

Less foot pad lesions by nutritional adjustments

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INTRODUCTION

Foot pad dermatitis (FPD) is very common in broiler and turkey flocks and is a potential economic and welfare problem in intensive production systems. Foot pad dermatitis develops rapidly in commercial flocks, where fully developed lesions may occur by three weeks of age. From literature and practical experience it is clear that the cause of FPD is multi-factorial (litter type, drinker type, climate, genetic variation and nutrition). The prevalence of foot pad dermatitis (FPD) in turkeys is closely related to high concentrations of litter moisture (Hocking and Wu, 2013; Wyneken et al., 2015). Litter condition is affected by many variables such as type of litter, humidity, season, type of drinker, nutrition, amount and consistency of faeces, and stocking density. The moisture content of the litter is affected by the amount and consistency of the faeces and this in turn is affected by diet composition. Soya bean meal is commonly used in turkey diets as the main protein source. Soya bean meal contains high levels of potassium which may adversely affect the consistency of the excreta. High dietary sodium and potassium contents may result in excessive water intake resulting in wet litter (Tucker and Walker, 1999; Murakami et al., 2000).

The ERA-Net (ANIHWA) project to reduce the development of FPD in commercial turkeys and the adverse effects on health, welfare and performance by identifying causative factors

and methods to ameliorate them was conducted in the period 2014-2016. One of the sub-objectives of the project was to study the impact of factors that may have a beneficial effect

on litter quality and decrease the incidence and severity of FPD in applied research projects. In two experiments the effect of soya bean meal in diets for turkeys on litter moisture and FPD was studied. The results of Experiment 1 will be summarized in this paper briefly as these results have been presented during the 10th Turkey Science and Production Conference (Veldkamp et al., 2016) and the results of Experiment 2 are presented in more detail in this paper.

Experiment 1: Effect of dietary protein source and crude protein content on litter moisture and FPD in two commercial turkey strains from 0 to 134 days of age

The objective of the study was to evaluate the effect of decreasing dietary electrolyte balance EB (high EB (HEB) vs. low EB (LEB)) and crude protein CP (high CP (HP) and low CP (LP)) in two turkey strains on growth performance, litter quality and FPD. The experimental treatments were evaluated in a 2x2x2 factorial block design. Diets were formulated to be isocaloric for 5 phases (0-28, 28-56, 56-84, 84-112 and 112-134 days of age) and containing per phase 290 vs. 260, 270 vs. 240, 230 vs. 200, 200 vs. 170, 170 vs. 140 g CP/kg, respectively; and EB (240 vs. 130 mEq/kg) in all phases. Free amino acids were supplemented to the diets according to breeder recommendations. LEB diets were formulated by exchange of soya bean meal by maize gluten meal, peas, potato protein, rapeseed meal and sunflower seed meal. LEB diets are the so called non-soya diets and HEB diets the soya diets. Water and feed were provided ad libitum. Body weight, feed intake, and FPD were recorded at 28, 56, 84, 112 and 134 days of age. Overall results indicate that daily feed intake in turkeys fed on LP was numerically higher than on HP diets. Body weight gain was not affected by CP and FCR was significantly higher in turkeys fed on LP diets than in turkeys fed on HP diets (2.56 vs. 2.50; P=0.002). FPD in turkeys fed on LP diets was significantly lower than FPD in turkeys fed on HP diets until 84 days (P<0.001). Turkeys fed on non-soya diets showed a significantly lower feed intake (420 vs. 435 g/d) and

body weight gain (166 vs. 172 g/d) over the period 28 to 134 days of age and a lower body weight (18588 vs. 19405 g) at 134 days of age compared with turkeys fed on soya diets. Litter was significantly dryer in pens with turkeys fed on non-soya diets than in pens with turkeys fed on soya diets ($P<0.001$). FPD in turkeys fed on non-soya diets was significantly lower than in turkeys fed on soya diets ($P<0.001$). FPD was not affected by turkey strain.

