Comparative Survey Of Ascites Syndrome Incidence Rate In Various Strains Of Broiler Chickens

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Abstract: Ascites syndrome is indicating the abnormal accumulation of non-inflammatory fluid in abdominal space. Hypoxia is the most important cause of pulmonary hyper blood pressure in broiler poultry. The aim of this study is a comparative survey of ascites syndrome incidence rate in Ross, Arbor-Aacre and Cobb strains of broiler chickens. For this purpose, 150 broiler male chicks of Ross, Cobb, and Arbor-Aacre strain, and totally 450 chicks were distributed to three groups The breeding condition was identical for all groups. For increasing the susceptibility to ascites syndrome, pellet meal and cold stress were used and 16ºC was applied since their 7th to 21st day old then the temperature was brought to 22 ºC, suddenly and did not changed until the end of breeding period. The rate of ascites syndrome incidence in Cobb strain was highest and in Ross strain was lowest. Hematocrit parameter in Cobb and Arbor-acres strains increased following third week compared with Ross strain. Between Ross and Cobb strains on 28th day, and among all groups on 35th and 42nd days was different statistically (p<0.05). The growth rate of Cobb and Arbor-acres was more than Ross and it was statistically different among all three strains on the end of experiment (p<0.05). Feed usage in Arbor-acres strain was more than two other strains which was statistically different (p<0.05). But FCR was not different statistically between groups. The results of this experiment showed that cobb strain was susceptible to the ascites syndrome in cold regions.

Key words: ascites syndrome, broilers, ross 308, cobb 500, arbor-acress,

INTRODUCTION

Ascites syndrome indicates abnormal increasing of endemic transudation of fluid in one or more different spaces of abdominal area. The great accumulation of this fluid is seen in liver area especially in hepato-peritoneal and in pericardial area (Saif et al., 2008). Now, ascites syndrome considered as one of the serious problems in broiler poultry breeding. The syndrome reveals with accumulation of transudes in abdominal area. Typically, impress the young and fast growing poultry (Hasanzadeh, 2008). Ascites syndrome occurs all over the world in growing broiler chicks and considered as one of the important mortality causes in broiler flocks (Nakamura et al., 1999). However, there are some reports about suffering guinea fowl, duck, and turkey from the syndrome (Cowan et al., 1988, Julian, 1988, Julian et al., 1993). The syndrome was reported in broiler flocks of Bolivia altitudes (altitude more than 1800 m from sea level) (Hall and Machicao, 1968). Today's, occurrence of the syndrome is reported both in high and low altitudes' flocks (Buys and Barnes, 1981, Cueva et al., 1974, Yersin et al., 1992). Previous studies findings revealed that the most important factor in ascites syndrome occurrence is hypoxia (Maxwell, 1987, Owen RI Fau - Wideman et al., 1995, Owen et al., 1993). All respiratory system infectious diseases of broiler chickens, which cause destruction of pulmonary tissue, will lead the reduction of respiratory capacity and hypoxia, and with increasing pulmonary blood pressure it will be cause ascites syndrome (Hasanzadeh, 2008). In some diseases like Chronic Respiratory Disease (CRD), infectious bronchitis, colibacillus and aspergillossus that the pulmonary tissue is destroyed and its capacity reduces, and so the occurrence of ascites syndrome is inevitable (Cook et al., 1986, Darbyshire, 1985, Ganapathy and Bradbury, 1999, Hofstad and Yoder, 1966, Julian and Goryo, 1990, Lucio and Fabricant, 1990).

Researchers have proved the relationship between increased resistance to pulmonary blood circulation and ascites syndrome incidence (Wideman and Kirby, 1995, Wideman et al., 1995, Wideman R. J. F. et al., 1997). Zafra et al. (2008) demonstrated the occurrence of ascites syndrome following fungal aspergillus disease, which has led to the destruction of pulmonary tissue (Zafra et al., 2008). Enkvetchakul (1995) showed the effect of inflammatory reactions on increasing the thickness of gas exchange area in lungs. In relation with this issue,
some infectious agents like aspergillus, *E.coli*, and Infectious bronchitis virus have been mentioned (Enkvetchakul et al., 1995).

