

## Research Note

# The Occurrence of Deep Pectoral Myopathy in Roaster Chickens

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**ABSTRACT** A study was conducted to determine the incidence of deep pectoral myopathy (DPM) in male roaster chickens reared under intensive conditions, processed at different ages (from 47 to 65 d of age), and belonging to 2 commercial genotypes (Ross 508 and Cobb 500). The study was carried out in a major Italian processing plant on a total of 120,700 male roaster chickens chosen at random from 151 flocks during a 6-mo period. The evaluation of DPM was performed on pectoralis minor muscles and consisted of a visual assessment of the presence or absence of the myopathy as well as the scoring of muscle damage level as being in an “early” (hemor-

rhagic appearance) or “old” (gray or green discoloration) developing stage. The average incidence of carcasses affected by DPM was found to be 0.84% (0.62 and 0.22% in early and old stages, respectively). The range in the incidence of total DPM was fairly large and varied from 0 to 16.7%. Considerable variations were also observed for early (range: 0 to 12.0%) and old (range: 0 to 5.6%) developing stages. Considering the effect of genotype, Ross 508 exhibited a higher incidence of DPM in respect to Cobb 500 (1.27 vs. 0.35%;  $P \leq 0.01$ ). This result was due to the higher incidence of carcasses affected by both early (0.94 vs. 0.26%;  $P \leq 0.01$ ) and old (0.33 vs. 0.09%;  $P \leq 0.01$ ) developing stages of DPM in Ross 508 birds.

**Key words:** roaster chicken, deep pectoral myopathy, genotype

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## INTRODUCTION

Deep pectoral myopathy (DPM), also known as Oregon muscle disease or green muscle disease, was first described in 1968 (Dickinson et al., 1968) as “degenerative myopathy” in turkeys, and it was subsequently studied at the Oregon State University by Harper (Harper et al., 1983) and his collaborators (Siller, 1985).

Even though this condition was first recognized in adult meat-type turkey and chicken breeders, it is becoming more and more common in meat-type growing birds (Richardson et al., 1980; Grunder et al., 1984; Bilgili and Hess, 2002).

According to Siller (1985), DPM occurs exclusively in birds that have been specially selected for breast muscle development.

It is generally recognized that DPM is an ischemic necrosis that develops in the deep pectoral muscle (supracoracoideus or pectoralis minor muscle) mainly because this muscle is surrounded by inelastic fascia and the sternum, which do not allow the muscle mass to swell in response to the physiological changes occurring when muscles are exercised, as in wing flapping (Jordan and Pattison, 1998).

It has been estimated that, in turkeys and broilers, the supracoracoideus increases in weight by about 20% during activity for the huge blood flow into the muscle. The increased size of the muscle is so marked in the heavy breeds that the muscle becomes strangulated and ischemic, because the increased pressure within the muscle occludes the blood vessels and causes a necrosis of the muscle (Harper et al., 1983; Siller, 1985). The resultant necrotic muscle has a characteristic hemorrhagic appearance, with a swollen reddish-brown lesion (early developing stage) that later becomes green and shrunken and then pale green (old stage), depending upon the time of induction of the vigorous wing exercise (Bilgili and Hess, 2002). Evidence that this condition only appears because of intensive selection is supported by the absence of DPM in wild turkeys, even when these birds are experimentally forced to produce DPM by wing flapping (Siller, 1985; Calnek et al., 1997; Bilgili et al., 2000). Moreover, because commercially reared broilers and turkeys are relatively inactive during the growing period, the pectoralis minor muscle is not exercised, and this determines a further reduction of the elasticity of the muscle compartment that does not allow the accommodation of the swollen muscle after wing flapping.

