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The Effects of Production Systems (Barn and Free-Range) on Foot Pad Dermatitis and Body Defects of White Turkeys

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Abstract: This study was carried out to determine the effects of barn and free-range housing systems on some body defaults and foot-pad-dermatitis scores in turkeys. Total 176 male and female mixed white turkey poults were reared under intensive conditions until 8 weeks of age. The birds were allocated to two groups of compartments with 4 replicates and each replicate contained 11 female and 11 male poults. In the first group, poults were reared under intensive conditions and in the second group; poults had access to free-range area. At the age of 18-20 weeks, 88 Turkeys from two groups were slaughtered and live weight, foot and finger defects, craw enlarge and Foot-Pad Dermatitis (FPD) scores on right and left feet were determined. Data was subjected to analyses of variance for a fully randomised design. Live weight, age and breeding system data was evaluated by factorial variance analysis and the other data by non-parametric Friedman Test. Differences were determined by Kruskal-Wallis test in the traits whose interactions were found significant. Duncan Multiple Comparison Test was applied in the comparison of the groups. Also, the correlations between the traits and live weights were determined by Spearman's Rho. Effect of production systems on the live weight and FPD scores were found significant in the study. Free-range system had lower FPD values. Age and sex only affected craw enlarge and live weight. Craw enlarges and live weights were found significant by the effect of age x sex interaction. Also, FPD on right foot was found significant by the effect of housing system x age x sex interaction.

Key words: Foot pad dermatitis, free range, barn, non parametric feildmen test, Turkey

INTRODUCTION

Foot Pad Dermatitis (FPD) is a wide spread problem in commercial broiler and Turkey grower flocks in which the skin of the foot pad becomes hard, scaly, swollen and necrotic (Mayne, 2005; Mayne *et al*., 2007a). The skin of the foot pad frequently splits and the apparent inflammation is likely to represent a significant welfare problem. Furthermore, proposed legislative changes in the European Union may force grower to decrease the prevalence of FPD or be forced to adopt lower stocking rates (Mayne *et al*., 2007a).

Many factors have been associated with the prevalence of FPD (Mayne 2005) including specific nutrients and the quality of feed ingredients (Eichner *et al*., 2007; Mayne *et al*., 2007b). Wet litter has been clearly associated with an increasing prevalence of FPD in turkeys and broilers (Martland, 1985). The absorbency of the litters and ventilation systems are therefore important in controlling litter wetness and the prevalence of FPD. This is related to the high amount of feces present in the litter because commercial stocking densities are high in intensive production in barn. There is higher incidence of FPD lesions in males compared to females in different reports (Mcllroy *et al*., 1987). Also, breed, diet (vitamin and amino acids) and body weight have effect on the occurrence of FPD (Mayne, 2005). The situation of FPD is not described in free-range birds (Martrenchar *et al*., 2002). The occurrence frequency of FPD can be changed in free-range system because litter wetness changes according to the external environmental conditions. In this study, FPD was determined by standard scoring method (Hocking *et al*., 2008) and the effect of breeding system, sex and age on FPD was executed in female and male white turkeys slaughtered at 18-20 weeks of age which were reared under free-range and barn systems.

MATERIALS AND METHODS

This trial was conducted at Agricultural Faculty Research Farm of Ondokuz Mayis University. All

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procedures were approved by the local Ethical Committee of Ondokuz Mayis University for Experimental Animals. Commercial fast growing turkey genotype (Hybrid Converter) was raised to 20 weeks of age. Poults were reared in indoor confinement (Barn; B) and in outdoor access as free-range (FR; partially confined). Poults were hatched at the University Poultry Research Farm and vaccinated for TRT and Newcastle disease.

