DIFFERENTIAL IMPACT OF AN AUDIOGENIC STRESSOR ON LEWIS AND FISCHER RATS

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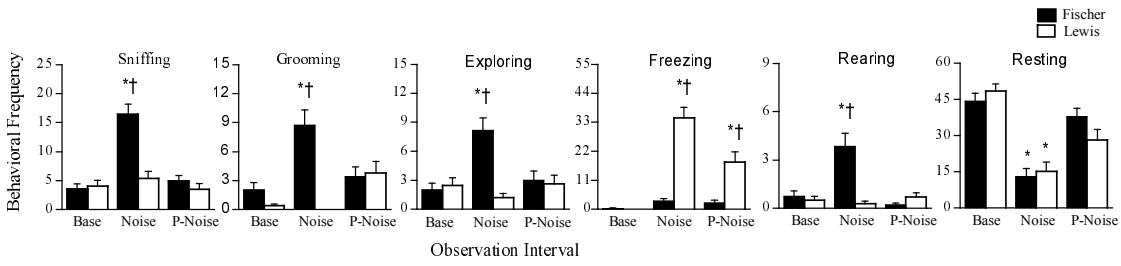
Introduction Concerns that environmental noise promotes non-auditory adverse health effects are based on the notion that noise acts as a stressor. However, studies of psychophysiological response in humans to environmental noise have been too inconsistent for conclusions to be made [1]. In part, this may result from individual differences in human response. The purpose of this study was to investigate, under controlled conditions, whether two animal strains showed different neurochemical, endocrine and behavioral responses to acute noise exposure. The results presented here are a portion of a manuscript published elsewhere [2].

Methods *Animals*: Adult male Fischer and Lewis rats (350-400g) were housed individually with a 12:12- h reversed light-dark cycle with *ad libitum* access to food and water. Procedures met Health Canada guidelines on ethical treatment of animal subjects in research.
Noise exposure & testing: Animals were exposed to a 15-min burst of 90 dB continuous white noise, band-limited from 80 Hz to 20 kHz, and equalized in 1/3 octave bands within the cage. Based on measurements from 10 positions within the cage, overall the standard deviation for the unweighted average sound level was ± 2 dB, and in individual 1/3-octave bands it was ± 4 dB. Plasma and specific brain regions were collected immediately or 1-hr post noise termination and stored at -80□C until hormone and neuropeptide assays were performed. In a separate study, animals were surgically implanted with a guide cannula aimed at the anterior pituitary gland within which a push-pull perfusion probe was inserted to assess neurochemical changes prior to, during, and following noise exposure in freely behaving animals. At these sampling intervals, various stress-responsive behaviors were also scored.

Results Acute noise evoked robust strain-dependent behavioral responses. The Fischer rats displayed a more active coping strategy, while the Lewis rats were more defensive (see Figure 1).

Figure 1

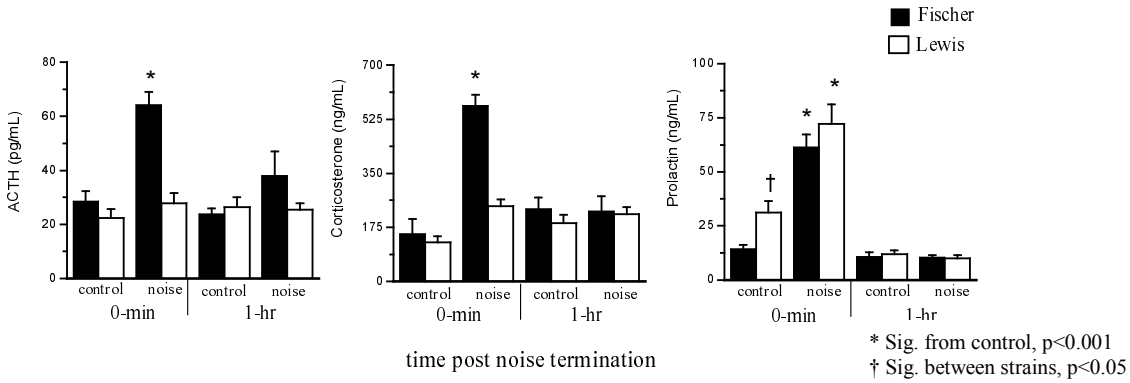


* Sig. from baseline, p<0.001
† Sig. between strains, p<0.05

The strains also showed differences in their endocrine response to noise. In this regard, immediately following noise termination, plasma ACTH and corticosterone levels were

significantly elevated in only the Fischer rats. On the other hand, both strains showed a similar noise-induced increase in plasma prolactin levels immediately following noise termination. In all cases, elevated plasma hormones returned to pre-noise levels within 1-hr after noise exposure (see Figure 2).

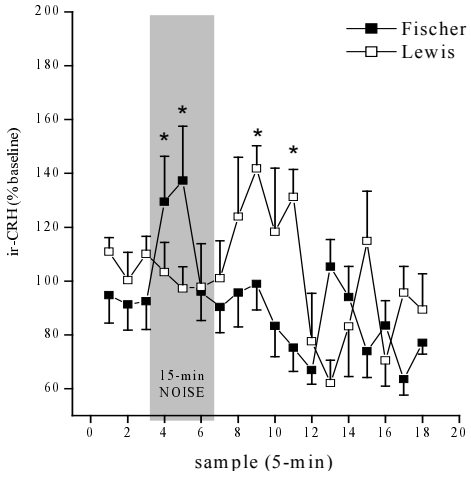
Figure 2



* Sig. from control, p<0.001
† Sig. between strains, p<0.05

Finally, when the changes in the release of CRH were monitored at the level of the anterior pituitary gland we observed that acute noise exposure was associated with a rapid increase in CRH among the Fischer rats compared to the relatively more delayed response observed in their Lewis counterparts (see Figure 3).

Figure 3



* Sig. from base, p<0.001

Discussion The current study demonstrates that acute noise exposure elicits robust strain-dependent neurochemical, endocrine and behavioral responses. Coping styles in humans under challenge conditions are also associated with different neuroendocrine responses [3]. The results of this study suggest that the strain differences in plasma hormones and behavioral output might be attributable to the observed strain differences in corticotropin-releasing hormone (CRH) availability at the level of the anterior pituitary gland during noise exposure. Similarly, we observed strain differences in tissue levels of CRH at discrete brain regions implicated in stressor responsivity, such as the locus coeruleus and amygdala (data not shown) [2]. This experiment adds to the knowledge base of biochemical changes engendered by acute noise exposure, suggesting neurochemical, neuroanatomical, endocrine and behavioural correlates that might be associated with individual differences observed in humans.

Keywords: stress, strain differences, plasma hormones, behaviour, neuropeptides

References

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