Experiment 2: Effect of soya bean meal on litter moisture and FPD in turkeys up to 12 weeks of age

The experiment was conducted from 0 to 84 days of age. The experiment was a completely randomised block design with one pen assigned to each of the eight dietary treatments in every block (6 replicates per diet). A facility with 24 pens (2.5 m wide x 1.8 m deep) was used and stocking density was 18 poults per pen. At 10 weeks of age the litter in half the pens (3 replicates per diet-litter moisture treatment) was moistened with the same volume of water daily from a garden watering can, to investigate the interaction between treatment and litter moisture. In total, 432 male B.U.T. Premium turkey poults (Aviagen Turkeys Ltd, Chester, UK) were used in the study. The pens were littered with wood shavings (depth of about 50 mm).

Feed was provided according to a three phase feeding programme in four-week phases. Wheat as well as maize based diets were formulated with or without soya bean meal and diets were formulated iso-caloric and iso-nitrogenous for 3 phases (0-28, 28-56 and 56-84 days of age) and containing per phase 11.8, 12.0 and 12.2 MJ/kg and 295, 275 and 235 g CP/kg, respectively. Experimental diets were supplemented with L-Lysine HCl, DL-Methionine, L-Threonine, and L-Arginine to have similar digestible amino acid contents in all experimental diets per feeding phase. Diets formulated with soya bean meal contained 500, 400 and 300 g soya bean meal/kg in the respective feeding phases. In diets without soya bean meal, the used protein sources were sunflower meal, rapeseed meal, peas, potato protein, fish meal and wheat gluten meal. Electrolyte balance in diets formulated with soya bean meal was 330, 290 and 250 mEq/kg and in diets formulated without soya bean meal was 230, 200 and 180 mEq/kg in the respective feeding phases. Diets were provided as crumbs (0-28 days of age), 3.0 mm pellets (28-70 days of age) and coarse mash (70-84 days of age). Water and feed were provided ad libitum.

Mortality was recorded daily. Body weight was recorded at 28, 56 and 84 days of age. Pen mean daily feed intake was measured at 3-4, 7-8 and 11-12 weeks of age. Litter moisture was determined at 56 and 84 days of age. Footpad lesions were scored by one person at 28, 56 and 84 days of age on a 5 point scale (0 = unaffected and 5 = more than half the footpad affected), as described previously (Hocking et al., 2008).

Foot pad lesions were not observed at 28 and 56 days of age. The number of turkeys with FPD scores of 0, 1, 2, 3 and 4 respectively at 84 days of age were 334, 20, 20, 13 and 6.

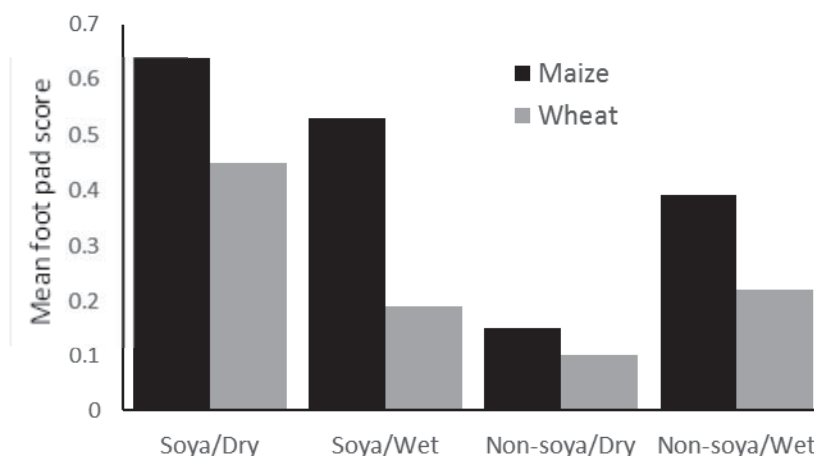


Figure 1. Mean foot pad score at different protein x litter treatments at 84 days of age.

