%$  (means  $\pm$  SE,  $n=30$ ). Thus, since the animals did not prefer any of the identical test cages, the choice system is considered to be valid.

In preliminary experiments, we measured preferences for various bedding/flooring materials such as small particle sawdust, large sized woodchips, a wire mesh floor and filter paper cuttings. Table 3 shows that the mice displayed a preference for dust-free, coarse-threaded but soft bedding materials. This may be related to the fact that these materials provide isolation and can be used for nestbuilding, as was illustrated by the analysis of video recordings. Again it is clear that preferences for the type of flooring can be demonstrated in rodents.

**Table 3** Mean relative dwelling time shown by mice in a choice test with different types of bedding/flooring material ( $n=20$ ).

Type of bedding/flooring material	Relative dwelling time (%)
<i>Sawdust</i>	16.8
<i>Woodchips</i>	22.1
<i>Wire mesh floor</i>	17.8
<i>Filter paper cutting</i>	43.3

### Conclusion

Our preliminary studies suggest that choice tests with rodents can produce unexpected results. This may stimulate further research, including the comparison of various housing conditions. However prior to applying the results of choice tests it must be clear that the results are not biased by the various limitations of the choice tests.

### *Animal welfare implications*

It is assumed that an animal's preference for a certain housing condition coincides with increased welfare, and thus movement towards fulfilment of its ethological needs. This would imply that preference (choice) tests with various housing conditions can be used to identify those conditions that are optimal from a welfare point of view.

The relative preferences, or avoidances, determined by these choice tests may eventually contribute to practical improvements in housing conditions so that the animals will attain optimum welfare within the restrictions imposed by their use as experimental subjects.

**References**

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