Measuring chronic stress in chicken brains: a way of monitoring animal welfare?

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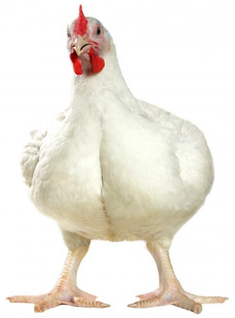
Aim

- To use changes in neurogenesis to show if feed restrictions in broiler breeders causes chronic stress.



http://www.instablogs.com/wp-content/uploads/2012/07/broiler-chicken_NsAz5_16270.jpg

Introduction

Broiler Breeders—The Problem

Broiler chickens are bred to reach slaughter weight in 42 days weighing 2.2kg. Broiler breeder chickens (the parental generation), if allowed to eat to appetite would reach this weight in the same time. However this has severe welfare implications and reproductive problems. The legs of the chickens are not strong enough to support the weight of the bird, resulting in broken legs soon after 6 weeks. The selection for large breast muscle has had a negative impact on the reproductive capability of the birds, resulting in low egg production. To avoid these problems the birds have the feed intake restricted to prevent the excessive weight increase, allowing a higher egg production and lower injury prevalence. However, there are concerns as to whether the feed restriction is causing stress to the birds, but methods of measuring stress in livestock are difficult and subjective.

Doublecortin—The Solution?

Doublecortin (DCX) is expressed by new neurons during the early stages of neurogenesis. Neurogenesis in adults only occurs in two regions of the mammalian brain: the hippocampus and the olfactory bulb; and all over the avian brain. Previous studies (Lee et al., 2006) in rats have shown that in depressed animals the number of doublecortin neurons is significantly reduced in the hippocampus, showing that the production of new neurons has been decreased. If this also occurs in chickens, then staining the brain to show the neurons containing doublecortin may be a way of determining the stress of broiler breeder chickens.

Lee, K.J., Kim, S.J., Kim, S.W., Choi, S.H., Shin, Y.C., Park, S.H., Moon, B.H., Cho, E., Lee, M.S., Choi, S.H., Chun, B.G. and Shin, K.H. (2006) 'Chronic mild stress decreases survival, but not proliferation, of new-born cells in adult rat hippocampus', *Experimental and Molecular Medicine*, 38(1), pp. 44-54

Methodology

- Chickens were fed on four different feeding regimes (Figure 2) for 12 weeks then slaughtered and the brains removed and split into the two hemispheres.
- Brains were then sliced into 50µm and stained with antibody to mark the doublecortin cells and then cresyl violet, and mounted onto slides.
- Slides were examined under the microscope and the cells counted (Figure 1).

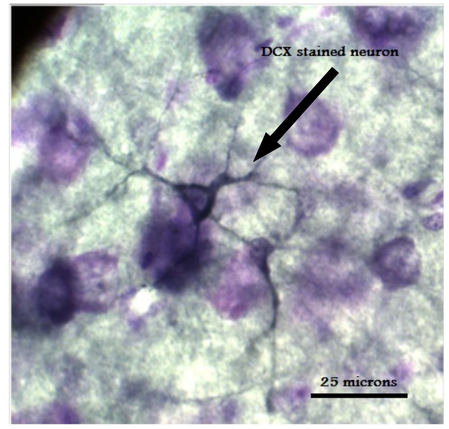
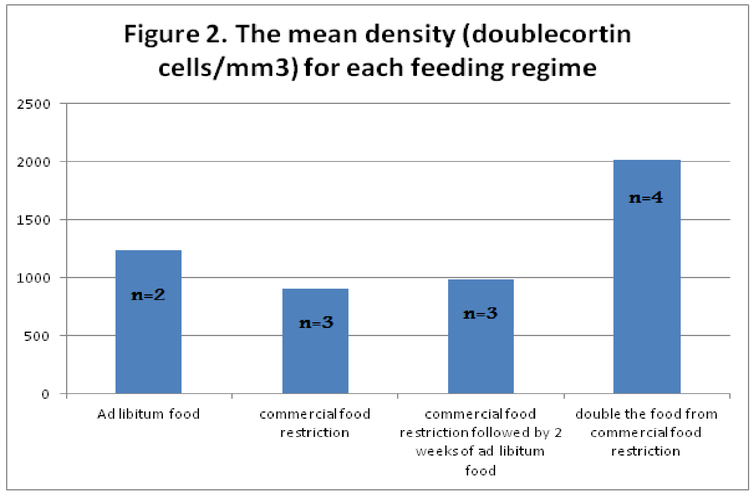


Figure 1. Photomicrograph of a doublecortin-positive neuron in the chicken hippocampus

Results

The results were analysed on Minitab using a General Linear Model, and show that although they were not significant ($P>0.05$) there was a trend. Figure 2 shows that the chickens on commercial restriction had the lowest density of doublecortin cells, compared to the ad libitum and double feed chickens who had much higher densities. There were only 12 birds in the data set as counting had not yet been completed so the results are only a pilot analysis. If the number of brains were increased this might help to improve the significance of the results as it would prevent any anomalies having such an impact on the results.



Conclusions

- Although the results were not significant, the trend suggests that the birds on feed restrictions may be more stressed than the non-restricted birds.
- Further work needs to be carried out on more birds as 12 is to smaller a group.