Leg weakness in broilers: an ever-present welfare concern

Investigates ways of producing fewer leg disorders in commercial meat chickens.

Jessica Leigh

Word count 1,000

Introduction

Leg disorders in commercial meat chickens are a chronic welfare issue of the poultry industry. Genetic selection and diet manipulation have successfully developed birds of rapidly growing musculature. The skeletal system is at present unable to support this development, often leading to disorders such as lameness, varus/valgus deformities (VVD), hock burn (HB), footpad dermatitis (FPD), femoral head necrosis and tibial dyschondroplasia (TD) (Knowles et al. 2008; Karaarslan & Nazligül 2018). Welfare concerns relate to reduced motility, and inability to reach food and water and to perform natural behaviours such as grooming or dust bathing. Many birds are also in chronic pain. Leg disorders present a major concern for producers, as carcass quality directly affects revenue, with bone breaks and perforations common during transport to processing facilities (Güz et al. 2019). Key factors linked to leg weakness include genetics, maternal hen age, incubation profile, stocking density, environmental enrichment, nutrition and growth rate (Knowles et al. 2008). This essay outlines three recent papers that present practical solutions to reduce occurrence of leg disorders.

Discussion

Due to multifactorial nature of leg strength, numerous incubation methods and developmental timepoints are being investigated to reduce the incidence and severity of leg disorders, ultimately enhancing broiler welfare. These include alterations to incubation profiles and diet formulations, and the utilisation of perches.

As the growth rate of modern broilers continues to increase and the lifespan to market weight decreases, time spent in the egg accounts for one third of the bird's potential development and total lifespan. A study by Muir and Groves (2018) investigated the effect of Slow start incubation on the standing ability of commercial meat chickens in a total of 216 fertile eggs of both Ross 308 and Cobb 500 strains. Eggs from each strain were incubated under either control (temperature maintained between 37.75 and 38^{O}C from day 0 to 18) or Slow start (initial temperature 36.75^{O}C gradually increased to 37.7^{O}C at day 16) conditions. Egg shell temperatures (EST) were recorded each minute using Remote Intelligent Multisensors attached to the equator of four eggs per incubator, and incubator settings altered accordingly. At take-off, hatch window was recorded, then birds were grown out in floor pens until 21 days, then moved to a deep litter shed until 35 days, when a latency-to-lie (LTL) test was performed to assess leg strength.

The results showed that Slow start incubation increased standing time of both strains in an LTL test by a minimum of 55 seconds. An association between strain and hatch window was recorded, with Ross 308 birds experiencing reduced hatchability and marked increase in live unhatched chicks compared to Cobb 500 chicks. This is not entirely unexpected due to strain-specific embryonic trajectories (Tona

et al., 2010). Chick quality and consequently leg strength may have been affected by time spent in the hatching tray post-hatch, with early hatchers forced to deplete their yolk sac for nutrients until take-off. This study concluded that Slow start incubation was beneficial to standing ability of broilers and presents a practical approach to improving leg strength. It is vital, however, to determine ideal EST for specific strains to avoid detrimental losses of developing chicks.

To address the dietary requirements for adequate bone growth of broilers, Güz et al. (2019) studied the effects of dietary organic macro and trace minerals, fish oil and hydrolysed collagen on growth performance and tibia characteristics of broiler chickens. A total of 384 day-old Ross 308 birds were randomly allocated one of four diet treatments with eight replicates of each, and grown out until 42 days. The four diets included a control diet, a second replacing inorganic minerals with their organic counterparts, a third with fish oil partly replacing palm oil and soybean oil, and a fourth partly replacing soybean meal with hydrolysed collagen.

The results indicated that replacement of inorganic macro and trace minerals with their organic counterparts positively affected tibia characteristics in broilers. This is potentially due to the increased bioavailability and intestinal absorption of organic minerals in comparison to their inorganic equivalents. Partial replacement of palm and soybean oil by fish oil and hydrolysed collagen were unable to positively alter tibial characteristics in a similar manner. These findings provide practical solutions for welfare improvements of fast-growing commercial meat birds.

The final study explores environmental modifications that can be utilised to increase mobility and hence decrease the occurrence of leg disorders in broilers, as opposed to altering the bone composition as in the other studies mentioned. Karaarslan & Nazigül (2018) developed a study to investigate the effects of lighting program, stocking density and the provision of perches on leg health in in 360 mixed-sex Ross 308 birds. Birds were randomly assigned a treatment and assessed for TD, VVD, FPD and HB at 42 days of age.

It was concluded that restricted light programs (18L:6D) and the provision of perches may aid in the reduction of leg health problems, ultimately leading to improved welfare of meat chickens. More specifically, the study found that restricted lighting in the first three weeks positively affected the incidence of TD and FPD, presumably associated with the reduced growth rate in in early life. The provision of perches decreased the incidence of HB via increased mobility and marginally decreased live weight.

Conclusion

Understanding the mechanisms behind leg strength in broilers is pivotal to the future of the poultry industry. Current consumers are heavily invested in the welfare of production animals and insist on ethically produced food. Reduced broiler leg strength and chronic pain impact on the ability of birds to eat and drink as well as perform natural behaviours; these must be addressed to comply with consumer preference. While an extensive array of research on associated factors exists, studies have failed to replicate results in several genotypes, suggesting strain-specific management requirements necessary to maximise leg strength. Slow-growing strains are known to experience significantly fewer leg problems (Knowles et al. 2008), however such strains are not ideal for the efficiency of the industry

or for producers. Further research is required to establish a solution that improves animal welfare while simultaneously avoids negative economic effects on producers.

References

Güz, BC, Molenaar, R, de Jong, IC, Kemp, B, van den Brand, H & van Krimpen, M 2019, 'Effects of dietary organic minerals, fish oil, and hydrolysed collagen on growth performance and tibia characteristics of broiler chickens', *Poultry Science* (in press).

Karaarslan, S & Nazligül, A 2018, 'Effects of lighting, stocking density, and access to perches on leg health variables as welfare indicators in broiler chickens', *Livestock Science*, vol. 218, pp. 31-36.

Knowles, TG, Kestin, SC, Haslam, SM, Brown, SN, Green, LE, Butterworth, A, Pope, SJ, Pfeiffer, D & Nicol, CJ 2008, 'Leg disorders in broiler chickens: prevalence, risk factors and prevention', *PLoS One* 3(2), e1545.

Muir, WI & Groves, PJ 2018, 'The leg strength of two commercial strains of meat chicken subjected to different incubation profiles', *Animal*, vol. 13 no.7, pp. 1489-1497.

Tona, K, Onagbesan, OM, Kamers, B, Everaert, N, Bruggeman, V & Decuypere, E 2010, 'Comparison of Cobb & Ross strains in embryo physiology and chick juvenile growth', *Poultry Science*, vol. 89, pp. 1677-1683.