Mean pen FPD score was higher for birds fed on maize compared with wheat diets (0.28 vs. 0.11; $P<0.05$) and mean pen FPD score for turkeys fed on soya bean diets was higher than for turkeys fed on non-soya diets (0.31 vs. 0.09; $P=0.012$). This was confirmed by the results of Experiment 1. A significant interaction ($P=0.022$) was found for protein source x litter treatment. Pen mean FPD scores for dry and wet litter treatments in turkeys fed on the soya diets were 0.44 and 0.22 and for the non-soya diets 0.02 and 0.20, respectively. In general, the mean FPD scores per pen are low but these data illustrate that turkeys on wet litter fed on soya bean meal diets are more susceptible to develop FPD than turkeys on dry litter fed on non soya bean meal diets. Wet litter as well as soya bean meal diets both intensify

the development of FPD lesions in turkeys.

A highly significant effect of protein source on litter moisture has been observed. Litter moisture was higher in turkeys fed on the soya diets compared with the non-soya diets at 4, 8 and 12 weeks of age. (Table 1). Mean litter moisture at 12 weeks for soya and non-soya treatments were 50.1% and 43.0% ($P<0.001$). Results in Experiment 1 showed also a higher percentage litter moisture for soya compared with non-soya diets. Litter moisture in turkeys fed on wheat and maize treatments did not differ significantly. Litter moisture for the dry and wet treatments at 12 weeks were 40.7% vs. 52.4% ($P<0.001$).

Mean body weights were similar at 28 days of age whereas body weights of turkeys fed on soya diets were higher than fed on non-soya diets: 9.33 vs. 9.29 kg ($P<0.05$) at 56 days of age and 11.25 vs. 10.90 kg ($P<0.001$) at 84 days of age, respectively. Body weight of turkeys fed on wheat diets as higher than fed on maize diets (11.25 vs. 10.90 kg; $P<0.001$) respectively. Feed intake of turkeys fed on soya diets compared with non-soya diets was numerically higher at 28 and 56 days and significantly higher at 84 days (587 vs. 524 g/d; $P<0.001$). A significant cereal x protein interaction for feed intake has been observed. The higher feed intake of turkeys fed on soya diets compared with non-soya diets was more pronounced in maize than in wheat diets at 12 weeks of age. This may be due to palatability problems as the meal form of the diets were only fed for the last 10 days. Mortality was not affected by the dietary treatments. In Experiment 1 also a higher feed intake and a higher body weight gain have been observed in turkeys fed on soya diets compared with non-soya diets. In general, the effects of soya bean meal in Experiment 2 on litter quality, FPD lesions and growth performance were in compliance with the effects observed in Experiment 1.

Table 1. Body weight, feed intake and litter moisture analysed separately by age of male BUT Premium turkey poult fed on iso-nutritional diets composed of maize or wheat as the cereal source and soya or non-soya sources of protein.

Cereal	Protein	Age (weeks)		
		4	8	12
<i>Litter moisture, %</i>				
Wheat	Soya	18	41	51
	Non soya	14	29	43
Maize	Soya	19	39	49
	Non soya	14	31	43
SED		2.5	4.3	4.5
<i>Significance</i>				
Cereal		NS	NS	NS
Protein		*	**	*
Cereal x protein		NS	NS	NS
<i>Body weight, kg</i>				
Wheat	Soya	1.45	5.83	11.45
	Non soya	1.49	5.94	11.04
Maize	Soya	1.46	5.77	11.20
	Non soya	1.44	5.76	10.60
SED		0.024	0.077	0.104
<i>Significance</i>				
Cereal		NS	*	***
Protein		NS	NS	***
Cereal x protein		NS	NS	NS
<i>Feed intake, g/d</i>				
Wheat	Soya	109	371	586
	Non soya	116	381	538
Maize	Soya	114	360	615
	Non soya	115	361	527
SED		2.4	9.8	11.1
<i>Significance</i>				
Cereal		NS	*	NS
Protein		*	NS	***
Cereal x protein		NS	NS	*

CONCLUSIONS

Foot pad lesions can be reduced by dietary adjustments.

Soya diets result in higher litter moisture contents and higher scores for FPD lesions compared with non-soya diets. Feed intake and body weight gain of turkeys fed on soya diets was higher than on non-soya diets.

Maize or wheat based diets did not affect moisture content in the litter but scores for FPD lesions of turkeys fed on maize diets was higher than fed on wheat diets. Feed intake and body weight gain of turkeys fed on wheat diets was higher than on maize diets.

Results are in compliance in two successive experiments.

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