Research Note

INCIDENCE AND DEGREE OF SEVERITY OF DEEP PECTORAL MYOPATHY IN COMMERCIAL GENOTYPES OF BROILERS[1,2]

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The growth and success of the poultry industry can be attributed, at least in part, to the significant improvements in growth and feed efficiency that resulted from genetic selection. However, those improvements have also resulted in the appearance of skeletal muscle disorders. Deep pectoral myopathy (DPM) is an abnormality of the supracoracoideus muscle of broilers and turkeys (Dickinson et al., 1968; Harper et al., 1971). A necrotic lesion that is limited to the deep pectoral muscle on one or both sides characterizes the condition. The necrotic muscles have a gross edematous appearance and a discoloration ranging from pale yellow to dark purple that eventually develops into a characteristic green color. The condition affects mainly adult birds with an incidence of around 15%, although incidences as high as 43% have been reported (Wight and Siller, 1980). Susceptibility, however, is not confined to adult birds; it has also been observed in 7-week-old broiler chickens (Richardson et al., 1980). The condition has been reported exclusively in birds genetically selected for increased musculature, particularly for breast meat yield. Evidence that this condition is the direct result of intense genetic selection has been shown in studies with wild turkeys and less intensely selected older commercial strains. These birds did not exhibit the condition naturally or after experimental induction and are apparently not susceptible to DPM. Hollands et al. (1981) and Grunder et al. (1984) evaluated the condition in commercial meat-type chicken strains and found an incidence of up to 43%, whereas in older commercial broiler strains there was no incidence of DPM. Research has revealed that selection for increased muscle size altered the vascular structure in relation to the muscle or skeleton, thus affecting blood circulation in the deep pectoral muscle. Martindale et al. (1979) reported that the exercise-stimulated deep pectoral muscle of heavy-type strains increases pressure within the fascial compartment by one-fifth more than that of light-type strains. These findings agree with studies on the vascular structure of the muscle that established that the myopathy is the result of ischemia brought about by an increase in internal pressure in the muscle that occludes the cranial and pectoral arteries resulting in a loss of blood supply and leading to a necrotic lesion. In all types of poultry, the muscle increases in

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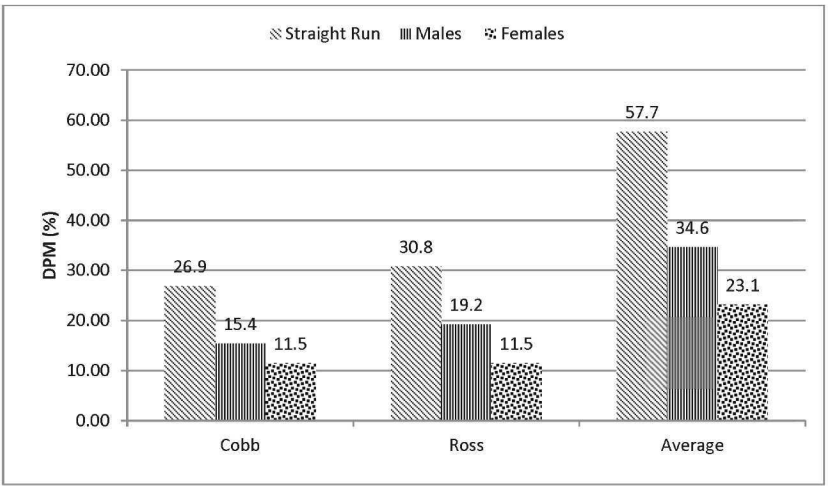

FIGURE 1. The influence of genotype and gender on the incidence of DPM in commercial strains of broilers.

weight by about 20% during activity, but because of its anatomical compartment, the size increase from muscular activity is so marked in the heavy-type breeds that the muscle becomes strangulated and ischemic (Siller, 1985). The same phenomenon does not occur in light-type breeds because there is enough space available to accommodate the swelled muscle. It is unknown why the compartment in birds selected for increased musculature has not also enlarged enough to allow for the normal function of the muscle. The objective of this work was to assess the occurrence and degree of severity of muscle damage due to DPM in broiler chickens.

