The impact of photoperiod on the health and welfare of broiler chickens

Explores the detrimental effects of constant lighting on broiler chicken health and welfare.

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Introduction

Day length has an important impact on the health of broiler chickens, and failure to provide suitable lighting can contribute to a decline in welfare in a number of ways (Schwean-Lardner et al., 2013). Changes to metabolism that occur during darkness are important for growth, ocular health, immune function and mobility. Studies have listed constant (CL) or near-constant lighting as a contributing factor to the development of metabolic and skeletal diseases (Schwean-Lardner et al., 2013; Zheng et al., 2013). Despite these negative effects, producers commonly use CL to maximise feed intake and growth rates (Rahimi et al., 2005). The current national guidelines governing Australian poultry production permit CL, simply stating that “photoperiods in excess of 20 hours per day may be detrimental to the adult laying bird” (CSIRO, 2002).

Discussion

Increasing periods of darkness have been associated with significant declines in total and metabolic disease-related mortality, and culling prompted by metabolic diseases is a significant issue in the poultry industry (Schwean-Lardner et al., 2013). Three recent studies by Schwean-Lardner et al. (2013), Zheng et al. (2013) and Turkowska et al. (2014) compared the physiological effects of different lighting schemes [(14L:10D, 17L:7D, 20L:4D, 23L:1D); (24L:0D, 16L:2D:1L:2D:1L:2D, 17L:3D:1L:3D); and (24L:0D and 16L:8D or 8L:16D depending on the season of hatch)] at different broiler ages (32±48 days, 22±50 days, and 12 days of age). Fast-growth, achieved using CL, commonly causes leg problems, sudden death syndrome and ascites in broiler chickens (Zheng et al., 2013). The gait of broiler chickens at different ages was examined in one study, with a score of 0 indicating normal gait, and a score of 5 indicating complete loss of mobility (Schwean-Lardner et al., 2013). A positive correlation emerged between day length and the proportion of birds with an abnormal gait score (Schwean-Lardner et al., 2013; Zheng et al., 2013). The pain associated with lameness has significant welfare implications.

A longer photoperiod has also been associated with increased ocular weights of broilers, which, through lesions caused by increased intracocular pressure, may cause vision impairment and pain (Schwean-Lardner et al., 2013). Sex-related differences in the response to various lighting regimes have been observed. However, these are likely to be attributable to differing metabolic demands during growth (Schwean-Lardner et al., 2013). Increasing darkness reduces early growth rate, and this is thought to reduce the growth-associated diseases mentioned earlier (Schwean-Lardner et al., 2013). Despite reducing growth rate early in life, intermittent lighting has been linked to a long-term improvement in growth performance (Buyse et al., 1996; Apeldoorn et al., 1999; Schwean-Lardner et al., 2013). An experiment by Zheng et al. (2013) yielded contradictory results, which may have arisen because the period of darkness was fragmented.

Melatonin, secreted by the pineal gland during darkness, plays an important role in the health of broilers. It is known to stimulate lymphocyte proliferation, enhance antibody formation (Zheng et al., 2013) and assist in scavenging free radicals. It also enhances the development of immune organs (Zheng et al., 2013), and is capable of suppressing sleep (Schwean-Lardner et al., 2013).

The antioxidant capability of the liver has been shown to increase with the provision of darkness (Zheng et al., 2013). The thymus and bursa of Fabricius, two lymphoid organs, are both important in the development of adaptive immunity, and darkness appeared to have a positive effect on their functioning (Zheng et al., 2013). These findings suggest that darkness may help chickens to be more resilient to illness, stress and diseases. Zheng et al. (2013) found that CL causes significant reductions in the serum melatonin of broilers, and this has serious implications for the welfare of broiler flocks. However, contradictory evidence has been found in a study into the diurnal changes in 12-day-old broilers (Turkowska et al., 2014). This study found that the melatonin concentrations in chickens born in winter were not affected by lighting regime, and future research could examine the effects of season at different ages.
Day length has a significant impact on many aspects of broiler health. Birds exposed to longer periods of darkness (>4h) appeared less lethargic, had a stronger melatonin-mediated diurnal rhythm and better overall welfare when compared to birds exposed to constant lighting (Schwean-Lardner et al., 2013). Improvements in the antioxidant status and nonspecific immunity of broilers exposed to increased darkness (Zheng et al., 2013) have positive implications for both welfare and production. Birds showing pain due to leg weakness or other factors also get some relief during dark periods (Schwean-Lardner et al., 2013). The implications of increased ocular weight on broiler welfare have not been well studied (Schwean-Lardner et al., 2013), but concern the presence of an associated increase in intraocular pressure.

In addition to the aforementioned welfare benefits, the provision of an appropriate photoperiod can also provide economic benefits. Increases in broiler mobility may result in easier access to feeders and water vessels and, therefore, improvements in growth performance. However, conflicting results warrant further investigation. Lower mortality means more birds being produced. and reductions in the period over which sheds are illuminated each day lowers power costs (Zheng et al., 2013).

Conclusions

While the current national production guidelines (CSIRO, 2002) don’t prohibit constant lighting regimes, the Australian state and territory governments agreed in mid 2013 on the need to review them (Australian Government Department of Agriculture, 2013). A new incentive by the RSPCA, an Approved Farming Scheme (2013), requires that farmers provide “a minimum period of 4 hours continuous darkness” every night, as part of their voluntary accreditation with the scheme. These represent two important steps toward improving the welfare of intensively farmed broiler chickens, and will hopefully lead to permanent changes within the industry.

References


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