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Study of the Relation Between the Incidence of Ascite Syndrome and the Ventilation Factor in Broiler Chickens of the Broiler House

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Abstract: The main objective of this study was to determine the relation between the incidence of ascites syndrome and the ventilation factor in broiler chickens in the northwest region of Iran. We studied seven flocks which showed ascites syndrome. We started to correct unsuitable ventilation conditions in all seven poultry houses. After correction of the ventilation conditions, the incidence rate of ascites syndrome decreased by 1% in all seven poultry houses and we could nearly reduce the prevalence of CRD complex from 7% to 1% in these flocks too.

Key words: Ascites syndrome, ventilation, broiler chickens

INTRODUCTION

The Ascites syndrome is the primary cause of death for rapidly growing broiler strains, resulting in economic loss (Huchzemeyer and DeRuyck, 1986). Ascites is a condition that leads to accumulation of ascitic fluid, in body cavities resulting in carcass condemnation or death. Physiologically, low oxygen concentration creates an oxygen deficit (hypoxia) and a demand for more oxygen. The increased demand may exceed the cardiopulmonary capacity to supply sufficient oxygen, resulting in pulmonary hypertension and right ventricular failure (Julian, 1993).

Mortality in broiler chickens associated with fluid accumulation in the abdominal cavity is the ultimate consequence of an excessively high blood pressure in the pulmonary circulation and is known as Pulmonary Hypertension Syndrome (PHS). The symptoms are generalized edema, hydropericardium syndrome, ascites, hypertrophy and dilatation of the heart, particularly hypertrophy of the right ventricle (Decuypere *et al*., 2000).

Decreased oxygen tension or increased oxygen requirements can create hypoxic tone. Regional reductions in pulmonary oxygen tension constrict the nearby arterioles and the heart has to respond by contracting more vigorously to overcome the higher flow resistance. An increase in blood viscosity further contributes to right ventricle hypertrophy. Indeed, anoxia in birds stimulates the kidneys to produce erythropoietin which in turn stimulates the production of red blood cells in the bone marrow (erythropoiesis). This results in higher haematocrit values which are accompanied by an increase in the viscosity of the blood (Julian, 1993). Together with severe pulmonary vasoconstriction; this may explain the appearance of general congestion, especially in the narrow capillaries of the lungs. The resulting hypertrophy of the right ventricle leads to a failure in the closure of the right valve between the ventricle and the atrium as a consequence, a volume of blood re-enters the atrium with each heart beat. The gradual reduction in output of the right ventricle results in a substantial increase in the venous pressure in the portal and hepatic veins, which is of special interest because the intercellular spaces in the capillary walls of the liver are larger than those in other tissues. Simultaneously, as a result of heart insufficiency, an elevated venous pressure may block the drainage capacity of the lymphatic vessels. Edema in the abdominal cavity (ascites), hydropericardium and edematous lungs are the direct results of such a change in blood pressure in different parts of the circulation (Decuypere *et al*., 2000). The housing environment, including factors such as temperature (cold or fluctuating temperatures) and air quality (dust concentration, carbon dioxide levels and oxygen levels), is known to influence the incidence of ascites in broiler chickens. The incidence of ascites greatly increases at altitudes greater than 1300 meters above sea level, presumably because of the low oxygen partial pressure (Hernandez, 1987). The metabolic rate of fast growing broiler chickens is very high and in less well ventilated poultry house as well as at higher altitudes, oxygen becomes a limiting factor as far as their health, welfare and performance are concerned. The high metabolic demands, together with decreased availability of oxygen, may lead to hypoxia, hypoxemia and anoxia (Julian, 1993; Maxwell *et al*., 1995; Scheel *et al*., 1992). The oxygen imbalance may be caused either by an extremely high metabolic demand by the tissues (resulting in anoxia, hypoxemia and hypoxia) or by an insufficient supply of oxygen (also resulting in hypoxia, hypoxemia and finally, anoxia), or both. This imbalance is caused by exogenous as well as by endogenous (genetically based).

