

DEEP PECTORAL MYOPATHY

Reducing the Incidence in Broiler Flocks

EXECUTIVE SUMMARY

Deep Pectoral Myopathy (DPM), or Green Muscle Disease, is a degenerative disease of the minor pectoral muscles (i.e., the tenders) characterized by atrophy and necrosis. The condition arises when the muscle fibers become deficient in oxygen and is associated with sudden and excessive wing flapping. The development of the disease can be split into three categories. Category 1 is the acute inflammatory lesion in which the deep pectoral muscle is very red and hemorrhagic. Category 2 describes the stage at which the lesion in the inner fillet becomes well-defined and is sometimes circumscribed by a hemorrhagic ring. Category 3 exhibits the progressive degeneration and greening of damaged tissue. Although the risk of DPM is increased in heavy broilers, it can occur at any age or weight and depends upon the management and husbandry systems employed. Identifying and eliminating the management issues that contribute to wing flapping and the development of the condition is vital to reducing the incidence of DPM.

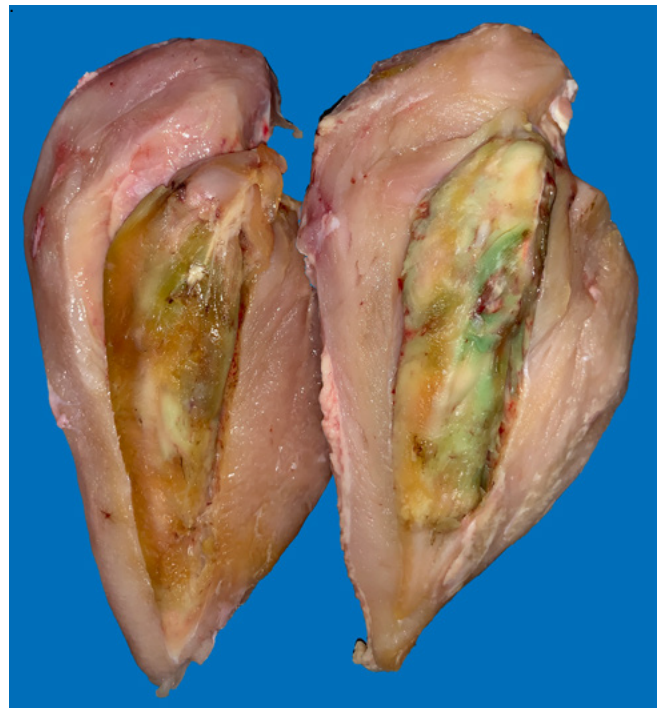
INTRODUCTION

DPM can be a hidden issue in modern-day broiler chickens. The condition is characterized by necrosis and atrophy of the tenders (i.e., supracoracoideus or minor pectoral muscles [inner fillet]). The lesions often affect both tenders and vary in color, progressing from a pinkish hemorrhagic appearance to a gray-greenish discoloration, as illustrated in **Figure 1**.

DPM was first described in mature breeder turkeys and broiler breeders but is now more common in meat-type chickens, especially those selected for breast muscle development. The affected muscles are discarded during deboning, resulting in saleable meat yield losses. However, the major issue with DPM is that if the birds are marketed as whole carcasses or parts, the problem is rarely detected during processing, resulting in consumer complaints and making the cause of the issue difficult to identify.

The condition is not associated with any infectious agent and, therefore, has no public health significance other than affecting the aesthetic appearance of the meat.

FIGURE 1: Deep Pectoral Myopathy.





KEY POINT

- DPM is rarely detectable during processing if the birds are marketed as whole carcasses or parts.

WHY DOES DPM AFFECT BREAST MUSCLES?

The pectoral muscles in avian species are associated with flight, and the deep and superficial pectorals work in synergy, one to raise the wing and the other to lower it. The anatomy of these muscles is, however, intrinsically different in that the inner fillet has a tough outer sheath made up of dense fibrous tissue, which is inelastic. The outer (or major) muscle is surrounded by loose connective tissue that moves easily over the muscle surface as the muscle profile changes.

