



Broiler Foot Health Controlling Foot Pad Dermatitis

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Introduction

Foot pad dermatitis (FPD) or pododermatitis can be a significant welfare issue for the broiler industry and is increasingly being used as an indicator of broiler flock welfare. The incidence of FPD also has financial implications for businesses who sell feet/paws.

The aim of this article is to provide information on what can be done to prevent FPD from developing in a broiler flock, focusing on three key areas: **Litter quality**, **Enteric health** and **Nutrition**

What is FPD?

FPD is the development of dermatitis (lesions) on the foot pad of the broiler, but it may develop on any area of the foot that is in contact with the floor. In the early stages, FPD shows itself as small erosions and discoloration of the skin. These can develop into painful ulcers, but if corrective action is taken and litter conditions are improved these erosions can heal. However, it is preferable to prevent rather than cure the occurrence of FPD.

What Causes FPD?

FPD can occur at any stage of the broilers life. The main cause of FPD is poor litter conditions, in particular, wet or capped litter. Below optimal environment and nutrition (and their effect on the litter) are the most likely causes of FPD. However, if minimal inputs are not met or if the bird is not managed correctly, susceptibility to FPD will be increased. Stocking density also needs to be considered to ensure the flock's requirements are met by the environmental management systems.

What can be done to prevent FPD

Good Litter Management is the Key

Good litter management and maintaining litter quality throughout the life time of the flock is key to the prevention of FPD in broilers. Litter should be kept dry and friable and litter quality assessed daily. The reasons for any changes in litter quality should be established and action taken to correct this where necessary. The main factors affecting litter quality are:

- litter material – should be absorbent, non-dusty and clean
- litter management and quantity – ensure appropriate litter depth and house pre-warming prior to chick placement

- drinker line management – ensure correct drinker line height and number, maintain drinker lines and have a good water line sanitation program in place.
- lighting – even light distribution will ensure an even distribution of birds and a more even litter quality.
- ventilation – establish minimum ventilation from day one, paying particular to ventilation during winter.

FPD and Nutrition

The following nutritional strategies will help maintain gut health and litter quality, and reduce FPD:

- minerals – ensure sodium, potassium and chloride levels are balanced; this will avoid excessive water intake.
- protein quality – Balanced Protein should be supplied from good quality raw materials; this will maintain gut health and avoid wet litter.
- raw material digestibility – avoid raw materials that have a low digestibility or are high in fiber, these have a negative effect on gut health.
- feed form – poor feed form (high level of fines) can lead to an increased water intake.
- anticoccidial program – the use of in-feed ionophores will help improve gut health.

Enteric health

Maintaining gut health is vital for maintaining good litter quality. The best way to maintain good gut health is to maintain environment and management conditions that are correct for the bird throughout its life.

- Ensure appropriate between crop disinfection procedures are in place.
- Regularly assess flock performance (crop fill, body weights, and uniformity).
- Vaccination and coccidial programs should be developed with veterinary input.

TAKE HOME POINTS

- The occurrence of FPD can have significant welfare and financial implications.
- Wet litter is the main cause of FPD in broilers.
- Optimizing environment, nutrition and enteric health throughout the life time of the flock will minimize the occurrence of FPD.

The remainder of this article provides more detail on the points summarized on the first page.

Introduction

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Measuring FPD

A number of scoring systems have been developed to try and assess the incidence and severity of FPD within individual broiler flocks. Many of the Scandinavian countries have adopted a system of assessing birds' feet using a three tier scoring system.

- **0 = No lesions;** no or very small superficial lesions, slight discoloration on a limited area, mild hyperkeratosis (**Figure 1**)
- **1 = Mild lesion;** discoloration of the foot pad, superficial lesions, dark papillae (**Figure 2**)
- **2 = Severe lesion;** ulcers or scabs, signs of hemorrhages or swollen foot pads (**Figure 3**)

Figure 1: Example of a foot pad with Score 0



Figure 2: Example of a foot pad with Score 1



Figure 3: Example of a foot pad with Score 2



At the processing plant, 200 feet per broiler flock are assessed using the above scoring system and noted accordingly. An overall score is then assigned to the flock. The grower needs to achieve a score of less than 50 to avoid financial penalties.

There are more complex systems in place that mark birds on a scale of 0 to 5 according to the severity and frequency of FPD while other less complex scoring systems categorize FPD's as simply being present or not present. The scoring systems currently in use are based on subjective measures of the occurrence of FPD, but all try to highlight to the grower or manager if there is an issue that needs to be corrected.

