The influence of environmental enrichment on clinical pathology and cardiovascular parameters in rats

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Environmentally enriched housing or not?

Over the last years and especially since the release of the revised Appendix A of the European Convention ETS 123 in 2006 it has been argued that laboratory animals should be housed under environmentally enriched conditions. A number of papers, especially within neurobiology, have raised the concern that environmental enrichment may increase uncontrollable variation in the animals, and thereby induce the need for a higher number of animals. However, even though this may be used as an argument to deny environmental enrichment, it is unclear whether there is any basis for concern within other research areas.

The aim of this study

The aim of this study was to study whether clinical pathology and cardiovascular parameters were influenced by housing rats under environmentally enriched conditions. Rats were housed under three different conditions in commercially available housing systems: non-enriched, standard enriched according to the revised Appendix A, and extra-enriched with a shelf and increased height of the cages (Figure 1).

Figure 1: The three different housing conditions

The Study design

Male outbred Sprague Dawley (NTac:SD) rats (*Rattus norvegicus*) (Taconic, Lille Skensved, Denmark) were used in all studies. The rats were socially housed under one of the three different, standardized housing conditions for at least twelve weeks from the age of four weeks before actual study initiation. A total of 41 different parameters were monitored by clinical pathology, telemetry and coagulation tests.

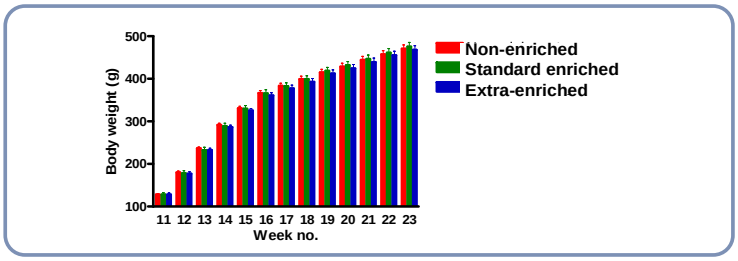

Figure 2: The impact of three different housing environments on the weight gain in rats

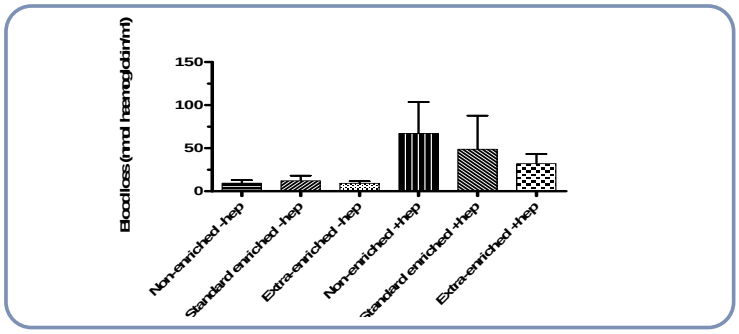

Figure 3: The impact of three different environments on the total blood loss during a coagulation test either with or without heparin in rats

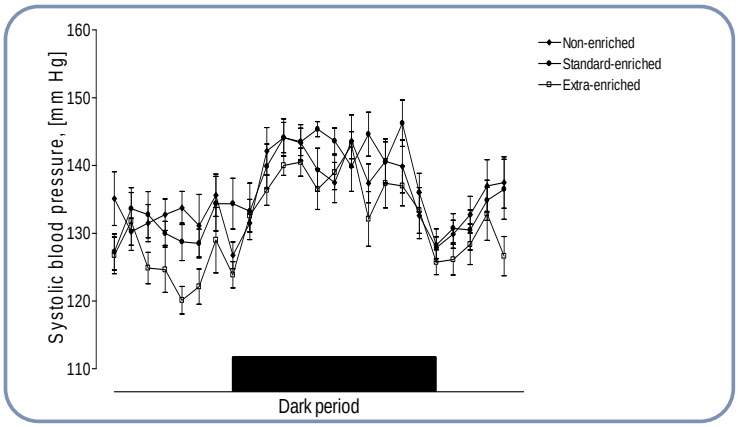

Figure 4: The impact of three different environments on the systolic blood pressure in rats. There are no significant differences between the housing environments

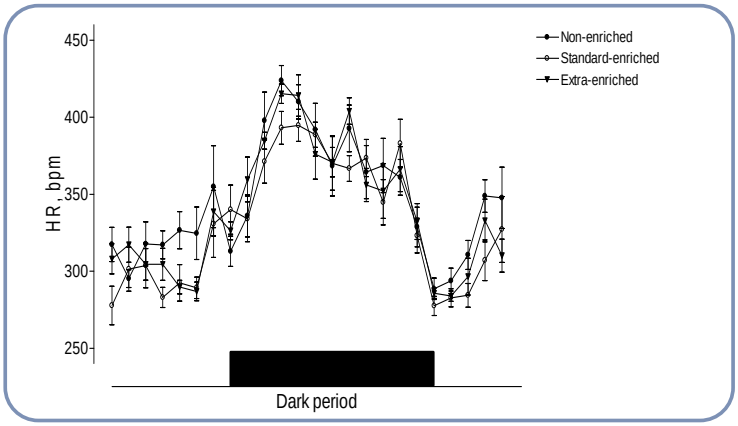

Figure 5: The impact of three different environments on the heart rate in rats. There are no significant differences between the housing environments

Results

In general, the clinical pathology, haematology and coagulation parameters differed very little in relation to the three different housing conditions. Rats housed under either standard enriched or extra-enriched conditions had significantly higher mean albumine than rats housed under non-enriched conditions ($p < 0.01$), while rats housed under non-enriched conditions had significantly higher fibrinogen C level as well as counts of white blood cells and neutrophiles than those housed under one of the two other housing conditions. The only significant difference in variation within the clinical chemistry seemed to be a lower variation in the number of red blood cells observed under the non-enriched housing conditions ($p< 0.05$). There were no significant differences between the three different environments when subjecting all normally distributed clinical pathology and haematological parameters of a power analysis.

Conclusion

We conclude that so far there is no basis for being concerned that environmentally enriched housing will lead to increased group sizes when using rats for research within clinical pathology and cardiovascular research, and as such there is no reason not to enrich the environment

VII World Congress on Alternatives & Animal Use in the Life Sciences, Rome, Italy, 2009