Contraction of the major pectoral muscles (the breast fillet) and the minor pectoral muscles (the tender) are responsible for the up and down strokes of the wings. During contraction, these muscles expand with increased blood supply (i.e., muscle pumping). The expansion of the minor pectoral muscle (by as much as a 25% increase in volume) is problematic because this muscle is confined in a tight compartment sandwiched between bone (the sternum) and the large breast fillet. The minor pectoral muscle is also encased in a rigid, fibrous sheath that restricts muscle volume increases. Therefore, when intramuscular pressure rises to levels above circulating blood pressure, the blood supply flowing into the muscle stops. With continued muscle activity, oxygen deficiency rapidly develops, and a lack of oxygen (ischemic necrosis) in the muscle fibers occurs. There is also an additive effect as the muscle pH decreases. Typically, the middle third of the muscle is involved. In experimental studies, relatively short periods of wing flapping are enough to induce these degenerative changes.

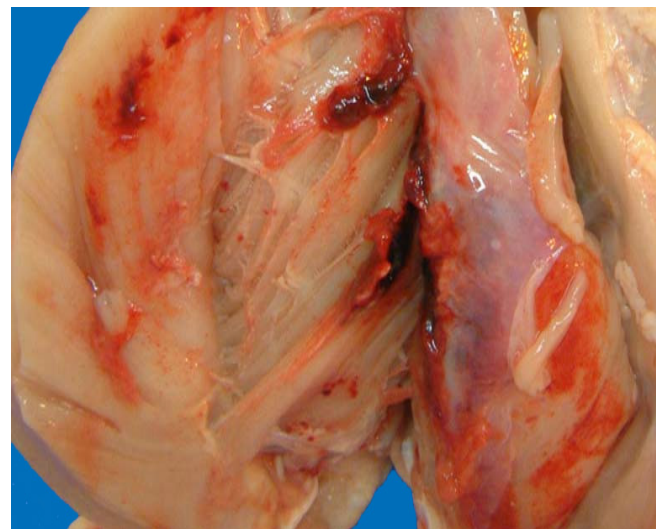
RECOGNITION AND IDENTIFICATION OF THE DEVELOPMENT STAGES IN DPM

An investigation should be organized in response to DPM complaints from the processing plant and/or customers. This should include identifying the category of DPM (fresh or old) at the processing plant. This information can then be correlated to flock management practices.

CATEGORY 1:

The acute inflammatory lesion in which the deep pectoral muscle is very red and hemorrhagic. Hemorrhages also appear on the fibrous sheath (**Figure 2**). There is an obvious suffusion of serous fluid in the area of the damage, making it appear wet. This stage will likely be associated with a handling event (e.g., catching) and will be present for about 48 hours.

FIGURE 2: Early Acute Pectoral Myopathy.



CATEGORY 2:

At this stage, the lesion in the inner fillet has become well-defined and is sometimes circumscribed by a hemorrhagic ring (**Figure 3**). The affected areas are pale pink to plum colored, and there are clear changes consistent with early coagulative necrosis of the muscle when the tissue texture becomes fibrous. This is sometimes described as “fish flesh.” This stage will continue for a few days after the initial event or incident.

FIGURE 3: Pectoral Myopathy — Developing Lesions.



CATEGORY 3:

This stage reveals the progressive degeneration and greening of the damaged tissue (**Figure 4**). Often, only the middle part of the fillet is involved, and the progressive greening parallels the loss of cellular structure so that a putty-like consistency develops within the lesion. This green necrotic area will persist and, through time, will gradually reduce in size as it is reabsorbed so that the symmetry of the breast is lost in some older birds. The green color is produced by the breakdown of hemoglobin and myoglobin into bile salts.

FIGURE 4: Aged Pectoral Myopathy.