Litter Quality

Poor litter quality is one of the main causes of FPD. The best way to avoid FPD is to maintain a good litter quality, keeping the litter dry and friable. Routinely assess litter quality as part of the day to day husbandry of the flock. Note any changes in the visual appearance or friability of the litter. Determine the reasons for the changes and take corrective action if necessary. There are a number of factors that can affect litter quality:

- Litter material
- Litter management and quantity
- Drinker line management
- Distribution of light
- Ventilation
- Nutrition

Litter Material

There are a range of different litter materials available for use in the broiler house. Decisions on which litter material to use should be based on local availability and sustainability of supply and cost. Good litter materials should be:

- Dry
- Absorbent
- Friable
- Provide insulation
- Free from contaminants

Litter Management and Quantity

When placing the litter it should be distributed evenly onto a dry concrete floor. The volume of litter required is dependent on its absorbency and ability to break down. The depth of litter should be deep enough to absorb moisture and shallow enough to allow the birds to work it. For example, soft wood shaving material should ideally be evenly distributed to a depth of 3-4 inches (8-10 cm). However, due to economics, shavings are more generally distributed to a depth of 1 inch (2-3 cm), this makes pre-warming of the floor a higher priority.

The house should be pre-warmed at least 24 hours before the chicks are placed. Litter temperature should be 28-30°C (82-88°F). Achieving the correct litter temperature is critical for the day old chick and removes any condensation from the concrete, helping to maintain litter quality.

There have been a number of trials completed in Europe which have shown peat/peat moss to be a good product for reducing the incidence of FPD. The results of trial work in Belgium have indicated that wheat straw can have a negative impact on the incidence of FPD (see **Table 1**) chiefly due to the poor moisture absorbency of straw.

Table 1: Influence of litter material and depth on the incidence of FPD in a trial completed in Belgium (2004)

Pododermatitis Score	% of Birds			
	Score 0 (no lesions)	Score 1 (some red coloring on foot pad)	Score 2 (intermediate red coloring on foot pad but no lesions)	Score 3 (severe red coloring on foot pad plus lesions)
Material & Volume				
Wood shavings 0.2 lb/ft ² (1.0 kg/m ²)	48.1	37.9	11.0	3.0
Wood shavings 0.3 lb/ft ² (1.5 kg/m ²)	52.5	39.4	7.5	0.6
Chopped straw 0.2 lb/ft ² (1.0 kg/m ²)	35.2	46.1	18.2	0.5
Chopped straw 0.3 lb/ft ² (1.5 kg/m ²)	29.4	49.9	20.1	0.6

Drinker Line Management

Birds should be provided with a source of good quality, clean drinking water which has a low bacterial count and is free from E. coli and pseudomonas. The presence of any of these organisms in the water will challenge the gut leading to problems of wet litter. A monitored terminal disinfection and routine sanitization program should be in place to prevent the build up of biofilms (for more information on water line sanitation programs see the AviaTech - Water Line Sanitation, August 2007). Drinker lines need to be maintained and regularly checked for leakage along the length of the pipe work. Any blocked or leaking nipples should be replaced. Drinker line height should be appropriate for bird height and not for bird age (**Figures 4 and 5**).

Figure 4: Nipple line height adjustments with bird size

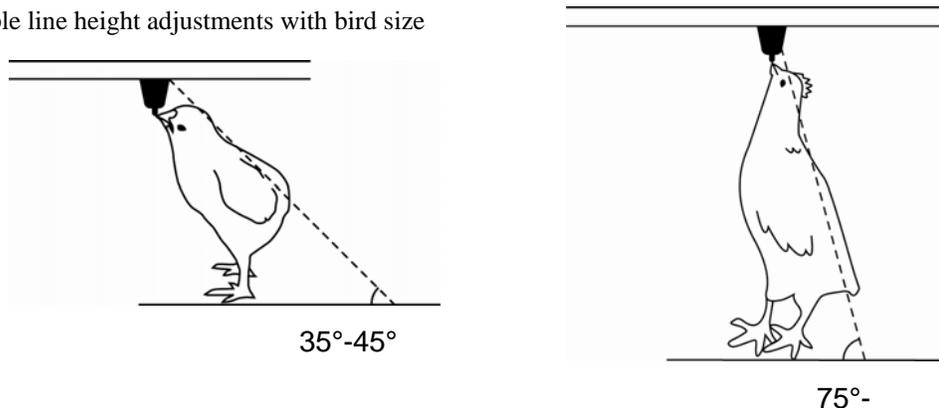
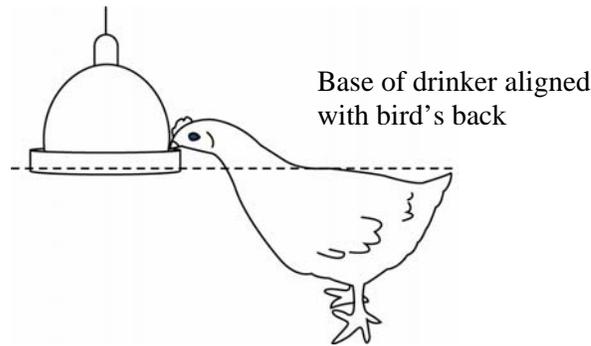


Figure 5: Bell drinker height



The number of drinkers available should be correct for the number of birds in the house (**Table 2**).

