

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.

By Emma Hall

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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 intraocular 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.

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