

Reduction of Lameness in Poultry

Could Probiotics Have an Impact?

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Biomin®

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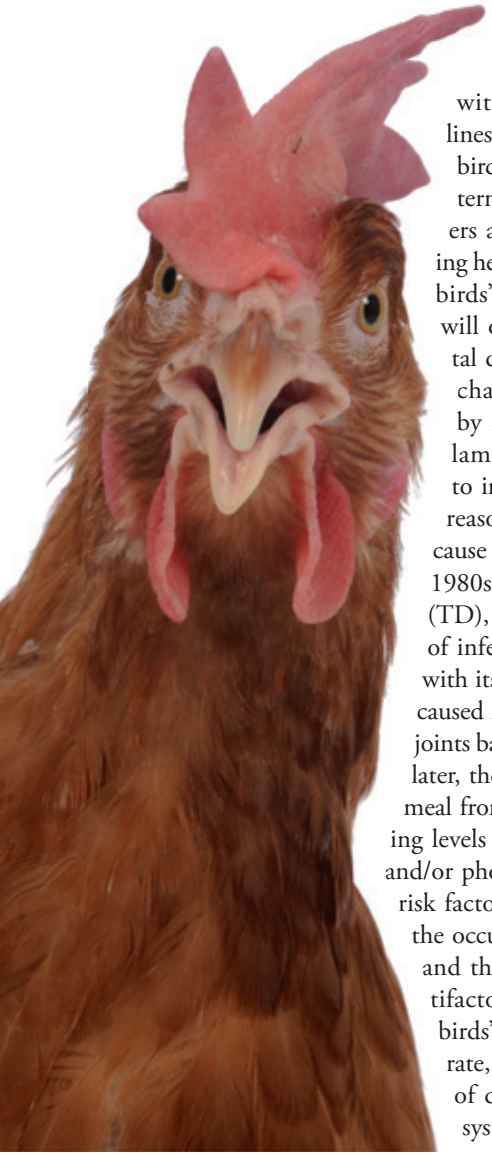
Lameness is a growing problem in modern poultry and one of the significant causes of mortality in broilers. It affects mobility of the birds and is usually related with pain. Lameness will cause birds to suffer and limit their natural movements, likely resulting in reduced feed and water intake. Leg disorders and lameness adversely affect the performance and wellbeing of poultry while increasing morbidity and mortality, which cause significant economic losses to the poultry industry. Some approaches to reduce the incidence of lameness are available to the industry but could probiotics also have an impact?



Lameness in poultry production

The poultry industry with its modern production lines places great demands on the birds' musculoskeletal system in terms of growth rates for broilers and egg production for laying hens. Any insufficiencies in the birds' nutrition or management will often lead to musculoskeletal diseases, which are normally characterized and diagnosed by lameness. The incidence of lameness has recently started to increase in poultry for many reasons. For instance, the main cause of lameness in broilers in the 1980s was tibial dyschondroplasia (TD), in the 1990s the emergence of infectious bursal disease (IBD) with its immunosuppressive nature caused high incidence of bones and joints bacterial infection. A few years later, the removal of meat and bone meal from poultry diets and increasing levels of pollution led to calcium and/or phosphorus deficiencies. Many risk factors could be associated with the occurrence of lameness in birds and the condition is usually multifactorial. These factors include birds' genotype, sex, age, growth rate, body weight and the length of dark periods in the lighting system used. Several causes can result in lameness in poultry including viral infections of soft tissues, bacterial infections of skeletal and soft tissues, and skeletal deformities.

Bacterial chondronecrosis with osteomyelitis

The most common cause of lameness in commercial broilers is bacterial chondronecrosis with osteomyelitis (BCO), formerly known as femoral head necrosis. The term BCO encompasses necrotic degeneration and microbial infection primarily within the proximal heads of the femur and tibia. Femoral head necrosis/BCO is caused by bacteria that reach the joints via the blood vessels that penetrate the bones to nourish the bones and the cartilages. The translocated bacteria adhere directly to the cartilage matrix preferably in the growth plates of growing bones, where they are harbored in microfractures. As the bird's immune system cannot access these microfractures, the bacteria grow rapidly and begin destroying bone minerals. This occurs primarily in the hip joints, proximal femur or proximal tibia. The damage caused by the festering of BCO bacteria leads, first to subclinical lesions and ultimately, if unchecked, to lameness. These bacteria can be transmitted from breeder parents, contaminated egg shells or hatchery sources, or enter via the respiratory system or via translocation from the gastrointestinal tract.

How could probiotics have an impact on the incidence of lameness?

Enteric bacteria can translocate from the intestine and migrate into the systemic circulation. Once these bacteria enter the circulation, they can reach the capillaries that irrigate the bones. Probiotics theoretically might interfere with the development of osteomyelitis by attenuating intestinal populations of pathogenic bac-

Table 1: Percentage of lameness incidence in broilers from two lines (C or D) that were fed control broiler starter feed (Control Feed) or the same feed containing 0.5 kg/ton PoultryStar® while being reared on wood shavings litter or wire flooring from 1 through 56 days of age.

