

Detecting Heat Stress in Broilers and Measures that can be Applied to Improve their Welfare

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Word count: 985

Introduction

Heat stress (HS) is a significant welfare concern in the Australian broiler industry. A broiler is considered to be heat stressed when it is no longer within its thermo-neutral zone and initiates a series of physiological and behavioural changes to adapt to (and correct) its elevated body temperature (Ahmad *et al.*, 2008). Some changes, such as panting and increased water intake, are designed to return body temperature to its thermal neutral point (Syafwan *et al.*, 2011). Other changes, such as decreased feed intake, are intended to prevent any further heat gain but, as a consequence, can lead to problems such as nutrient deficiencies, decreased bodyweight, poor feed conversion rates and overall poor performance (Abidin & Khatoon, 2013; Heidari *et al.*, 2013; Quinteiro-Filho *et al.*, 2010). In most cases, these adaptations are not enough to alleviate HS and further health conditions arise as a result. Immune suppression can occur due to the activation of the hypothalamic-pituitary-adrenal (HPA) axis, resulting in an increased secretion of corticosterones (Abioja *et al.*, 2012; Sohail *et al.*, 2012; Quinteiro-Filho *et al.*, 2010). It is therefore not uncommon to see a greater prevalence toward the development of secondary diseases as a result of HS.

Discussion

Vitamin C is an antioxidant that has been well documented to support the immune system by inhibiting stress-induced corticosterone release (Abidin & Khatoon, 2013; Abioja *et al.*, 2012). Broilers are able to naturally synthesise vitamin C but not in sufficient amounts to cope with HS (Abidin & Khatoon, 2013; Heidari *et al.*, 2013). Many studies have shown that supplementing with vitamin C can improve heat tolerance, immunity and overall broiler performance (Abidin & Khatoon, 2013; Heidari *et al.*, 2013; Abioja *et al.*, 2012). Supplementing with additional nutrients may further enhance the performance and health status of broilers undergoing HS. One such supplement is honey (Abioja *et al.*, 2012), which is naturally rich in vitamin C, B vitamins, glucose and other antioxidants and dissolves readily in drinking water (Abioja *et al.*, 2012). A study by Abioja *et al.* (2012) placed broilers in one of four groups to determine the effects that different concentrations of honey had on broiler performance and heat tolerance. The study showed evidence that honey added to drinking water at a concentration of 20ml per litre provided broilers with high heat tolerance. This conclusion was based on findings that demonstrated a decrease in panting, heart rate and rectal temperature in the broilers in that group.

Nutrient deficiencies can also occur as a result of corticosterone-induced trauma to the intestinal mucosa (Sohail *et al.*, 2012). The damage can significantly impact the intestine's ability to absorb nutrients (Sohail *et al.*, 2012). Sohail *et al.* (2012) proposed the addition of prebiotics and probiotics to broiler diets to improve broiler performance, enhance immunity and assist in tissue repair. Prebiotics stimulate growth of existing intestinal flora and encourage appetite, which is often suppressed in HS conditions (Sohail *et al.*, 2012). Probiotics can be added to establish intestinal microbial equilibrium and assist in reducing disease development (Sohail *et al.*, 2012).

Five groups were created for the study. The diet of one group was supplemented with prebiotics only, another with probiotics only and a third with both. These three groups were subjected to HS. A fourth group involved no supplementation but HS conditions were applied. The last group acted as a control, where broilers were neither supplemented nor exposed to HS. Conclusions were made based on changes seen in bodyweight and corticosterone concentrations. Results showed that adding just one of the supplements can improve bird performance and immunity (as demonstrated by an increase in bodyweight and a decrease in serum corticosterone concentrations). The best results were seen when birds were supplemented with both prebiotics and probiotics.

Adjustments made to broiler diets have shown strong evidence of their supportive attributes toward HS management but, unfortunately, are not effective in targeting the stressor directly. Applying

changes to the environment to enhance the broiler's ability to thermo-regulate may assist in reducing some of the physiological changes that develop as a result of HS (Heidari *et al.*, 2013), but the best results would be seen in facilities that implemented advanced housing designs or state-of-the-art cooling systems. Unfortunately, this is often an expense that is financially difficult (Heidari *et al.*, 2013).

Zhao *et al.* (2012) investigated the effects of installing cooling perches to assist in thermoregulation under HS conditions. The apparatus involved running cold water through the perch with the assumption that the broiler would improve its ability to thermo-regulate when perching by means of heat transfer. Standard perches were also included as controls. Results showed that the broilers had a strong preference for cooling perches over standard ones. The inclusion of perches was found to provide other benefits, too. Perches provided environmental enrichment and encouraged mobility and normal perching behaviour (Zhao *et al.*, 2012). Furthermore, perches significantly decreased the development of painful conditions such as footpad dermatitis, hock burns and abdominal plumage damage, which can develop as a result of prolonged contact with faecal-contaminated litter (Zhao *et al.*, 2012). A consideration associated with this design is that it may result in birds congregating around the cooling perch, which may create competition while also increasing body temperature through close contact with other clustering birds. Sand baths can assist both thermoregulation (Syafwan *et al.*, 2011) and parasite control (Nääs *et al.*, 2012). Furthermore, they can encourage broilers to space themselves out and promote normal behaviours such as preening (Nääs *et al.*, 2012).

Conclusion

In broiler production, environmental stressors are often one of the hardest to control in a manner that is both effective and economical. Dietary supplements significantly improve heat tolerance and immunity as well as restoring nutrients that have become deficient as a result of decreased feed intake and malabsorption. A combination of environmental enhancements and dietary supplements can therefore potentially offer a more efficient and economical way to improve the welfare status of broilers.

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