

Management of Broiler Breeders to Improve Leg Health During Production

Introduction

Broiler breeder leg health is key to achieving optimum flock production and welfare. This document provides management advice, includes the descriptions of common leg health issues and offers strategies to improve the leg health of broiler breeders, with a particular emphasis on the production period.

Leg health issues in broiler breeders

Staphylococcus

Staphylococci bacteria are normal chicken commensals, commonly found in poultry without any negative effects. However they can also be opportunistic pathogens and may be implicated in joint, tendon and bone infections. Staph bacteria may be associated with conditions such as tenosynovitis, arthritis and Bacterial Chondronecrosis with Osteomyelitis (BCO), also referred to as Femoral Head Necrosis (FHN). There are a number of Staph species but Staph aureus is of most clinical importance. The probability of infection and whether disease develops will increase in certain circumstances including:

- High levels of bacterial challenge
- Injuries allowing a route of bacterial entry (including conditions that compromise the intestinal or respiratory lining, for example coccidiosis or, infectious bronchitis)
- Immunosuppression or distress

If one or more of these risk factors is present in a flock, there will be an increased risk of Staph problems.

The condition can also be induced by not having regular sufficient feed increases in rear.

'Bumblefoot'

Bumblefoot is often associated with walking on hard, rough or sharp surfaces, which often occur, for example, where the litter is wet. A high percentage of slatted area (>30%) could also increase the risk. Feet affected with bumblefoot are commonly infected with Staph.

Good litter management in combination with good environmental control is important to prevent bumblefoot.

Foot Pad Dermatitis

The main cause of Foot Pad Dermatitis (FPD) in parent stock is wet litter. Litter type, moisture, stickiness and composition have all been identified as contributing factors. In the long term FPD can lead to infections in the foot and to more permanent (chronic) leg pathology such as bumblefoot.

Ruptured Tendons

Ruptured Tendons (RT) has been diagnosed in broiler breeders for many years, with cases reported as far back as the 1950's. However, our understanding of the causes of RT has improved greatly since then. It is now recognised that several predisposing factors may contribute to RT, and it is when these factors are sufficient in number and/or severity, that one or both gastrocnemius tendons rupture. It is also important to note that although RT most commonly occurs during early to mid-lay, tendon damage (i.e. loss of tensile strength) will most likely have occurred earlier in the bird's life, i.e. during rear.

There is little in the literature regarding causes of RT in poultry, although a number of hypotheses have been put forward, including degenerative disease, infections from some strains of reovirus and Staph bacteria, and experimentally, certain antibiotics (fluoroquinolones).

The two most common infectious causes of RT are reovirus and Staph bacterial infections. Reovirus should be ruled out as a contributor to RT during episodes of increased incidence; the use of vaccines both live and inactivated can help reduce the severity of a reovirus infection.

Some strains of Staph bacteria also produce proteinase enzymes which weaken the surrounding tissue potentially resulting in subsequent tendon ruptures. Concurrent or previous infections from reovirus and/or staph bacteria should be ruled out as contributors to RT. Further information is available through publications such as the AviaTech Bulletin Staphylococcus Infections in Broiler Breeder, or by consulting your poultry veterinarian.

Non-infectious causes including degenerative disease should be part of any RT investigation. While the exact predisposing conditions that lead to degenerative damage (and eventual rupture) may be difficult to pinpoint, there is clear evidence that nutrient delivery to the tissue is critically important. Diseases that impact intestinal health (such as coccidiosis, viral enteritis and dysbacteriosis) may adversely affect nutrient absorption and therefore, delivery of nutrients to tendon tissue. Hence, there may be an indirect adverse impact on tendon health due to poor intestinal health, and this must be taken into consideration when investigating RT.

How to measure leg health

The most effective way to monitor leg health is to record culling due to leg health issues. In order to do this the farm manager needs to be able to identify basic forms of leg problems, and must have an understanding of normal levels of leg culls within their operation. A sudden increase in leg cull levels should trigger an investigation (post mortems and histology) to determine whether the cause is infectious or non-infectious.

Management of broiler breeders to improve leg health during production

The occurrence of many of the leg health issues seen in broiler breeders during production can be alleviated by employing appropriate management techniques in rear. The key management factors for reducing leg health issues in broiler breeders during production are given below.