KEY POINT

- The desirable efficiency in growth and anatomy of today’s broiler brings with it the possibility of DPM development.

FACTORS AFFECTING THE OCCURRENCE OF DPM

The pectoral muscles comprise approximately one-quarter of the total live weight in modern meat chickens. Raising broiler chickens to heavy market weights can increase the probability of DPM occurrence. Incidence depends on management and husbandry systems, not simply body weight, as birds of any age or weight can be affected.

DPM is associated with the following factors:

- Excessive wing flapping.
- Heavy market body weight.
- Sex (incidence can be higher in males compared to females).
- High white meat yield.
- Rapid growth rate.

Commercially-raised broiler chickens are kept relatively comfortable and inactive during the growing period. Consequently, the pectoral muscles are not exercised enough to increase the efficiency of the circulatory supply to the muscles and to allow the expansion of the surrounding fibrous sheath. It is doubtful that even a subtle amount of wing activity would help improve circulation or develop the sheath adequately.

Few (if any) processing plants regularly track or document the incidence of DPM. Detecting DPM on whole carcasses and parts is extremely difficult, as lesions are not visible during carcass inspection or sorting. Since birds also exhibit no symptoms, finding affected live birds in a flock and treating them is not possible.

Preventative management is the key to avoiding DPM. Controlling the incidence of DPM hinges upon identifying and eliminating specific flock management issues that contribute to the development of the condition.

To avoid the occurrence of DPM, the following flock management guidelines (**Table 1**) are suggested as starting points for investigating and minimizing any unnecessary wing activity.



KEY POINT

- The key to reducing the incidence of DPM lies in management of the broiler flock and minimizing wing flapping.

TABLE 1: Flock Management Guidelines to Minimize Unnecessary Wing Activity.

DO NOT FRIGHTEN BIRDS	LIMIT SUDDEN AND EXCESSIVE WING EXERCISE	CONTROL OVERALL FLOCK FLIGHTINESS
Do not allow other animals in or around the house.	Avoid excessive human activity in the house, especially if the birds are flighty.	Bird activity and flightiness increase with increasing natural day length.
Eliminate novel sounds (e.g., buzzing security lights, sudden use of noisy ventilation fans, tractor/generator operation in or near houses).	Avoid walking birds too fast, especially when migration barriers (e.g., nets, pipes, or fences) are used; this may cause the birds to pile up.	Birds respond to increased light intensity with increased activity. Blue curtains may help calm the flocks in curtain-sided facilities.
Limit bird handling, weighing, penning, etc. Weigh birds in a bucket (or similar) instead of by the legs.	Train personnel for gentle bird handling techniques during catching.	In environmentally-controlled houses, avoid sudden and excessive increases in light intensity with dimmers, especially under low light intensity [<3 lux (0.28 fc)] conditions.
Avoid excitement induced by frequent thinning of flocks.	Keep birds comfortable during transport to the processing plant. Low crate stocking densities can cause problems. Prevent any unnecessary bird movements when crated. Automatic catching systems can exacerbate wing flapping depending on the system used.	Avoid extended feed and water withdrawal periods (>4 hours).
In tunnel-ventilated houses, use migration fences approximately 100 ft (30 m) apart.	Minimize birds perching on swinging equipment such as feed tracks, which allows the birds to flap.	Intermittent lighting programs can be a potential problem due to frequent bird stimulation.
		Ensure that stocking density and feeder and drinker space are adequate.
	A dawn-to-dusk type dimmer offers a gradual increase in lux.	

CONCLUSION

DPM continues to be a hidden issue for broilers that leads to losses in saleable meat yield when identified at processing. Although it is more likely to be seen in heavier birds, it is essential to remember that birds of any age or weight are also susceptible. Reducing DPM is a broiler flock management responsibility, and focus should be given to identifying and eliminating flock management issues that can increase the incidence of DPM. Preventative management is critical.

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