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Metabolic disease of broiler birds and its management: A review

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Abstract
Metabolic disease has developed into a major problem to the broiler industry, which are responsible for high morbidity and mortality of poultry. Forced selection for faster growth of broiler chicken results in an increase burden on cardiovascular system, which predisposes the birds to metabolic disorder such as ascites, sudden death syndrome and leg weakness. To overcome these problems we have to focus on managemantel practice such as provision of thermoneutral environment, growth curve manipulation through feed restriction programs and use of antioxidants.

Keywords: Broiler, growth, metabolic disease, management

Introduction
Metabolic problems have been a fact of life in poultry productions for at least the last few decades, intensify by the fast pace of improvements in the genetic potential of poultry for growth and efficiency. Metabolic diseases are more common in broiler. Leg problems seen in the absence of infectious agents are often the result of fast early growth and thus can be related to metabolic diseases. It is mainly associated with increased workload on the cardiovascular system predisposing birds to metabolic disorders. Poultry metabolic diseases occur primarily in two body systems: (1) cardiovascular disorders, which in broiler chickens are responsible for a major portion of the flock mortality; (2) musculoskeletal disorders, which account for less mortality, but slow down growth (thereby reducing profit), and cause lameness, which remains a major welfare concern (Julian 2005) [5].

Fatty liver and kidney syndrome (FLKS) in broilers
Fatty liver and kidney syndrome also known as "fat nephrosis" or "pink disease", it was first recognised in Denmark. It is a biotin deficiency-related metabolic disease in broiler and layers chicks of 2–3 weeks of age. The problem is caused by low activity of the biotin dependent enzyme pyruvate carboxylase results in negligible gluconeogenesis in the liver via pyruvate. When the bird is subject to a mild stress through high or low temperatures, a lighting failure or short term fasting, liver glycogen reserves become rapidly depleted and a progressive hypoglycemia develops that ultimately proves fatal (Whitehead 1979) [7]. Affected chicks are hyperlipaemic showing increase in the free fatty acid and triglyceride levels in the plasma and there is a 2- to 5-fold increase in the lipid content of the liver and kidneys. There is frequent association of Fatty liver and kidney syndrome with wheat-based diets because very little of the biotin present in wheat, and some other cereals, which is available to the chicken. Adequate dietary biotin will prevent FLKS and the condition is no longer seen in broilers on commercial rations.

Ascites
Ascites is caused by an increased production or decreased removal of peritoneal lymph results in accumulation of serous fluid in body cavity leading to carcass condemnation or death. The etiology of ascites may be associated with the typical lesions, like obstruction of lymph drainage, decreased plasma oncotic pressure, increased vascular permeability and increased hydrostatic pressure in the vascular system (Currie1999) [4].

The most frequent cause of ascites in birds is increased portal pressure, secondary to right ventricular failure (RVF) or liver damage. Genetic selection of broilers for fast growth rate or body weight gain predisposes them for ascites compared with slow-growing strains (Sahraei 2014) [6], because a fast growth rate increases the demand for oxygen and hence the workload on the heart predispose broiler for the development of pulmonary hypertension syndrome. Chicken embryos grow rapidly over the last 7 days of incubation, resulting in a 60% increase in the oxygen consumption during the interval between the start of pulmonary breathing and hatching so, maintenance of adequate ventilation and oxygen supply in the hatcher and setters advice to control the ascites and also used as an effective means of improving hatchability of broiler eggs.

Monitoring of temperature during brooding is critical, as low temperatures increase the incidence of ascites by increasing both metabolic oxygen requirements and pulmonary hypertension. Feeding a low protein/low energy diet during the first 14 days after hatching is recommended to manage the ascites in birds at farm level. The elevated production of free radicals (super oxide anion radicals, hydroxyl radicals, hydrogen peroxide and singlet oxygen) in broilers prone to ascites may potentiate the development of the disease. Presence of major antioxidant compounds such as vitamin E, selenium, vitamin A, vitamin C, and glutathione in the circulation or at the level of the respiratory membrane plays vital role in protecting damage at cellular levels, prevent the induction of hypoxia and thus reduce the incidence of ascites.

Sudden death syndrome

Sudden death syndrome (SDS) is also known as "acute death syndrome" or "flip-over disease" and normally occurs in healthy, fast-growing, commercial broilers. As name suggest, birds affected from this disease show sudden death. This syndrome mostly occurs in heavier males birds when their growth rate is highest. In fast growing broilers have a large proportion of muscles compared to visceral organs which are not proportionally developed leading to inadequate supply of oxygen to muscles, which leads to hypoxic condition. Lack of aerobic metabolism in hypoxic condition result in production of more lactate leads to systemic acidosis, change in blood pH, cardiovascular disturbance leads cardiac failure" which increases the incidence of sudden death syndrome. Symptoms in birds suffering from SDS are mainly a short wing beating, convulsions prior to death because of this the majority of affected broilers are found dead lying on their backs. So the condition often been referred to as "Flip-Over Disease".

More feed intake and continuous lighting for long period of time in broiler house results in higher mortality due to sudden death syndrome compared to intermittent lighting. There is no proper treatment and preventive measures for control of SDS, but incidence can be reduced by management techniques that reduce early maximum potential for growth. By reducing the hours of light per day (Blair *et al.,* 1993) [2] or by completely restricting feed intake to 75% of what would be eaten by free-choice (Bowes *et al.,* 1988) [3]. Broiler should be fed with low protein/ low energy diet during 14 days of life, reduced oxygen demand in growing broilers, which may lowers the incidence of sudden death syndrome. As it is well known that broilers must have proper growth during first 7 days of life so during this period diet must be remain unchanged to achieve adequate growth and thereafter change should be done with caution so that it should not have any adverse effect on broiler.

Leg Problems

The incidence of non-infectious leg problems such as chondrodystrophy or angular bone deformities, valgus-varus deformities (commonly known as twisted leg), spondylolisthesis or kinky back are probably related to rapid growth of broiler chickens. The production of strong tissue, remodeling and alignment of bone requires more time than rapid growth allows. The use of management methods to reduce metabolic diseases by decreasing feed consumption, without increasing mineral concentration in the pre-starter diet, affect the healthy bone development and predisposes the broilers for different leg problems (Angel 2007) [1].

Twisted legs and angular bone deformity associated with rapid growth and appear to be related to limitations in time for remodeling of the bone of the distal tibio-tarsus. It can be reduced by slowing early growth and by extended daily rest (dark) periods. Vitamin D plays important role in proliferating chondrocytes, deficiency of this leads to Tibial dyschondroplasia and ratio of Ca and P in the diet also plays vital role and influence the incidence and severity of tibial dyschondroplasia in broiler chicken. The addition of vitamin D3 alleviates the clinical signs of this disease primarily by inducing maturation of chondrocytes.

Spiking mortality syndrome in broiler chickens

It affects the rapidly growing broiler chicken with sudden increase in mortality between 12 and 18 days of age, in this condition birds are unable to rise and move their head. Death is mainly due to hypoglycemia which occurred due deficiency of melatonin, because of lack of long dark period. Males are more susceptible than females, probably because of their faster growth rate.

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