Experiment	Line	Gender	Control Feed + Wood Shavings	Control Feed + Wire Flooring	Control Feed + Probiotic PoultryStar® + Wire Flooring
1	C	M & F	12%	68%	**36%**
2	D	M & F	8%	28%	**8%**
3	D	M	2%	22%	**10%**
4	D	M	–	32%	**18%**

a,b Values with different superscripts differed significantly at P < 0.05 using repeated Z-tests (SigmaPlot) to compare proportions.

teria, by improving gut health and gastrointestinal tract mucosal barrier, by reducing bacterial leakage (translocation) across the gut wall and by priming the immune system to better eliminate translocated bacteria. Intestinal protection by means of probiotic supplementation could lead to fewer bacteria reaching the articular surface, thereby reducing the incidence of BCO and subsequently lameness.

Effect of multi-species probiotic on BCO

Earlier studies have already established the positive effect of the host-specific multispecies synbiotic PoultryStar® on gut health. As good gut integrity lessens bacterial translocation from the gut, it was hypothesized that the feeding of such a probiotic product could reduce the incidence of lameness caused by BCO.

In order to study the development of lameness, a wire flooring model for inducing lameness in broilers was developed by a group of researchers under the direction of Prof. Wideman at the Department of Poultry Science, University of Arkansas, USA. As the incidence of lameness is low in research flocks, the phenomenon has been difficult to study so far, which has hampered efforts to develop measures that may help producers. Growing broilers on wire flooring provides an excellent experimental model for reproducibly triggering significant levels of clinical lameness attributable to osteochondrosis and osteomyelitis of the proximal femur and tibia to enable statistically sound studies. Leg disorders and lameness are commonplace when birds are reared in cages with wire flooring due to high stocking densities and lack of exercise. The results of a study to evaluate the effect of PoultryStar® as a prophylactic feed additive for preventing the onset of lameness in broilers by using the wire flooring model for inducing lameness in broilers were recently published in Poultry Science, (R.F. Wideman et al., "A wire-flooring model for inducing lameness in broilers: Evaluation of probiotics as a prophylactic treatment." Poult Sci 2012 91:870-883). In this study, a series of four independent experiments were carried out and table 1 illustrates a summary of the results. Comparing between the Wire-Control groups, the addition of PoultryStar® to the control diet significantly reduced the incidences of lameness in all experiments.

Conclusions

The results of these studies demonstrate that the feeding of the multispecies probiotic consistently reduced the incidence of clinical lameness in broilers raised on wire flooring in four statistically significant experiments. The most common cause of lameness, bacterial chondronecrosis with osteomyelitis (BCO), may be reduced by administering the probiotic prophylactically from the first day of rearing. The probiotic was shown to reduce the development of clinical lameness by interfering with bacterial translocation into sub-clinically damaged voids or clefts in the proximal femoral and tibial epiphyseal plates. These experiments indicate that bacterial translocation from the gastrointestinal tract is likely to be a significant route contributing to hematogenous infection. The multispecies probiotic PoultryStar® administered prophylactically from the first day of rearing can provide a plausible alternative to antibiotics for reducing the incidence of BCO.

References

R.F. Wideman et al., "A wire-flooring model for inducing lameness in broilers: Evaluation of probiotics as a prophylactic treatment." Poult Sci 2012 91:870-883).

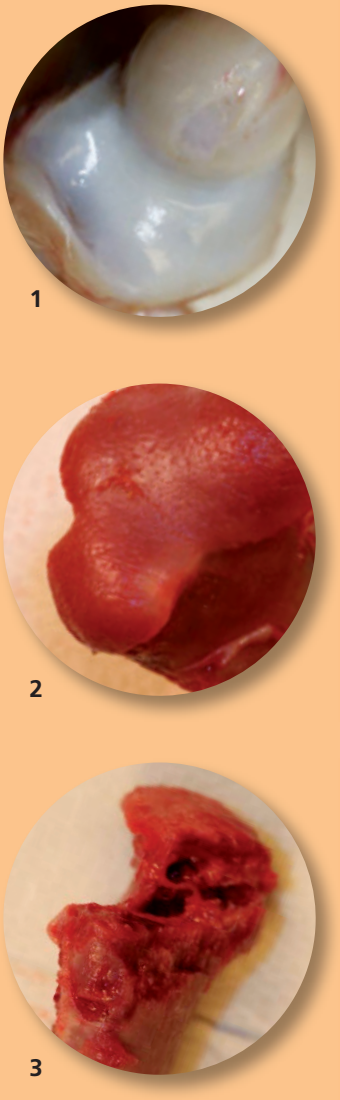


Figure 1: Stages of proximal femoral head degeneration leading progressively to bacterial chondronecrosis with osteomyelitis (BCO):
1 Normal proximal femoral head;
2 Femoral head separation;
3 complete destruction of the femoral head (Courtesy R.F. Wideman)

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