A total of 45 birds (15 each) from two meat-type genotypes (Ross 308 and Cobb 500) and one egg-type strain (Isa-Brown) were used in the experiment. Broiler companies located on the island provided broilers of 21 d. Layers (75 wk) were also provided by a local producer and used in the study as controls. All birds were identified by a wing tag upon arrival at the Lajas Agricultural Experiment Station facilities, placed in floor pens, and kept under standard management practices in a conventional poultry house. In order to induce DPM experimentally, all birds were suspended by hand to stimulate voluntary wing movement for 5 min 24 h prior to processing. A market age of 63 d was selected because it is the age at which broilers dedicated for deboning are commonly processed in commercial operations. Birds were processed manually according to standard practices and both breast muscles excised from the carcasses. Carcasses and muscles were weighed to calculate yields. Breast muscles were individually evaluated for the presence or absence of lesions consistent with DPM. After visual examination of each carcass and breast muscle a score from 1 to 4 was assigned to measure the severity of the condition according to the presence of lesions in the muscles as follows: 1 = absence, 2 = unilateral involvement, 3 = bilateral involvement, and 4 = severe lesions in both breast muscles.

Data were analyzed as a 2 x 2 factorial design using the statistical analyses and the General Linear Model procedures of SAS® (SAS Institute, 1990). The analysis of variance employed genotype and gender as main effects. Tukey's multiple comparison test was used to separate treatment means. Correlation coefficients for measured traits were

TABLE 1.—*Effect of genotype and gender on carcass weight (CW), white meat weight (WMW), white meat yield (WMY), and DPM lesion severity score (LSS).*

Genotype	Gender	CW[1] (g)	WMW[2] (g)	WMY[3] (%)	LSS[4] (%)
		Individual means			
Cobb	Males	3067	772	25.0	1.62
Ross		2810	685	24.4	1.86
ISA -Brown		—	—	—	—
Cobb	Females	2344	593	25.4	2.00
Ross		2276	562	24.6	2.33
ISA -Brown		1042	172	16.4	1.00
		Main effect means			
Cobb		2789 a[5]	703 a	25.2 a	1.77 ab
Ross		2564 b	628 b	24.5 a	2.08 a
ISA -Brown		1042 c	172 c	16.4 b	1.00 b
	Males	2947 a	732 a	24.7 a	1.73 a
	Females	1622 b	356 b	20.3 b	1.54 a
Source of variation		Probability			
Genotype		<0.0001	<0.0001	<0.0001	0.003
Gender		<0.0001	<0.0001	0.721	0.193
Genotype x Gender		0.254	0.371	0.912	0.876

[1]Eviscerated weight after chilling for 24 h

[2]Includes both pectoralis muscles without skin and bone

[3]Calculated as: WMW/CW X 100

[4]Severity of the condition according to the presence of lesions in the muscles as follows: 1 = absence), 2 = unilateral involvement, 3 = bilateral involvement, and 4 = severe lesions in both breast muscles.

[5]Means in a column within an effect with no common letters differ significantly.

generated using the Pearson's Correlation Coefficient option of SAS. All statements of significance are based on a probability of $P < 0.05$.