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Table 1: Ventilation condition at the first visiting of different poultry houses

	Poultry house Number						
	1	2	3	4	5	6	7
The capacity of the poultry house (birds)	20000	3500	10000	12000	4600	30000	10000
Number of chambers	2	2	1	1	1	3	2
The size of poultry house (meter)	12 x 32	11.5 x 20	13 x 81	12 x 100	12 x 30	12 x 83	12 x 55
Inlet speeds of the fans (m^3/h)	34500	20400	43600	88000	44000	22000	27500
Inlet area (m^2)	7.2	2.8	2.24	4.2	10	4	3
The incidence rate of the ascites syndrome (%)	7.5	5	7	6	4	7	5
The prevalence of CRD complex (%)	7	5.3	7.1	7.1	5	8.1	6.3
FCR	2.3	2.26	2.3	2.25	2.23	2.31	2.3

Table 2: Ventilation condition after correction of different poultry houses

	Poultry house Number						
	1	2	3	4	5	6	7
The capacity of the poultry house (birds)	20000	3500	10000	12000	4600	30000	10000
Number of chambers	2	2	1	1	1	3	2
The size of poultry house (meter)	12 x 32	11.5 x 20	13 x 81	12 x 100	12 x 30	12 x 83	12 x 55
Inlet speeds of the fans (m^3/h)	72000	56000	160000	192000	73600	160000	88000
Inlet area (m^2)	21.5	16.8	48	57.6	20	48	26.4
The incidence rate of the ascites syndrome (%)	1	1.2	1.2	1.5	1	1.2	1
The prevalence of CRD complex (%)	3	1.5	2.5	3.5	2	2.5	2
FCR	2.18	2.19	2.19	2.2	2.19	2.2	2.19

MATERIALS AND METHODS

In March 2011, we visited a broiler flock which showed 7.5% the incidence of ascites syndrome and the prevalence of CRD complex was 7%. The poultry house was in the northwest region of Iran. The Food Conversion Ratio (FCR) of this flock was 2.3. This unit had two chambers for 20000 birds. The size of each chamber was 32 x 12 meter. Inlet speeds at the intake were maintained at least at 34500 m^3/h and the inlet area was 7.2 m^2 (Table 1). We started to correct these conditions during a year according to the Table 3.

After this case we studied the relation between the incidence of ascites syndrome and the ventilation factor in broiler chickens in the northwest region of Iran and we visited five broiler flocks which showed high incidence rate of ascites syndrome then we applied the same ventilation standards to them (Table 1).

RESULTS

After correction of the broiler houses condition, the incidence of ascites syndrome decreased by 1% in the flocks and the prevalence of CRD complex reduced. The FCR changed in flocks and it reduced (Table 2).

DISCUSSION

The objective of the present study was to detect the relation between the incidence of ascites syndrome and the ventilation factor in broiler chickens. In the present study, we only studied seven poultry houses which showed ascites syndrome. McGovern *et al.* (2001) reported that the birds in the low CO_2 treatment did not have a reduced ascitic score compared to the birds in the raised high CO_2 treatment, however, the right ventricle area was significantly reduced in the low CO_2 treatment from 0.50-0.47 cm^3 suggesting more ascites syndrome percent in the high CO_2 treatment and under recommended management practices in Alberta, CO_2 and O_2 levels should not be a contributing factor to the incidence of ascites (McGovern *et al.*, 2001). Some believes that ascites may be a consequence of lowered oxygen tension in poultry sheds caused by increased quantities of dust or noxious fumes as a result of poor ventilation (Pattison, 1993). It is clear from this study that there is a relation between the incidence of ascites syndrome and the ventilation factor in broiler chickens. In this study, we could reduce nearly the incidence rate of ascites syndrome by 1% and the prevalence of CRD complex reduced from 7% to 3% in seven poultry houses and the Food Conversion Ratio (FCR) changed.

Table 3: Guiding standards for ventilation rates in poultry houses (Pattison, 1993)

	Ventilation rate (m^3/h/kg BW)	
Season	Broilers	Adults
Summer (maximum)	4.0	8.0
Winter (minimum)	0.7	1.5

Conclusion: From this study, the following conclusions can be drawn:

This study confirms that carbon dioxide and oxygen contribute significantly to the incidence of ascites under unsuitable ventilation and it is possible to decrease the incidence rate of ascites by correction of the poultry house conditions.

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