Based on obtained data, in 1996 the disease was observed in 18 countries of 4 continents of the world (Maxwell and Robertson, 1997). Also, hematological studies demonstrate significant changes in hematological components due to low blood oxygen in broiler chicks which had ascites. Hemoglobin accumulation increases cell volume and red blood cell. It is worth to note that the number of lymphocytes decreases and the number of heterophils increases as a result of stress (Maxwell, 1987, Maxwell et al., 1986). Increased red blood cell demonstrates abnormal increase of erythropoietin hormone secretion which occurs under the low oxygen pressure along with hemoglobin synthesis (Maxwell et al., 1986, Maxwell, 1987, Miersalimi and Julian, 1991).

Some researchers believe that the broiler strain improvement is based on low feed conversion ratio (FCR) along with decreasing of thyroid hormone activity (hypothyroidism) such that causes to decrease the use of oxygen and hypoxia which conforms with increasing susceptibility of broiler chicks to ascites. In general, involved mechanisms in androgen factors can have some effects on ascites occurrence from embryonic period (Dayton and Hathaway, 1991, Decuyper et al., 1994a, Maxwell and Robertson, 1997). In recent years the successful genetic selection has caused new broiler strains can be offered to the market 60% earlier than the broilers of 40 years ago. But the broilers cardiac and pulmonary capacity does not differ from olden broiler chicks which lack of conformity makes them susceptible to ascites (Anthony, 2001). Genetic selection programs have worked very well in selecting of fast growing broiler chickens strain but their organs growth especially cardiac and pulmonary growth have not been coordinate with their growth (Saif et al., 2008, Currie, 1999).

The aim of present study was to compare incidence rate of ascites syndrome in Ross, Arbor-Acress and Cobb strains of broiler chickens.

**MATERIALS AND METHOD**

In the present study 150 broiler chicks of each strain (male chicks), and totally 450 chicks were distributed to three groups (with three repetition of 50 chicks). The breeding condition including temperature, humidity, crowding, feeding, vaccination and water were same for all groups. In order to increase the broilers susceptibility to ascites syndrome, pellet and cold stress were used such that 16ºC was applied from their 7th to 21st day old then the temperature suddenly was brought to 22 ºC, and it did not changed until the end of breeding period. Mortality rate especially ones because of ascites syndrome was recorded for all groups. Furthermore five blood samples from each frequency were obtained randomly in order to measure hematocrit percentage. Necropsy results relative to ascites syndrome were examined especially the ones relative to heart deficiency such that the right ventricle size relative to other ventricles was calculated which is an important criteria about heart dilution in ascites syndrome.

**Vaccination Program:**

Vaccination programs were identical in both groups and were done according to following program: 1) H120 vaccine on one-day old (made by Merial Co. – France) by spraying, 2) Inactive vaccine of Newcastle-influenza on eighth-day (made by Merial Co. – France) subcutaneous injection + B1 eye drops (made by Introt-Holland), 3) Oral Gambro Vaccine GM97 on 15th-day old (made by Hipray- Spain), 4) Oral La Sota vaccine on 22nd-day old (made by Intervet- Holland). And also 10 cc of multivitamin in 10 liters after prescribing of any vaccine was given for 12 hours.

**Feeding Dietary:**

Dietary program in each of three groups was same and crumble was used following pellet feeding. Applied dietary formula is as follows:

**Blood Sampling And Plasma Separation:**

10 chicks of any group random selection were done weekly from the first week of breeding period. Blood samples were obtained from their wings vein by microhematocrit tubes. The samples were transferred to the laboratory following grouping and labeling; then each group of tubes were centrifuged at 12000 rpm for 5 min and Hematocrit percentage of each sample was identified by an especial Hematocrit ruler.
Table 1: Feeding diet in understudying farms

<table>
<thead>
<tr>
<th>Foodstuff</th>
<th>Age (day)</th>
<th>0–20</th>
<th>21–35</th>
<th>36–42</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>564.5</td>
<td>634.5</td>
<td>674</td>
<td></td>
</tr>
<tr>
<td>Soybean</td>
<td>370</td>
<td>300</td>
<td>260</td>
<td></td>
</tr>
<tr>
<td>Concentrate*</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Oyster</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Salinomycin</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

*5% concentrate was used.