Deep pectoral myopathy commonly results from exercise of the supracoracoid muscle when birds are being caught and handled for transportation to the processing plant. However, stressors such as feed, water and light outages, abrupt noises, and human and equipment movements can increase bird activity and trigger the development of DPM in broilers (Bilgili et al. (2000). In this study, experimental induction of DPM by wing flapping successfully generated the condition in the meat-type strains but as expected none of the egg-type chickens developed lesions characteristic of DPM. Birds selected for processing were in apparent good health and body condition. Deep pectoral myopathy was observed in 57.7% of broilers as shown in Figure 1. Both broiler strains were susceptible to the condition with Ross broilers exhibiting a higher incidence and severity of DPM than Cobb broilers (Table 1; Figure 1). In both broiler genotypes, females exhibited a lower incidence (23.1% vs. 34.6%) but a higher severity (2.18 vs. 1.74) of the condition than males (Figure 1). These findings agree with those of Bianchi et al. (2006) that DPM

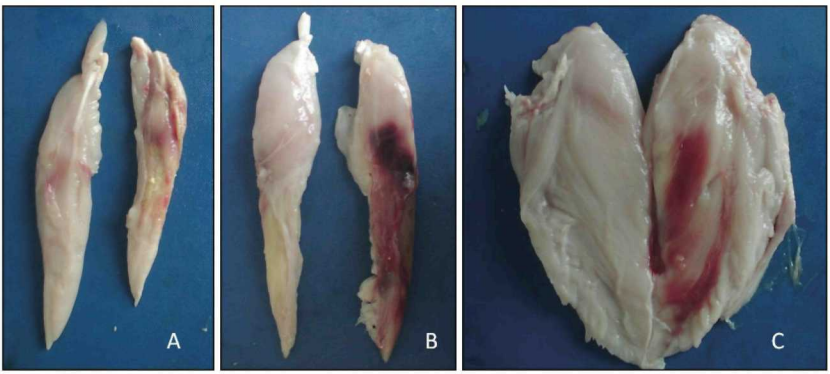

FIGURE 2. Pictures A, B, and C exemplify DPM lesions consistent with scores of 2, 3, and 4. Note that lesions can be present in both *pectoralis* muscles with unilateral or bilateral involvement.

lesions normally do not impair the general health of birds and is not found until processing of the carcass. Interactive effects of genotype x gender were not found.

The *pectoralis minor* muscle (tenderloin) was the major muscle affected; however, there were cases in which the *pectoralis mayor* muscle (fillet) was also involved. The condition involved one supracoracoid muscle in 80.8% and bilateral involvement in 19.2% of the broilers used in the study (Figures 2A; 2B). Bianchi et al. (2006) stated that the condition could be both unilateral and bilateral, affecting just one or both pectoralis minor muscles. Lesions consistent with DPM were also observed in the *pectoralis mayor* muscle in 7.7% of the broilers evaluated in the experiment (Figure 2C).

The correlation coefficients between carcass weight (CW), white meat weight (WMW), and white meat yield (WMY), and lesion severity score (LSS) for the meat-type birds are shown in Table 2. All correlation coefficients evaluated were significant. As expected, correlations among carcass weight, muscle weight and yield were very strong, ranging from 0.86 to 0.98 (Table 2). Lesion severity scores were strongly correlated with carcass size and breast muscle weight and yield. These correlations suggest that broilers selected for white meat yield are more susceptible to the development of DPM and thus this problem is likely to be more prevalent in current commercial flocks. Data also indicate that genetics play an important role in the predisposition and incidence of this condition. Bianchi et al. (2006) indicated that the incidence of DPM in broilers increases with market weight and that males and high yield strains are more susceptible.

TABLE 2.—*Correlation coefficients of carcass weight (CW), white meat weight (WMW), white meat yield (WMY), and lesion severity score (LSS).*

	CW	WMW	WMY	LSS
CW		0.985*	0.869*	0.423*
WMW			0.931*	0.445*
WMY				0.502*

*Significantly different from zero at a $P < 0.05$.

In conclusion, the results from this study indicate that meat-type chickens selected for rapid growth and breast muscle deposition are highly susceptible to DPM and support the hypothesis that selection for such traits tends to lead to muscle problems in broilers (Velleman et al., 2003). Both sexes and commercial genotypes of broilers evaluated in this study were similarly affected. However, Ross broilers appear to be more predisposed to the development of the condition. These facts should be considered by primary breeder companies in their selection scheme to reduce the incidence and severity of DPM.

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