

Abstract from Final Report on UFAW PHHSC Research Scholarship

Effects of cage size, space allowance, environmental enrichment and their interactions on behaviour, stress, immune function and welfare of laboratory mice

Student: Kerry Westwood

**Supervisors: Prof Mike Mendl, Prof Christine Nicol, Dr Chris Sherwin
University of Bristol**

Abstract

The first part of this study examined the effects of varying cage size (340, 960cm²) and space allowance (60, 100, 167cm²/ mouse) on behavioural, physiological, immunological, morphological and histopathological indicators of welfare in inbred (C57Blk/6J) and outbred (ICR(CD-1)) male mice between 5.5 and 11 weeks of age. Cage sizes, space allowances and mouse strains were chosen according to Council of Europe proposals for rodent housing, and on the basis of a survey of current practice carried out at 10 commercial laboratories as part of this project. The inbred mice yielded data on all 3 space allowances and both cage sizes in a 3 x 2 factorial design, while the outbred mice were too heavy to be housed at the lowest space allowance and so were studied using a 2 x 2 factorial design. Increasing both cage size and space allowance appeared to induce behavioural changes which may indicate better welfare (e.g. lower stereotypy, higher levels of activity and non-agonistic social interaction per individual). There were few suggestions of adverse effects, especially for the outbred animals which seemed to be more socially active than the inbreds, and may thus have benefited more from the larger groups that accompany increased cage size, as evidenced by a slight reduction in their faecal corticosterone levels in larger cages. The inbred strain studied here appeared less socially active, and may have benefited less from the larger cage size in which their faecal corticosterone levels were higher, and their body weight lower. However, it is possible that these changes were related to their higher levels of activity in larger cages. There was also no evidence that they experienced extra aggression and related social stress in large cages. Furthermore, increasing space allowance (and hence decreasing group size) also appeared to lead to a decrease in corticosterone and an accompanying increase in growth rate in this strain. The clear strain differences in response to different cage sizes and space allowance emphasise that different strains may be affected in different ways by the same housing environment. It should also be noted that the cage sizes and space allowances studied were relevant to current commercial practice, and it is possible that the use of much larger cages or greater space allowances may have had led to more pronounced effects on the welfare indicators measured.

The second part of the project investigated the effects of providing an enrichment object (a 'hammock feeder' designed on the basis of results from another study) on ICR(CD-1) male and female mice housed in single sex groups of 3 at a 100cm² per mouse space allowance in small (340cm²) cages between 3.5 and 9 weeks of age. Many of the welfare indicators used in the first study were also measured in this study. The hammock feeder encouraged more physical and social activity, but it is not clear that this led to an enhancement of welfare, as bar chewing, aggression and stereotypies increased as the study progressed. High intensities or increases in any of these behaviours would generally be taken to indicate that welfare could be improved. The hammock feeder also had only a minor influence on physiological indicators of welfare. It may be that the effects of the small cage over-rode any welfare benefits that the enrichment could offer, or that earlier (e.g. pre-weaning) provision of the hammock feeder may have been more effective. Females used the hammock feeder more than males, confirming previous reports of sex

differences in the use of other enrichment objects by mice. A sex biased difference in the use of enrichments could have important consequences for the design and successful implementation of environmental enrichments.