All poults were assigned to randomly 8 floor pens (1.5×3.0 m) on wood shavings in an environmentally controlled experimental unit with 23 h fluorescent lighting and 1 h dark. The poults were fed with a commercial starter diet based on corn, soybean meal and fish meal (260 g crude protein with 12.1 MJ ME per kg diet) from 1 day old to 8 weeks of age. Temperature of the experimental unit was maintained at 32±1°C during the first week and gradually <21°C by third week and the relative humidity was maintained within a range of 60-70%.

A total of 176 poults (mixed-sex) were allocated randomly for two housing systems (barn and free-range). Each production system was represented in 4 replicate indoor pens and 4 replicate pens with outdoor access, respectively, containing 22 poults each. The facility was a curtain-sided house with a concrete floor and was equipped with fans for ventilation and cooling. Indoor pens measured 3.5×3.5 m and contained one drinker and two hanging tube feeder. For free-range treatments, outdoor access from these pens was provided after 8 weeks of age during daylight hours through a single doorway measuring 50×90 cm. The outdoor pens each measured 14×3.5 m. Birds were confined to indoor pens at night. Indoor pens and pens with outdoor access were interspersed in the same building with pens randomly assigned.

All pens contained new pine wood shavings and 23, 20 and 16 h of light was provided to 7, 12 and 21 weeks of age, respectively. All birds were fed with the same commercial diets based on corn and soybean meal with 190 g CP and 13.0 MJ ME and 140 g CP and13.4 MJ ME per kg diet from 8-12 weeks of age and from 13-21 weeks of age, respectively. Access to feed and water was freely available and all diets were formulated to contain adequate nutrient levels as defined by the NRC.

At the age of 18-20 weeks, 88 turkeys from two groups were slaughtered and live weight, foot and finger defects (Toe Clipping TC), Craw Enlarge (CE) and Foot-Pad Dermatitis (FPD) scores on right and left feet were determined. All birds were commercially processed at the slaughterhouse of Agricultural Faculty. Feed was withheld for 10 h before slaughter and turkeys were weighed individually at the plant, where they were identified as male or female. Foot pad dermatitis scores in every poult's left and right feet were examined and given a lesion score using the methodology described by Hocking *et al.* (2008). Briefly, the scores were 0: no lesion; lesion on <25% of the pads; lesion on 25-50 of pads; lesion on 50-75 of pads; lesion on >75% of the pads. Evaluations were conducted independently by two individuals and scores were not exchanged between them until the end of the study. Different EU countries are using the similar scoring systems in broiler production in the slaughterhouses. In Denmark the legislation stipulates that representative samples of 100 feet are to be taken from all flocks of broilers delivered to Danish slaughterhouses. These feet are each scored on an integer scale of 0, 1 and 3 by independent, competent assessors (Nielsen, 2009). Litter samples were collected from the pens of the production systems at 18th-20th weeks. Determination of litter dry matter was conducted in duplicate for each production system, averaging 100 g each. Samples were owen-dried at 105°C for the time needed to reach weight loss stability (Eichner *et al*., 2007). Data was subjected to analyses of variance for a fully randomised design. Live weight, age and breeding system data was evaluated by factorial variance analysis and the other data by non-parametric Friedman Test. Differences were determined by Kruskal-Wallis test in the traits whose interactions were found significant. Duncan Multiple Comparison Test was applied in the comparison of the groups. Also, the correlations between the traits and the live weights were determined by Spearman's Rho (SPSS Inc. 1999, Release 10.0). The level at which differences were considered significant was $p<0.05$.

RESULTS AND DISCUSSION

The effects of breeding system, age and sex on live weight were found significant at two slaughtering age and age x sex interaction was also found significant (Table 1). The production systems did not significantly affect the body defects such as Toe Clipping (TC) and Craw Enlarge (CE). The wetness of litter was higher in the pens of barn system (38% for B and 28% for FR) and FPD levels were lower in free-range system (Table 2). But body defects and FPD were higher at 20 weeks of age.