Results:
The present study was conducted in three groups of Ross, Arbor-Acres and Cobb strains. Each group consist of 120 broiler with three repetitions of 40 chicks. At the first part of the study, comparative survey of ascites syndrome incidence and at the second part, comparative study of Hematocrit percentage, weight increase, grain usage, FCR were conducted.

Table 2: comparison of ascites syndrome incidence at the end of each week in two experimental groups

<table>
<thead>
<tr>
<th>Experimental groups</th>
<th>The rate of ascites syndrome incidence in weeks</th>
<th>Total ascites syndrome incidence percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st</td>
<td>2nd</td>
</tr>
<tr>
<td>A</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
A: Ross, B: Arbor-Acres and C: Cobb strain.

As it was mentioned in table 2, the rate of ascites syndrome incidence in Arbor-Acres strain group and in Cobb strain group is more than Ross strain group, but this difference is not statistically different. With regard to clinical signs, the chicks suffering from ascites syndrome have less growth and were smaller and ruffled feathers, comb darkness, abdomen emphysema and weak pigmentation in these chicks were relevant. Accumulation of ascetic fluid containing fibrin in umbilical region and edematous liver (fig 1), pulmonary sever hyperemia (fig 2), right ventricle hypertrophy (fig 3) and hydro-pericardium were relevant.

Table 3: the average of blood Hematocrit percentage in experimental groups' chicks. (Mean ± SEM)

<table>
<thead>
<tr>
<th>Understudying Factor</th>
<th>Sampling age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7th-day old</td>
</tr>
<tr>
<td>Hematocrit percentage A</td>
<td>37±0.1</td>
</tr>
<tr>
<td>Hematocrit percentage B</td>
<td>37±0.3</td>
</tr>
<tr>
<td>Hematocrit percentage C</td>
<td>37±0.5</td>
</tr>
</tbody>
</table>

Different lowercase alphabets in each column show meaningful difference among means on that age (p<0.05).
A: Ross, B: Arbor-Acres and C: Cobb strain.

As it is apparent from the results of table 3, Hematocrit parameters in broiler chicks of Arbor-Acres strain and Cobb strain increased from third week afterwards compared with Cobb strain. The difference was meaningful between Ross and Cobb strains on 28th-day old, among all strains on 35th-day old and between Cobb and two other strains on 42nd-day old (p<0.05).

Table 4: the average of weight, feeding, FCR in experimental groups. (Mean ± SEM)

<table>
<thead>
<tr>
<th>Understanding factors</th>
<th>Age (day old)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3-7</td>
</tr>
<tr>
<td>Weight (gram)</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>C</td>
</tr>
<tr>
<td>Grain usage (gram)</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>C</td>
</tr>
<tr>
<td>FCR</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>C</td>
</tr>
</tbody>
</table>

Different lowercase alphabets in each column show meaningful difference among means on that age (p<0.05).
A: Ross, B: Arbor-Acres and C: Cobb strain.

As it is apparent from the results of table 4, growth rate in broiler chicks of Arbor-Acres strain and Cobb strain is more than Ross strain. The difference was meaningful between Arbor-acres and Cobb compared with Ross strain on fifth week, between Cobb and two other strains on 28th-day old, among all strains on 42nd-day old (p<0.05).
Feed consumption in Arbor-acres strain was more than two other strains and the difference was meaningful statistically (p< 0.05). There was not any meaningful FCR difference among three strains.

