

Chronic stress in fast- and slow-growing broilers chickens raised in simple and complex environments

Sadie Grant, Alexandra Ulans, Leonie Jacobs

School of Animal Sciences, Virginia Tech, Blacksburg, VA, 24061, USA

Introduction

- Broilers have been genetically selected for improved feed conversion and weight gain which can negatively impact health and behavior, which may lead to chronic stress.
- Chronic stress is a key component of animal welfare but is not yet thoroughly investigated.
- Corticosterone is deposited in feathers in response to acute and long-term stressors (Bortolotti et al., 2009).
- Complex environments can positively impact emotion and possibly decrease chronic stress (Altan et al. 2013).
- Impacts of complex environments on slow-growing strains are rarely explored.

Objective

Determine chronic stress in fast- and slow-growing broilers housed in complex or simple environments.

Methods

Animals and housing

- 1,200 broilers: Ross 708 & Hubbard Redbro (fig. 1)
- 50 birds/24 pens (0.175 m²/bird)
- 6 replicates per treatment



Figure 1. slow-growing Redbro (left) & fast-growing Ross 708 (right).

Complexity treatment

- Simple environment
 - Litter, feeders, drinker line (fig. 2)
- Complex environment
 - Permanent: perches and dust bath with sand

Temporary enrichments: scratch & mirrors, oats & strings, cabbage & hay (fig. 2)

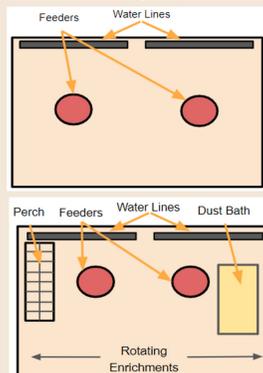


Figure 2. Simple (top) and complex (bottom) pen layout.

Measurements

Feathers were collected from birds as follows:

- 1 bird/pen/time point (n=96) when birds were 1, 2, 3 kg and 4, 5, 6 weeks old
- Feather corticosterone was extracted via shaking baths, separating of methanol and corticosterone from remaining waste, and evaporation of methanol leaving corticosterone (Fig. 3).
- Corticosterone concentrations were determined using an ELISA kit.



Figure 3. Feathers undergoing corticosterone extraction.

Statistics

Corticosterone concentration was analyzed using a linear mixed-effects model with strain and complexity as fixed factors and pen as random factor. Data are presented as ls means \pm SEM. Bars with uncommon superscripts differ at $P < 0.05$.

Results

As birds gained weight, feather corticosterone levels decreased ($p = 0.002$). Fast-growing birds at 1 kg showed higher corticosterone levels than slow-growing birds at 2 kg and fast-growers at 3 kg (fig. 4).



Figure 4. Mean (\pm SEM) feather corticosterone levels of fast- and slow-growing broilers at 1, 2, or 3-kg body weights.

Slow-growing birds in a simple environment had lower feather corticosterone levels compared to slow-growing birds in a complex environment ($p = 0.005$; fig 5).

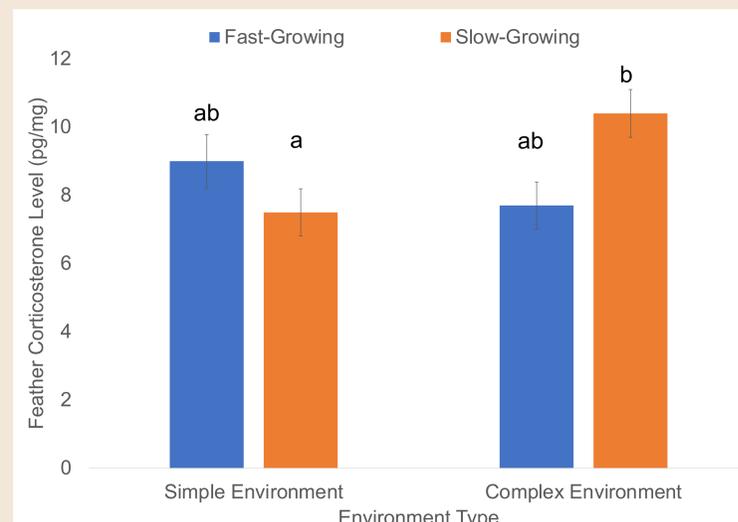


Figure 5. Mean (\pm SEM) feather corticosterone levels of fast- and slow-growing broilers housed in a simple or complex environment.

Discussion

- We hypothesized that slow-growers would show reduced feather corticosterone levels compared to fast-growers, because of their improved health and ability to express behavior (Rayner et al., 2020).
 - Overall, results did not align with the hypothesis
 - The slow-growers may have been worse at adapting to housing conditions than the fast-growers, as the genetic selection of fast-growers may have unintentionally resulted in improved adaptation and docility.
- We hypothesized that complex environments would reduce feather corticosterone concentrations as it would stimulate the expression of natural behavior.
 - Results do not confirm the hypothesis as complexity resulted in more chronic stress in slow-growing birds
 - Provided enrichments may not have been effective in stimulating positive behaviors in slow-growing broilers



Conclusion

Chronic stress in fast- and slow-growing broilers differed across some weight points, but overall slow-growing birds did not show reduced chronic stress responses in this study.

Providing environmental complexity did not reduce chronic stress responses, and even increased chronic stress responses in slow-growing birds.

Acknowledgements

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References

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