Eichner *et al.* (2007), informed that in broilers, the occurrence of FPD rises and can reach 50% as the wetness of litter rises. Similarly, FPD levels were found higher in barn system which had wetter litter. Mayne *et al.* (2007b) also found higher FPD levels in turkeys depended on litter moisture. In breeding systems, particularly in FR system, wetness of litter changes according to environment conditions. Consequently, defecating on outdoor area and the absence of rains cause reducing the wetness of litter and could be a factor

Table 1: Changes in live weight, body defects and FPD scores depending on breeding system, age and sex

Housing system	Age (week)	Sex	Live weight (g)	Craw enlarge	Toe clipping	FPD
B	18	F	9022.86	0.14	0.00	1.86
		M	13348.57	0.00	0.00	1.14
	20	F	9438.57	0.71	0.00	1.29
		M	15391.43	0.00	0.14	1.57
FR	18	F	9405.71	0.00	0.14	0.43
		M	10205.71	0.00	0.14	0.14
	20	F	13645.71	0.43	0.00	0.71
		M	16165.71	0.14	0.14	0.71
B			11800.36	0.214	0.036	1.464
FR			12355.71	0.143	0.107	0.500
	18		11355.71	0.036	0.071	0.893
	20		12800.36	0.321	0.071	1.071
		F	9518.210	0.321	0.036	1.071
		M	14637.86	0.036	0.107	0.893
SEM			142.07	0.043	0.036	0.128
Main effects						
Housing system			*	NS	NS	**
Age			**	*	NS	NS
Sex			**	**	NS	NS
Housing system x age			NS	NS	NS	NS
Age x sex			**	**	NS	NS
Housing system x sex			NS	NS	NS	NS
Housing system x age x Sex			NS	NS	NS	NS

B: Barn, FR: Free-Range, M: Male, F: Female, *:p<0.05; **p<0.01, NS: Non Significant

Table 2: Changes in the appearance of body defects and FPD depending on breeding system and age (%)

	Breeding system		Age (weeks)	
Traits	B	FR	18	20
CE	10.72	7.15	1.79	16.07
TC	1.79	5.36	3.57	3.57
FPD	25.00	8.93	10.79	19.65

CE: Craw Enlarge; TC: Toe Clipping

Table 3: Correlations between different body defects and FPD scores (Spearman's rho)

Traits	LW	CE	TC	FPD
LW				
Correlation coefficient	1	-0.291*	0.094	-0.045
Significance (2-tailed)		0.029	0.489	0.740
CE				
Correlation coefficient		1	-0.129	0.186
Significance (2-tailed)			0.342	0.170
TC				
Correlation coefficient			1.00	0.009
Significance (2-tailed)				0.947
FPD				
Correlation coefficient				1.00
Significance (2-tailed)				

LW: Live Weight; CE: Craw Enlarge; TC: Toe Clipping; FPD: Foot Pad Dermatitis. *: Correlation is significant at the 0.05 level (2-tailed)

in the reduction of FPD appearances (Martrenchar *et al*., 2002; Mayne, 2005). The improvements have been achieved through a combination of measures such as prevention of water leakage from the drinkers and heating the chicken houses prior to introducing the litter to prevent condensation between floor and litter (Nielsen, 2009). Pagazaurtundua and Warriss (2006) showed that there are large variations in the prevalence and severity of FPD in broiler chickens reared under different production systems and this needs to be taken into account, when assessing the overall welfare associated with each type of system.

The conclusion between different live weight, body defects and FPD scores are given in Table 3. The negative correlation coefficient were found between craw enlarge and live weight. The other correlation coefficients of the traits were not found significantly. Wu and Hocking (2009) informed that mean foot score increased in a curvilinear relationship with litter moisture content and FPD increased with age.

CONCLUSION

As a result, when the weather is not rainy, the wetness of the litter will be lower, so the occurrence frequency of FPD will be lower in free-range system as compared to barn system. Comparing production systems in all periods of the year could provide more data on factors influencing occurrence and development of FPD.

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