**Fig. 1:** Accumulation of ascetic fluid containing fibrin in umbilical region and edematous liver

**Fig. 2:** Pulmonary sever hyperemia

**Fig. 3:** Right ventricle hypertrophy

**Discussion:**

Since 1957 many studies have been conducted about ascites syndrome and its relevant etiology. As reported by Cueva et al. (1974), ascites syndrome was observed at first in high regions (altitude more than 1500 m from sea level) (Cueva et al., 1974). As reported by Hull et al. in 1968, ascites syndrome was observed at first in broiler flocks of in high regions of Bolivia (Hall and Machicao, 1968) but nowadays the syndrome is observed in other flocks which are bred in other regions (Decuypere and Buysee, 2000).
Decuypere et al. in 2000 divided ascites causing factors to internal and external groups in a comprehensive article (Decuypere and Buysee, 2000). High altitude, insufficient ventilation, pulmonary diseases, cold, feeding and water salinity are among important external factors while strain correcting and genetic changes in various broiler strains are the most important internal factors (Anthony, 2001, Bendheim et al., 1992, Decuypere and Buysee, 2000, Wideman et al., 1995, Shlosberg et al., 1992, Hassanzadeh, 1997).

Cold weather was applied in the present study as an external factor for induction ascites. Cold weather causes to increase the need for oxygen in low-temperature regions. In order to increase body metabolism at low temperature; as well as stabilizing body temperature, oxygen is necessary. The cold roll in ascite syndrome occurrence was defined by Hassanzadeh in 1997, Julian in 1993, Lugar et al. in 2001 which conform to our findings (Hofstad and Yoder, 1966, Hassanzadeh, 1997, Luger et al., 2001).

Decreasing environmental temperature causes to increase TSH secretion and thyroidal hormones. It was reported that the birds which are kept in cold environments have higher plasma T3 and low T4 compared with birds which are bred in normal environment (Decuypere et al., 1994a, Ganapathy and Bradbury, 1999). Furthermore, high hematocrit, polycythemia and blood high viscosity in cold weather are some signs of increasing hematopoiesis due to hypoxia resulted in high metabolic activities (Julian et al., 1993, Mirsalimi et al., 1992, Yersin et al., 1992).

In this study cold stress was applied as a factor in ascites syndrome occurrence. Food dietary influence on ascites syndrome was known as well. Feeding with pellet instead of mash feed increases ascites syndrome in various breeding conditions. Pellet causes to increase the growth rate so increases oxygen demand and possibility of ascites syndrome (Dewil et al., 1996, Decuypere et al., 1994b, Dale, 1986, Decuypere and Buysee, 2000). By using pellet the rate of used grain increases by time, therefore the rate of growth increases, so the need for oxygen increases as a result of fast growth and hypoxia occurs which causes pulmonary hyperemia and finally ascites (Julian and Goryo, 1990, Maxwell et al., 1986). In the present study we used pellet for two groups in order to increase the susceptibility to ascites. Anthony and Martine in 2001 reported that strain susceptibility against ascites in broiler chicks are variable moderately to very much such that the susceptibility of broilers to ascites syndrome will become more with fast growth (Saif et al., 2008, Maxwell et al., 1986). With regard to the results of table 4, final weight strains (p<0.05) which can account for ascites syndrome occurrence in Cobb broilers.

Since 1950 till now the growth of broilers flocks has been increased three times and metabolic disorders like ascites syndrome have been increased due to fast growth (Baghbanzadeh and Decuypere, 2008, Beker et al., 1995).

**Conclusion:**

Therefore in order to ascites control in all of broilers especially fast growing strains like Cobb the following points must be paid attention: 1) Breeding in saloons with standard ventilation, heating and humidity, 2) Avoiding high accumulation, 3) Avoiding intensifier stresses of ascites like cold, 4) Controlling the respiratory diseases especially infectious bronchitis, influenza, coli bacillus, aspergillus, and Finally 5) Alternative lightening program (at least in high regions).

**REFERENCES**