The lesion does not impair the general health of birds and is generally found during cut-up and deboning; moreover, it can be both unilateral or bilateral, affecting just 1 or both pectoralis minor muscles, respectively. No public health significance is associated to DPM, but it is aesthetically undesirable. The fillet should be removed,

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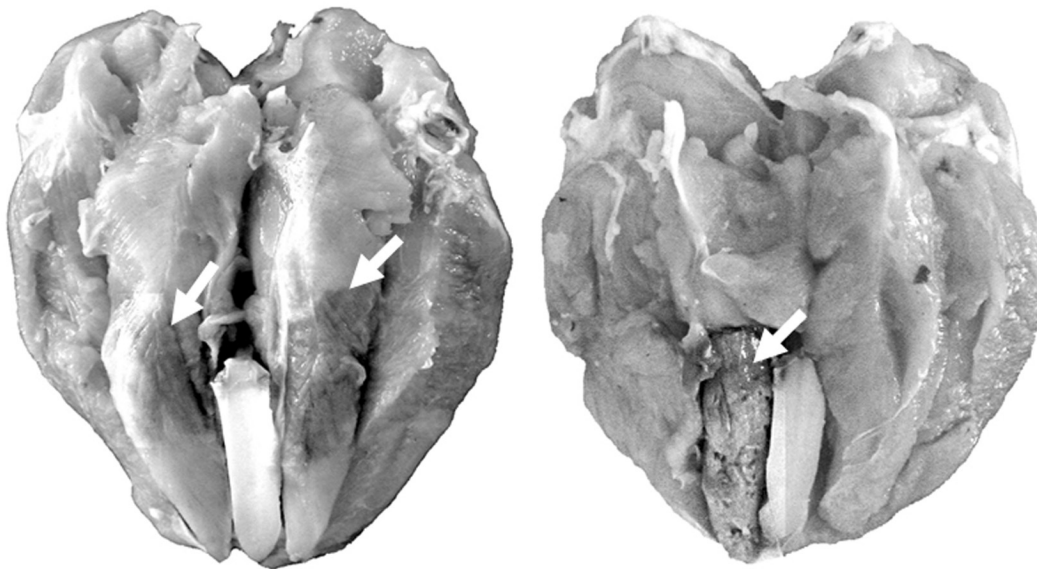


Figure 1. Deep pectoral myopathy in its early (left) and old (right) developing stages.

whereas the rest of the carcass is still fit for human consumption (Jordan and Pattison, 1998). However, the required trimming operations determine the downgrading of the products and produce an economic loss for the industry, especially because it affects the more valuable part of the carcass.

The incidence of DPM increases with market weight in broilers, with more cases reported in higher-yielding strains and in males. Increased bird activity (flock nervousness, flightiness, struggle, and wing flapping) induced by factors such as feed or water outages, lighting programs and intensity, human activity, and excessive noises in and around chicken houses should be looked at as a trigger for the development of DPM in broilers (Bilgili et al., 2000). However, most of the studies conducted to evaluate the incidence of DPM in poultry are concerned with parental commercial breeding stocks under experimental conditions.

The Italian conventional production system is characterized by 2 elements that can stress the outbreak of

DPM in meat-producing broilers: the recurrent use of thinning operations and the tendency to produce heavy male broilers. In Italy, female and male broilers are usually reared in the same house and kept separate by movable wire nettings that are removed when females (or a part of the males) are slaughtered. This management system implies thinning operations during the rearing of males that are the last birds leaving the house. Another characteristic of the Italian broiler production system is the tendency to produce heavy male broilers (>3 kg of live weight), because the age at slaughter of the birds can reach 60 to 65 d old.

The purpose of this project was to determine the incidence of DPM in commercial strains of meat-type broiler chickens reared under intensive conditions.

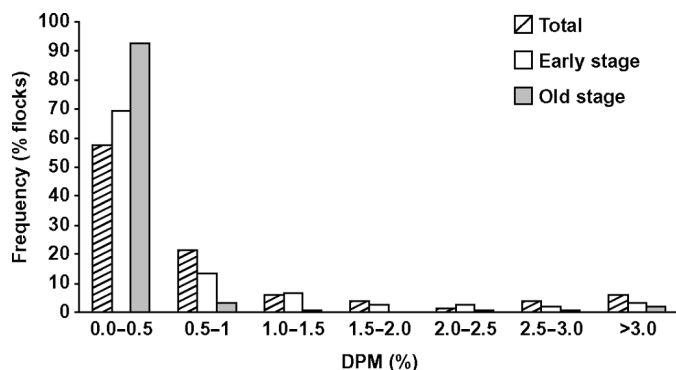


Figure 2. Frequency distribution of the incidence of deep pectoral myopathy (DPM) in male roaster chicken flocks (n = 151).