Gut integrity

Any factor that reduces gut integrity and leads to an impaired gut development will result in reduced nutrient absorption. If nutrient absorption is reduced there will be reduced key nutrients for optimal physiological development, pre-disposing birds to leg health problems during production. A good, calm chick start will aid gut integrity and nutrient absorption.

Body weight and feed amounts

The target of parent stock management must be to deliver the correct nutrients, including water, to the correct tissues, at the correct time and in the correct quantity to every bird in the flock from day old to flock depletion.

Rear

To ensure birds receive sufficient nutrients, provide dietary nutrient levels recommended by Aviagen (2013 Parent Stock Nutrient Specifications) and allocate feed to achieve or slightly exceed the recommended body-weight profile in rear. Target weekly incremental body weight gains should always be as per target even if birds are overweight and feed amount should never be kept the same for longer than a week. Birds should not fall below the recommended body-weight target. Birds that are underweight during rear will not be receiving the nutrients they require; early physiological development will be impaired, and the risk of leg health issues in production will increase. In some situations where a higher incidence of leg problems has been seen, the introduction of modified body weight profiles in rear has reduced the incidence of RT. For specific advice on these programmes, consult your Aviagen Technical Manager.

The critical period for weekly feed increases is between 9 and 16 weeks of age. During this period birds should have continual increases in weekly feed amounts for optimal physiological development; a minimum of approximately 2 g per bird per week (5 kcal per bird per week) is recommended. Importantly, this increase in feed (and incremental increases in body weight) should be maintained even if birds are over the recommended body-weight target. In locations where this approach has been implemented, a reduction in leg problems has been realised. **Feed levels should never be held or reduced.**

Uniformity of body weight and skeletal development is also of importance. Simply put, a uniform flock will respond uniformly to feed increases. Grading at 4 weeks of age will help maintain good flock uniformity. All graded populations should be back on the target profile by 9 weeks of age. Flocks that are overweight at this age should be left heavy and be given the appropriate feed to maintain that heavier profile and achieve the targeted incremental weight gains.

Post transfer

Poor weight control from transfer to peak egg production can be a contributory factor to the incidence of some leg issues. Recent trials have shown that feeding to control body weight and avoiding excessive weekly increases after 20 weeks of age can be beneficial.

Feeder & drinker management

Leg health issues have been found to be higher in flocks that are fed in pan feeders or given water in bell drinkers. This is unlikely to be as a result of the feeders/drinkers themselves, but as a result of these systems being inappropriately managed.

With both systems, adequate space for the number of birds in the house must be given; Aviagen recommended minimum feeding and drinker space (Table 1) should be adhered to at all times (see Parent Stock Management Handbook for more information on feeding and drinking space).

Table 1. Minimum recommended feeding and drinker space for pan feeders and bell drinkers

Age	Pan Feeder cm (in) per bird
0-5 weeks	5 (2)
5-10 weeks	8 (3)
10 weeks to depletion	10 (4)

Age	Bell Drinker cm (in) per bird
0-15 weeks	1.5 (0.6)
16 weeks to depletion	2.5 (1.0)

The space between feeders and drinkers must also be adequate. If feeders and/or drinkers are positioned too closely together then birds will not be able to fit comfortably between feeders and drinkers, or too few birds will be able to fit round the pan feeder/bell drinker at the same time. Figure 1 illustrates how bird body length changes with increasing age. Figure 2 shows birds feeding when correct feeder space and house set up are in place.

