Breast Myopathies in Fattening Chickens

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Broiler chicken meat will soon become the most popular source of animal protein globally. Breeding efforts has been extremely successful in improving the health, growth efficiency, and meat (muscle) yield of meat-type (i.e., broiler) chickens. The rapid expansion of the food service and its preference for white meat (i.e., breast muscle) have led to a steady increase in slaughter weights. Compared to other animal protein sources, broiler breast meat provides the processors with a homogenous raw material for further-processing of ready-to-cook and ready-to-eat products that are always consistent in their portion size, composition, quality (nutritional, sensory), functionality and cost.

Broilers even when slaughtered at heavy slaughter weights (>3 kg) are still considered as juveniles developmentally. The growth efficiency and muscle accretion rate during this juvenile phase of growth is maximal, naturally requiring a sustained demand for balanced macro- and micro-nutrients, environment, as well as ample metabolic and structural support. Muscle growth is a complex and extensively regulated process that involves a high rate of protein turnover. Degeneration and regeneration are normal physiological maintenance processes in the muscle tissue of rapidly growing animals. However, subtle aberrations in tissue homeostasis and cellular dysfunction can lead to myopathies such as deep pectoral myopathy (DPM), white striping (WS), woody breast (WB), and spaghetti breast (SP). DPM appears as green discoloration of the minor pectoral muscle due to extensive ischemic necrosis. WS is characterized by the presence of white striations that extend along the length of muscle fibers. Histologically, it is abnormal fat and connective tissue deposition as a response to degenerating myofibers. WB is an abnormally firm breast muscle with a pale, bulging appearance. In severe cases, petechial hemorrhaging and fibrinous exudate may be present on the proximal end of the affected fillets. Fillets affected by WS and WB have significantly increased fat and collagen content, and lower protein content compared with normal fillets. All breast myopathies exhibit poor meat quality (i.e., color, texture, and composition) manifested following slaughter.

Broiler breast myopathies are seen globally in varying prevalence with all breeds/strains of chickens, under a wide-range of slaughter weights and rearing systems. Affected birds exhibit excellent health and growth performance with no signs morbidity. Histological observations of muscle fiber fragmentation, swelling, and degeneration, as well as accumulations of connective tissue, fat and inflammatory cells are common in all myopathies. There is no indication of systemic or local infection, but only aseptic ischemic necrosis and varying degrees of inflammatory response. Molecular analysis of gene expression of

affected muscles show buildup of reactive oxygen species, reduced glycolytic metabolism, abnormal calcium homeostasis and hypoxia, indicative of multifactorial triggers.

The breeding efforts that have been put in place to reduce their prevalence will naturally require some time, as the heritability values for theses myopathies are low. In the meantime, intervention strategies are focused on non-genetic factors (i.e., flock management, environment and nutritional programs), as the prevalence of these myopathies vary significantly by region, company, farms within a company, houses within a farm, and even lots of chickens within a house. Factors leading to rapid growth acceleration as well as thermal load appears to be important. Manipulation of dietary nutrients (energy, amino acids), high levels of phytase, antioxidants and trace mineral supplementation have been successful in reducing the severity of breast myopathies.