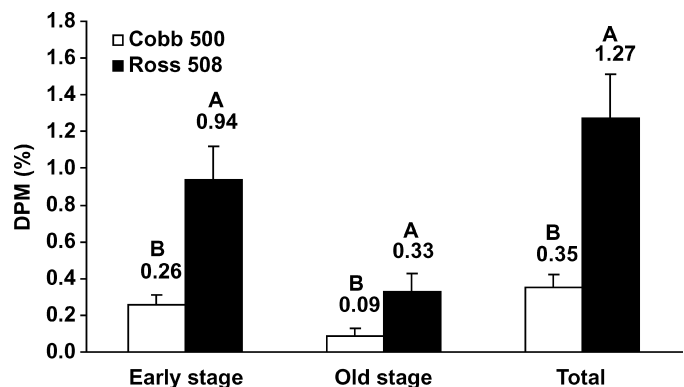


Figure 3. The influence of genotype on the incidence of deep pectoral myopathy (DPM) in male roaster chickens (mean  $\pm$  SEM). A, B =  $P \leq 0.01$ ; no. of flocks: 71 for Cobb 500 and 80 for Ross 508, corresponding to 57,800 and 62,900 inspected broiler breasts, respectively.

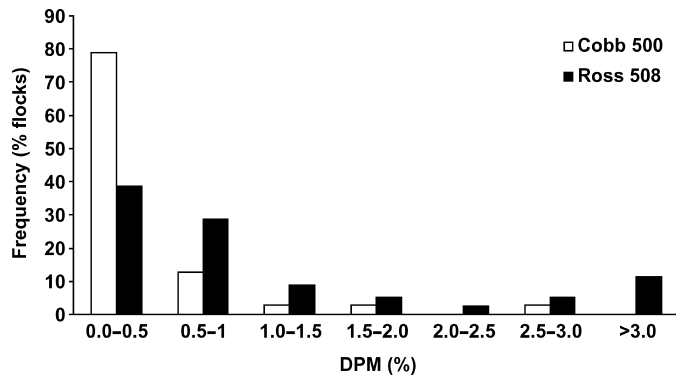


Figure 4. Frequency distribution of the incidence of total deep pectoral myopathy (DPM) in Cobb 500 ( $n = 71$ ) and Ross 508 ( $n = 80$ ) male roaster chicken flocks ( $n = 151$ ).

## MATERIALS AND METHODS

### Birds and Identification of DPM

The study was carried out in a major Italian processing plant on a total of 120,700 male roaster chickens chosen at random from 151 flocks during a 6-mo period. Chickens belonging to 2 commercial genotypes (Ross 508 and Cobb 500) were reared under intensive conditions and slaughtered from 47 to 65 d of age (average live weight: 3,143 g).

The evaluation of DPM was performed on the processing line after the breast-deboning area. For each flock of birds considered, about 800 whole (with both pectoralis major and minor muscles) breasts were taken and used to establish the presence or absence of the myopathy. Moreover, for those muscles affected by DPM, it was determined whether the muscle damage level was in an "early" (hemorrhagic appearance) or "old" (gray or green discoloration) developing stage (Figure 1). These operations were carried out in collaboration with the official veterinary personnel.

### Statistical Analysis

The data were analyzed by descriptive statistics (mean, SEM, minimum and maximum values). To study the influence of genotype on the incidence of DPM, data were analyzed using the ANOVA option of the GLM procedure of SAS software (SAS Institute, 1988), testing the effect of genotype (Cobb 500 vs. Ross 508) as a main effect. Before running the ANOVA, the percentage of data of DPM were normalized by the function  $\text{ArcSin}(\sqrt{\text{Variable}/100})$ .