Figure 1. Changes in body length of females with age

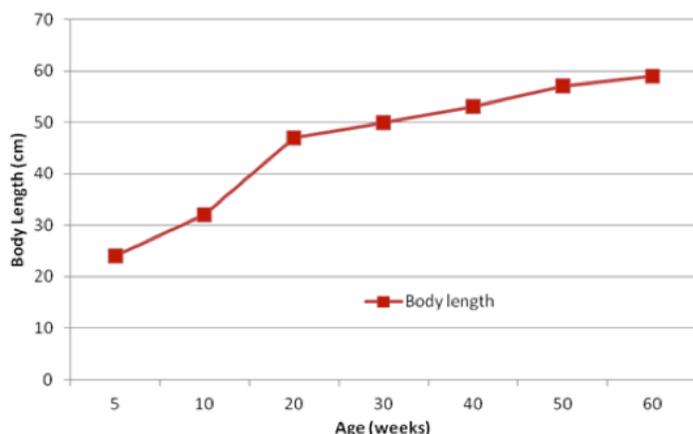


Figure 2. Examples of adequate spacing between feeders and drinkers



Inadequate feeder or drinker space, (either as a result of inadequate space for the number of birds in the house, or due to feeders/ drinkers being positioned too closely together), will result in feed and water intake being restricted which may be a pre-disposing factor to leg health issues.

Birds should be monitored closely at feeding time to identify any potential issues associated with inadequate feeding space. If there are birds still looking for feed 5 minutes after feeding then it may be necessary to increase feeder space.

Controlling water provision during periods when water intake is naturally low (such as during the night) may help to reduce water leakage which will lead to wet litter and potentially FPD. Extreme care must be taken not to restrict the amount of water needed for growth/production and no control of water provision should occur before 6 weeks of age. Any control of water provision is more difficult to manage when bell drinkers are used and should be implemented with care. Ensuring the adequate provision of water in rear and early production has reduced the incidence of RT. For further advice, consult your Aviagen Technical Manager.

Feed distribution

Feed must be distributed evenly to the whole flock quickly if all birds are to receive adequate nutrient intake.

1. Track feeders

- Should run in opposite directions
- Feed should be distributed to each population within 3 minutes
- If feed distribution is a problem a supplementary feed bin halfway round the feeder loop can help

2. Pan feeders

- Pan feeders provide good feed distribution if managed properly

- Pan feeders must remain charged at all times
- Check regularly to ensure all pans are receiving feed evenly

Feed depth, distribution time and clean-up time should be monitored regularly at several points around the house to ensure that feed distribution is correct and that all birds have access to the feeders at the same time.

Litter management

Good litter management and maintaining good litter quality is essential for optimal feet and leg health in broiler breeders. Litter must be kept dry and friable. This is achieved by;

- Maintaining correct environmental temperatures
- Ensuring the floor is completely dry before spreading the litter
- Ensuring that ventilation supplies enough fresh air and removes excess moisture from the house. Cold air entering the house must not be allowed to fall directly onto the birds and litter
- Keeping relative humidity less than 60% whenever possible
- Drinker management must ensure that;
 - o drinkers are well maintained and do not leak
 - o drinker height is adjusted daily
 - o the drinker line is level

Where floor feeding occurs, litter depth at placement should not exceed 4 cm (1.5 in). This will prevent feed becoming lost in the litter which can lead to reduced/poorly distributed feed which in turn may result in some birds having a poor nutrient intake and therefore a non-optimal physiological development.

Slats

Slats that are too high will lead to increased leg health issues in broiler breeders. Internal test data has shown that when slat height was increased from 25 cm (10 in) to 60 cm (24 in), mortality due to leg problems almost doubled. There are some data to suggest that a slat height of around 25 cm (10 in) may help with leg health issues. Slat area should not be greater than 30% of floor space to reduce the risk of leg health issues such as bumblefoot.

Perches

Perches should be installed during rear to encourage and train females to jump on slats in lay; this will also promote good leg strength. Perches should be placed in the female rearing pens from 28 days of age. Sufficient perches to give 3 cm (1.2 in) per bird should be provided.

Incubation

Research projects in the USA, Turkey and the Netherlands have investigated the impact of various aspects of incubation, at different stages of embryo growth, on bone development. They have demonstrated that hatchery and incubation conditions can affect bone growth and condition, although most of the trials have been done with broiler, rather than parent stock, hatching eggs.

Where femoral head necrosis due to *Staph aureus* is a problem in an integration, chicks hatched from floor eggs can show a higher incidence. Where this is an issue the chicks will show problems within a week of hatching. The problem can be significantly reduced by not setting floor eggs, or if their use is unavoidable segregating them into separate incubators and fumigating effectively with formaldehyde before the eggs are set and during the hatching process.

