

Environmental enrichment for laboratory rats

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Introduction

Rats have been the primary species used in research for over a century, and their use has led to significant findings in medicine and science. Current standard housing provides little for their behavioural and physiological needs (Johnson et al, 2004), which compromises the welfare of the rats and can undermine the validity of research results if stress has impinged upon the rats as models of normal biological and psychological functioning (Chance and Russell, 1997). Environmental enrichment is the alteration of an animal's environment to provide an opportunity for positive species-specific behaviour, while reducing abnormal behaviours (Key, 2004), to enhance animal welfare. This paper will review the results of recent studies on the environmental enrichment of rat cages.

Discussion

Laboratory rats spend most of their lives in their home cage so alterations to the cage environment can provide an overall enhancement of welfare. In the past year there has been considerable research on foraging, increased space and complexity of cages, and the use of nesting material as forms of environmental enrichment.

Wild rats spend most of their waking hours searching for food (Key, 2004). The standard laboratory feeding practice is to provide food ad libitum via a food 'hopper', which provides little opportunity for rats to perform foraging behaviours (Key, 2004). The effectiveness of foraging enrichment as a method of improving laboratory rat welfare, through encouraging natural behaviour and alleviating frustration and boredom was investigated by Johnson et al, 2004. Preference testing demonstrated that rats showed an inclination for the foraging device (food hidden in a dish filled with gravel) over the standard hopper and gnawing sticks. This suggests that foraging behaviour may have an intrinsic value to rats, suggested by the fact that they perform the behaviour even when it decreases their efficiency in finding food (Johnson et al, 2004). Therefore, encouraging foraging behaviour seems to be an excellent means of environmental enrichment. The foraging device also showed a tendency to decrease aggression between the pairs of rats housed together. This may be because the food was scattered around the cage by the rats, which increased the opportunity for subordinate individuals to feed away from their cage mate. This lends itself to the enhancement of animal welfare by reducing social stress and risk of aggression-induced injury (Johnson et al, 2004). Stewart (2003) suggests that a practical means of providing foraging enrichment for laboratory rats is the provision of corn-cob bedding. This material has small pieces of corn throughout, thus offering a foraging opportunity each time the cage is cleaned.

The standard cage used for housing laboratory rats can often result in sedentary and overweight animals because of restricted opportunities for physical activity. The benefits of physical activity in improving health would have positive implications for animal welfare, so a system that enhances physical activity would be an advantageous form of environmental enrichment. Previous studies have shown that exercise can counteract the deleterious effects of a sedentary life combined with overeating (Holloszy, 1988), and may prevent stress-induced immune suppression and consequent disease (Moraska and Fleshner, 2001). Spangenberg et al (2005) investigated the effects of housing rats in groups of eight in large pens furnished with objects to climb on and hide in, compared with a control group of individually housed rats in standard cages. The large pens had approximately four times as much floor space per animal as the standard cage. Large pens were equipped with an inverted wire cage, a towel hammock, an inverted opaque plastic box, and a plastic board that partly divided the pen, while the only addition to the standard cage was a black plastic tube. At the end of the four-week study it was found that the pen-housed rats weighed 17% less than the standard housed rats, which implies that the pen stimulated physical activity. The

pen-housed rats also scored better in the endurance strength test and had significantly higher glycogen content in muscle. In addition to improved physical fitness found, pen-housed rats were also observed to have a more diverse behavioural repertoire, including running, climbing and social behaviours, which may indicate improved animal welfare. A similar 2002 study by Augustsson et al concurred with these results that a larger and more complex environment has positive consequences for rat welfare through increased display of natural behaviours and promoting health.

Wild and pet rats have been observed to build complex nests from nesting material at hand (Van Loo and Baumans 2004). Nesting material provides rats with control over their environment in that they can construct places to hide and create a preferred micro-climate with regard to temperature and light intensity (Van Loo and Baumans 2004). Past research has shown that rats will work persistently to gain access to cages with nesting material (Manser et al, 1998). Van Loo and Baumans (2004) tested the suitability of nesting material as a means of environmental enrichment for laboratory rats. They hypothesised that nest building was an acquired behaviour as, unlike wild or pet rats, adult laboratory rats do not spontaneously build nests. Van Loo and Baumans studied the reactions of various age groups of rats to nesting material, and discovered that the age the rats were when first provided with nesting material correlated with the amount of material eaten and soiled, and negatively correlated with nest complexity. The study concluded that nesting material provided environmental enrichment for laboratory rats if provided from birth, as it seems that rats need to learn to use nesting material for nest-building purposes.

Conclusion

These studies confirm that environmental enrichment in the form of provision of nesting material and the encouragement of foraging behaviour and physical activity are effective in enhancing the welfare of laboratory rats. Further investigation is required into environmental enrichment methods and their most valuable combination, along with examination of the potential costs of enrichment economically, and as a source of confounding variables into research. Hopefully, such studies will encourage the implementation of environmental enrichment for all cages housing laboratory rats and consequently significantly advance their welfare.

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