## RESULTS AND DISCUSSION

Table 1 shows the incidence of DPM in male roaster chickens evaluated under commercial processing. The total (early plus old developing stages) incidence of carcasses affected by DPM was found to be 0.84% (0.62 and 0.22% in early and old stages, respectively). The range

Table 1. The incidence of deep pectoral myopathy (DPM) in male roaster chickens.

Item	DPM <sup>1</sup> (%)		
	Early stage	Old stage	Total
Mean	0.62	0.22	0.84
SEM	0.10	0.06	0.14
Minimum–maximum	0.00–12.00	0.00–5.60	0.00–16.67

<sup>1</sup>No. of considered flocks: 151, corresponding to 120,700 inspected broiler breasts.

in the incidence of total DPM was fairly large and varied from 0 to 16.7%. Considerable variations were also observed for early (range: 0 to 12.0%) and old (range: 0 to 5.6%) developing stages.

To better understand the occurrence of DPM in the different flocks examined in this study, Figure 2 shows the frequency distribution of DPM. Figure 2 shows that about 60, 70, and 90% of the flocks presented an incidence of DPM from 0 to 0.5% for total, early, and old stages, respectively. Moreover, it was found that only 18.5% of the flocks did not present any case of DPM.

Richardson et al. (1980) reported that 7-wk-old broilers subjected to handling stress had a 5% incidence of DPM. Grunder et al. (1984) found that the incidence of DPM in 20 parental commercial breeding stocks ranged from 0 to 43% in males and 0 to 22% in females at ages ranging from 49 to 68 wk. Bilgili et al. (2000) monitored the incidence of DPM on several experimental trials conducted with commercial strain crosses of broiler chickens and found that the incidence of DPM can vary from 1.5 up to about 27%, according to the flock and the studied effect (feeding regimen, age at slaughter, live weight, season, gender of the birds, wing flapping induction, etc.). However, it is difficult to compare these results, obtained under experimental conditions, with those obtained in this study, which was conducted under commercial conditions.

Considering the average incidence of total DPM that was found in this study (0.84%), it could be pointed out that even if this value seems to have little relevance, it is actually important when considering the overall production of the industry; it means that over a batch of 100,000 processed broilers, about 840 carcasses need some trimming operation in their breast muscles, which causes both a product loss and downgrading, as well as some extra labor cost.

Considering the effect of genotype, Ross 508 exhibited a higher overall incidence of DPM compared to Cobb 500 roasters (1.27 vs. 0.35%;  $P \leq 0.01$ ; Figure 3). This result was due to the higher incidence of carcasses affected by both early (0.94 vs. 0.26%;  $P \leq 0.01$ ) and old (0.33 vs. 0.09%;  $P \leq 0.01$ ) developing stages of DPM in Ross 508 birds.

Figure 4 shows the frequency distribution of total DPM in the different flocks of Ross 508 and Cobb 500 birds. Figure 4 shows that most Cobb 500 flocks (about 80%) presented an incidence of total DPM lower than

0.5%, whereas over 60% of Ross 508 flocks had incidences of DPM that were higher than 0.5%, with 11.2% of flocks presenting an incidence greater than 3%. Moreover, it was found that 29.6% of Cobb 500 and only 8.7% of Ross 508 flocks did not present any case of DPM.

It has been postulated (Richardson et al., 1980) that intensive selection for fast growth and increased pectoral muscle mass have contributed to the occurrence of DPM in commercial meat-producing broilers. However, it is actually difficult to explain the differences among genotypes observed in this study, because they were both commercial strains selected for breast muscle hypertrophy and fast growing. Further effects, such as birds' activity during the growing period, should be looked at as a trigger. However, further studies need to be conducted to confirm whether the differences between these 2 genotypes still exist under different housing systems and to better understand the causes for these differences.

In conclusion, this study showed that the occurrence of DPM in male roaster chickens may be economically significant to the industry as a whole. Moreover, this data suggests that genetics may play an important role in the determination of this condition.

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