A method to improve the housing of breeding rats used to produce pups for tissue

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Introduction

Our facility houses a small colony of Sprague Dawley rats whose purpose is to supply pups at specified time points after they are born for neurophysiology and related research. Historically a male and female were put into a grid floor cage for seven days or until the female plugged. The male and female were then separated and housed individually in solid floor cages with a wood shaving substrate. The male remained on his own until used for further meetings and the female remained alone until she had littered down. Once her pups were weaned, she was single housed until she was put back in the grid floored cage to mate.

The system had been set up originally to allow plug date identification but when we talked to the scientists it was clear that they did not need this information. They simply needed an idea of when litters might be born and therefore when the pups would be available for *ex vivo* work.

What did we want to do and why?

Rats are considered highly social animals (Research Animals Department, RSPCA). In the wild, they live in groups and develop complex social structures. Regrouping rats is considered stressful (Suckrow 2015). We therefore wanted to keep animals in monogamous pairs so that they could develop a social bond that was not being repeatedly disrupted and where they could be housed on solid floors all the time as we felt that this would provide better Animal Welfare (Manser 1995).

We had to be able to produce pups efficiently. We had to identify whether the females were pregnant and their likely date for littering. To help with planning and to provide tissue regularly, the scientists wanted 2 litters born each week ideally with several days between each litter.

What did we do?

We bought in six-week-old male and female Sprague Dawley rats from Charles River Laboratories (Margate). They arrived in boxes of ten. Animals were housed in the groups that they had arrived in, until they had recovered from transport. They were acclimatised and had then reached a size and weight considered big enough to breed (as judged by an experienced technician).

Some animals were kept on the previous system to ensure that a continuing supply of pups were available to the scientists. At the same time, we set up an initial group of 3 stable pairs (Figure 1). These animals were housed in RC2R cages. Over time additional animals were set up as pairs as the trial progressed and currently there are eight monogamous pairs in use.

We tried two methods of assessing pregnancy which were manual palpation and visual inspection. The latter was sufficiently accurate for the needs of the scientists



Figure 1. Cages on rack are joined using red tubes inserted through holes cut out of the side of the cage bases, towards the back.



Figure 2. Female with pups in double cage, with male sleeping in adjoining cage

and was considered a lot less stressful for the animals. Health and welfare of the animals, pregnancy rates and number and sizes of litters born were monitored.

To increase the area available to a pair of rats, two cages were linked together (Figure 2) by means of a polycarbonate red rat tube from Datesand. To do this the end of the tube was placed against one side of a cage base 3 cm from the back of the cage and was drawn around with a marker pen. The same was done on the next cage base but on the opposite side. A 5 mm drill bit was used to drill a hole big enough to insert a jigsaw blade and then the marked circles were cut out, ensuring that they were cut accurately to be opposite each other so the tube could be inserted from inside one cage and across to the other. The holes were filed



Figure 3. Plastic grid in the tube to join two cages.

to ensure they were smooth and that the tube fitted snugly. The tubes are not fixed and can be easily slid into place and then pulled back out when cages need to be separated for cleaning.

It was noted that females in pairs began to synchronise their oestrus cycles and therefore when they gave birth. To avoid separating and reintroducing the pairs, with associated risk of aggression between the pair or the male and the pups, we used a plastic grid in the tunnel joining the cages to allow contact but not mating (Figure 3).

Results

Females in the monogamous pairs housed in standard cages suffered from hair loss around their nipples and underbelly and some of the males had hair loss on their cheeks. The Named Veterinary Surgeon considered the most likely diagnosis was excessive grooming by the pups. The cages also became damp rapidly with the numbers of animals present. Increasing cage change frequency for pairs with large litters from once to twice a week was unsuccessful in reducing the over grooming.

We increased the space available to pairs with pups by linking two cages together (Figures 1 and 2) to see whether this benefited their welfare, as judged by external signs. All animals regrew lost hair and no more hair loss was seen. Technicians caring for the rats noted that the adults were much easier to handle, calmer and interacted more with the handlers.



Table 1.

Data generated under the previous and new systems were compared (Table 1).

For the time-mated animals, their median litter size was 9 (inter-quartile range 6 to 11 and 40 observations) and in the monogamous pairs, the median litter size was 13 (inter-quartile range 9 to 15 and 52 observations). Thus the median litter size was about 50% higher in the monogamous pairs. It was difficult to compare the data directly beyond these basic figures as mothers were at different stages in their reproductive life.

Dividing grids have been used in 7 pairs for 11 meetings to date. On one occasion, one female did not become pregnant, was divided from the male for a second time, was reintroduced to him and became pregnant. The median litter size for these meetings is 15 (inter-quartile range 11-15; 10 observations). On average pups are born 35 days after reintroduction of the male (range 24-43 days).

Conclusion

The change to monogamous pairs was very successful resulting in marked increase in median litter size. This allowed us to reduce the number of adult rats with related decreased costs and husbandry-related time. By joining two cages together, thus providing a greater floor area, there were improvements in outward signs of welfare and docility of the animals. It appears that we can control the tendency for females to synchronise their oestrus cycles which otherwise could result in an uneven supply of pups, by allowing the male and female in each pair to remain separated but in communication with each other using a grid and then reintroducing the pair around 6 to 7 weeks before pups are needed.

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