Table 2: Minimum drinker requirements per 1000 birds post-brooding

Drinker type	Drinker requirements
Bell drinkers	8 drinkers (16 in (40 cm) diameter) per 1000 birds
Nipples	83 nipples per 1000 birds (12 birds per nipple, or for heavy broilers (> 6.6 lb / 3kg 9-10 birds per nipple)

Water pressure must be appropriate for the flow rate to ensure adequate water delivery without leading to wastage. Low flow rates can improve litter conditions but will limit growth rate. In buildings with sloping floors pressure reducers must be fitted to ensure pressure is equalized along the drinker line and to prevent leakage.

Lighting and Distribution of Light

Even light distribution after the initial brooding period is essential as it encourages an even distribution of birds over the floor area and a more even litter quality. The use of dimmable fluorescent lighting has been shown to decrease the friability of the litter particularly when the fluorescent lights are positioned near to the floor (less than 8 ft (2.5 m)). This can lead to behavioral changes, probably due to the lights flickering when dimmed, which results in litter levels being reduced under the lights. If droppings are passed onto minimal amounts of litter it will quickly become capped. If litter levels do become depleted under the lights the litter should be moved back or replaced as soon as possible.

Incandescent lights tend to draw birds closer to the source; this encourages activity which can often negate the increase in droppings in an area. In areas where natural light is used the birds' natural floor scratching behavior tends to be increased helping to maintain litter quality. In addition, increasing the surface area open to the air will help remove moisture from the litter. However, natural light needs to be well managed to decrease the risk of other issues occurring.

Ventilation

Minimum ventilation rates should be established right from day one of the flock. Minimum ventilation not only supplies the birds with fresh air but also removes harmful gases and excess moisture from the house. For the first three days, relative humidity (RH) should be between 60 and 70%. From day 18 onwards, if RH is above 70%, excess moisture will build up leading to wet litter.

It is imperative to ensure, especially during winter, that airspeeds for achieving minimum ventilation are correct. If the airspeed is too slow or too fast the cold air being drawn into the house will be 'dumped' near the air inlet. During winter the incoming air will have increased moisture and this will contribute to wet litter problems. The correct airspeed will depend on the house type and dimensions, as well as the age/weight of the flock.

Warm air should flow across or near the surface of the litter. This will prevent air stratification and allow the relatively drier warm air to absorb moisture out of the litter. In conventional type systems achieving the correct airflow pattern can be difficult. Airflow can be assessed by using smoke, but in general the first area of litter to suffer from the effects of poor air flow (increased moisture content) is near the walls.

FPD and Nutrition

Nutritional control over FPD involves implementing nutritional strategies to avoid wet litter. Areas to consider include:

- Minerals
- Protein quality
- Fats quality
- Digestibility of feed raw materials
- Anti-nutritional factors, mycotoxins
- Feed physical form
- Anticoccidial program

Provided suitable management, health and environmental practices are followed, the following nutritional strategies will help to ensure that litter quality is maintained.

Minerals

Dietary sodium, potassium and chloride levels need to be balanced to avoid excessive water intake by the birds and to ensure good gut health and stability. Of particular importance is sodium. Increases in sodium will directly affect water intake, potentially resulting in wet litter. Sodium levels should be balanced to supply adequate levels for broiler performance without encouraging excessive water intake.

The addition of Phytase to broiler diets not only promotes the release of phosphorous from plant material but also the release of other minerals. This must be accounted for when formulating diets with Phytase if wet litter problems are to be avoided.

Protein Quality

Good levels of protein and amino acids are necessary to promote efficient growth in broilers, but it is important that amino acids are supplied to the broiler as Balanced Protein from good quality raw materials. A failure to do so will result in excess nitrogen needing to be metabolized and excreted by the broiler. This will have a negative impact upon gut health and will result in wet litter, increasing the risk of FPD. Formulating diets on the basis of digestible amino acids will ensure that the nutrient content of the feed is matched as closely as possible to the requirements of the birds, reducing the risk of wet litter.