Low or high temperature and low or high oxygen levels in incubation can alter the weight or length of the leg bones, increase the incidence of tibial dyschondroplasia or cause some asymmetry between left and right legs. Any problems tend to be seen in the day old chick, or within normal broiler grow out. None of the published trials have considered any possible impact in broiler breeders. The trials reported in the literature have used a wide range of treatments and different ways of defining incubation temperature, but confirm that leg health will be optimal where egg shell temperature is held at 100 - 101 °F (37.8 - 38.3 °C) throughout incubation, and ventilation in the hatcher is adequate to maintain oxygen levels between 19 and 21%.

A series of internal trials run by Aviagen compared the outcomes when eggs from a common source were hatched in different breeding stock hatcheries. The chicks produced were then placed together on the same farm and the leg culls monitored throughout both the rearing and the laying periods. Although there were small differences seen between the hatcheries in the levels of hatch of fertile and first week mortality, no differences in leg health were seen on farm in the rearing or the laying period. The trials confirmed the conclusions from the published literature that provided incubation conditions are well controlled, leg health issues in the chicks are unlikely to be due to the hatchery.

Nutrition

Routine feed samples should be taken and analysed for actual nutrient content to ensure that the birds are receiving the nutrients they need at the right time.

Amino acids (AA) - Ideal amino acid (AA) dietary profile should be fed to birds from day-old, in order for birds to achieve their body weight objectives. Excess crude protein (CP) and AA in the diet can lead to excessive body-weight gain, which can affect leg health. Also excess CP and AA can lead to increased uric acid excretion and secondary ammonia production in the excreta or litter, which can increase the risk of foot pad lesions.

Calcium (Ca) pidolate - there is evidence that Ca pidolate improves the availability and absorption of Ca, helping the treatment of osteoporosis in humans. Ca pidolate is also involved in protein biosynthesis and leads to the formation of amino acids, especially proline, hydroxyl-proline and arginine, which are structural amino acids involved in collagen formation. Recent field studies suggest leg health may be improved when Ca pidolate is fed during rear.

Calcium, Phosphorus (P) and Vitamin D3 - a deficiency of either Ca or P results in reduced skeletal calcification, impairing bone integrity. Rickets, which is seen mainly in young growing birds, can be caused by lack of Vitamin D3 as well. Ca/P ratio is a factor in causing Tibial Dyschondroplasia (TD), therefore maintaining a Ca/P ratio of 2 is important for preventing TD. Calcium deficiency in adult laying hens usually results in osteoporosis. When Ca is mobilized from bone to overcome a dietary deficiency, the cortical bones become too thin to support the weight of the bird. However, excess of Ca can lead to increased water intake, and a noticeable increase in the moisture in the litter, which can increase the risk of foot pad lesions.

Electrolyte balance - Ideal electrolyte balance (180-200 mEq/kg for (Na+K)-Cl); the balance of Sodium (Na+), potassium (k+) and chloride (Cl-), is required for proper bone development and also to maintain good litter quality.

Key Points

- The target of parent stock management must be to deliver the correct nutrients, including water, to the correct tissues, at the correct time and in the correct quantity to every bird in the flock from day old to flock depletion.
- All leg culls should be recorded in the flock record sheet along with the cause.
- Management should optimise gut health to maximise nutrient absorption and the nutrients available for physiological development.
- Birds should receive weekly feed increases of a minimum of 2 g per bird per week (5 kcal ME per bird per week) between 9 and 16 weeks of age irrespective of body-weight gain.
- Never hold or pull feed off the females in rear.
- Body weight should be on or slightly above target but never below.
- Pan feeders and bell drinkers must be carefully managed.
- Implement recommended feeding and drinking space per bird.
- Adequate water supply is essential during rear and early production.
- Ensure the distance between feeders and/or drinkers is adequate for bird size.

- Ensure volume, uniformity and speed of feed delivery.
- Maintain dry and friable litter.
- Low slat height may be beneficial.
- Introduce perches in rear.
- Follow Aviagen incubation recommendations to minimise the risk of leg problems.
- Dietary levels of AA, calcium and phosphorous, and electrolyte balance are all important for correct physiological development.
- Any concerns regarding leg health of the flock consult a veterinarian for assistance.

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