Fat Quality

Highly digestible (unsaturated) fats will promote enteric health in the broiler. The use of poor quality fats often cause greasy or sticky litter which will lead to problems with FPD.

Raw Material Digestibility

The use of raw materials that have a low digestibility or are particularly high in fiber should be avoided as these will have a negative effect upon gut integrity, excreta of the broilers and litter quality.

Anti-nutritional factors such as trypsin inhibitors should be avoided, and raw materials must be free from high levels of mycotoxin contamination. If it is impossible to avoid poor quality raw materials, then a binding product should be considered for inclusion in the feed mix.

The use of Non-Starch Polysaccharide (NSP) enzymes is an important tool for improving gut health and controlling litter quality. These enzymes reduce gut viscosity and will lead to drier litter.

Over the past number of years particularly in areas of Western Europe there has been a move to vegetarian and antibiotic free diets, this in turn has increased the industries reliance on vegetable protein sources which makes friable litter much more difficult to maintain.

Feed Physical Form

The benefit to broiler performance in terms of live-weight gain and FCR from feeding a good quality crumble and pellet is well documented. A feed that is of poor physical form with high levels of dust not only leads to problems with broiler performance but could also lead to an increased ratio of water to feed intake, which in turn could lead to poor litter conditions and ultimately increase the risk of FPD.

Anticoccidial Program

Generally, there is a benefit to gut health from the use of in-feed ionophore anticoccidials, and an anticoccidial program that incorporates the use of such products will help to improve gut integrity and maintain litter condition. If using a vaccination for coccidial control in broilers, greater care and attention to gut health is required to ensure litter condition is suitable.

Nutrients that Could Help with FPD

The addition of some nutrients to the diet may help to reduce the occurrence of FPD in the broiler house. These include:

- Biotin
- Zinc
- B vitamins
- Clay mineral binders

There has been a great amount of work investigating Biotin supplementation in relation to FPD. It is known that Biotin has an important role in the integrity of skin, and trials have shown that deficiencies can result in FPD. Therefore it is important to ensure that dietary levels are adequate and that deficiency is avoided. Levels of between 0.1 and 0.2 mg will help to optimize performance and have been shown to reduce the incidence of FPD. It may be possible to use higher levels of Biotin to prevent FPD even when litter conditions are not ideal. However, research suggests that Biotin is ineffective as a treatment for birds already displaying dermatitis.

Zinc plays an important role in cell regeneration and is involved in protecting the skin. As with Biotin, it has been shown that deficiency results in FPD, therefore it is important to ensure correct levels of zinc in the feed. The same applies with the B vitamins, where ensuring adequate levels could help to prevent FPD. For further information on appropriate levels of zinc and the B vitamins in feed, contact your local Aviagen Nutritional Services Representative.

In an extra effort to improve litter conditions, there are examples where some clay mineral binders such as sepeolites have been included in feed to improve gut stability and produce drier litter.

Enteric Health

Management of the gut is a critical part of not only maximizing feed efficiency and weight gain but also of maintaining good quality litter. Any bacterial or disease challenge of the gut will significantly contribute to problems of wet litter and hence FPD. One of the best ways to achieve good enteric health is to ensure that the methodology for cleaning out in between crops is adequate.

1. Remove all organic material from the house.
2. Apply detergent.
3. Wash and disinfect.
4. Disinfect with an anti viral agent, formaldehyde / formalin fogging.
5. Enforce a sound biosecurity program that starts from the point of washing, including foot bathing facilities and house specific boots to limit the number of pathogens brought into the house by staff or visitors.

Enteric health will be optimized if the bird is kept in an environment and under management which is suitable to its requirements throughout its life cycle. A good chick start is essential for uniform growth, regular examination of management factors needs to take place to assess the impact of management styles, crop fill, weighing and uniformity measurements. If any of these measurements are substandard then corrective action has to take place in preparation for subsequent crops. Veterinary input is critical to ensure that vaccination and coccidial programs and the identification of clinical and subclinical disease are effective so that damage to kidneys and the gut is limited.

Conclusion

Achieving an understanding of what causes the occurrence of FPD and the management strategies that need to be put in place in order to prevent the problem from arising is important if FPD is to be avoided. The main environmental factor involved in FPD is wet litter. Optimizing nutrition, environment and enteric health will reduce the occurrence of wet litter so that litter quality is maintained throughout the life time of the flock. This will contribute significantly to minimizing the risk of FPD in the flock.

Every attempt has been made to ensure the accuracy and relevance of the information presented. However, Aviagen accepts no liability for the consequences of using the information for the management of chickens. For further information, please contact your local Technical Service Manager or the Technical Services Department.



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