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Effective Management Practices to Reduce the Incidence of Ascites in Broilers

SUMMARY

Introduction

Ascites is a multi-factorial syndrome caused by interactions between physiological, environmental and management factors. Its presence in a broiler flock will have a significant effect on the biological and economical performance of the flock. The key to preventing Ascites is ensuring that good basic management is adhered to, particularly with regards to **ventilation**.

Increased metabolic requirements (due to cold temps, low partial pressure of 0_2, etc.)
↓
Increased demand for 0_2
↓
Increased cardiac output
↓
Enlargement and partial failure of the heart
↓
Leakage of fluid from the liver into the abdominal cavity
↓
Ascites

What is Ascites?

Factors that increase the workload of the heart by increasing the demand for oxygen (such as fast growth rate, cold stress, low partial pressure of oxygen or respiratory diseases) can lead to Ascites.

Leakage of fluid from the liver into the abdominal cavity eventually restricts breathing and ultimately can lead to death.

Reducing the Incidence of Ascites in Broiler Flocks

1. **Ensure adequate ventilation from placement to depletion.** Ventilation rates should be linked to house biomass, supplying enough air to replenish the oxygen consumed and ensure the adequate removal of waste gases. Providing sufficient oxygen is vital at high altitudes. Oxygen is a constant percentage of air, but at low atmospheric pressures associated with altitude, the absolute levels of oxygen may predispose birds to Ascites, particularly when other factors increase metabolic rate.
2. **Maintain air quality.** This is directly associated with good ventilation and appropriate litter management. High levels of air contaminants (e.g. carbon monoxide, carbon dioxide and dust) cause respiratory damage. This reduces respiratory efficiency and blood oxygen levels increasing the risk of Ascites.
3. **Avoid periods of cold stress particularly during the brooding period.** Exposure to cold periods increases the metabolic rate (oxygen demand) and can predispose/lead to Ascites later in the production period. At placement, floor temperatures should be 28-30°C (82-86°F), air temperature should be 30°C (86°F) and relative humidity between 60-70%.
4. **Feed programs to control early growth.** Well managed feed programs to control early growth (e.g. reducing the nutrient density of the diet, changing feed form) may help reduce Ascites. Implement programs after 7 days of age to ensure chicks get a good start.
5. **Lighting programs.** An additional 1-2 hours of dark added to the recommended 4 hours for broilers <2.5kg/5.5lbs (from 8 days of age to slaughter) or 6 hours for broilers >2.5kg/5.5lbs (from 8 days of age to slaughter) may help reduce Ascites. Do not implement light programs before 7 days of age.
6. **Incubation and Ascites.** Ensure adequate ventilation is achieved during the latter stages of incubation, particularly if incubation occurs at high altitudes.

KEY POINTS

- If incubating at high altitudes, ensure adequate ventilation is achieved.
- Achieving appropriate ventilation (based on house biomass) from placement through to depletion is essential, particularly at high altitudes. Check ventilation rates and equipment regularly.
- Prevent unnecessary increases in metabolic rate due to periods of cold stress, particularly during the brooding period.
- Well-managed growth control programs implemented **after** 7 days of age may also help where the incidence of Ascites is high.

Introduction

Ascites, water belly or pulmonary hypertension syndrome is a disease of broiler chickens that can occur worldwide but tends to be most prevalent at high altitudes. Its presence in a broiler flock will have a significant effect on the performance of the flock both biologically and economically.

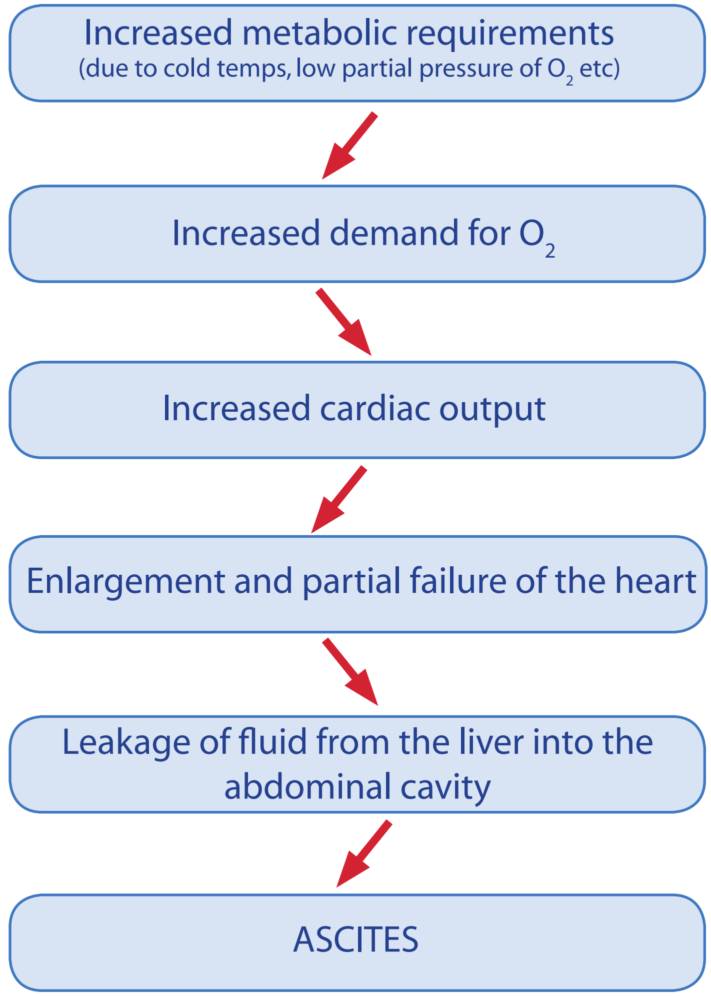
Ascites is a multi-faceted syndrome caused by interactions between physiological (e.g. O_2 demand), environmental (e.g. altitude) and management (e.g. ventilation, disease status) factors. Although Ascites may be most common at high altitudes, broilers grown at low altitudes with substandard environmental conditions and poor brooding temperatures can also have higher mortality and processing downgrades as a result of increased Ascites incidence.

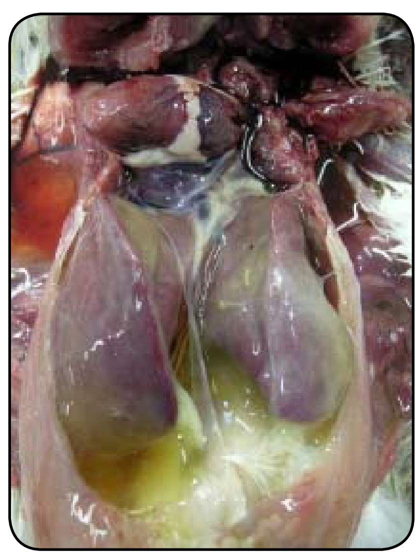
What is Ascites?

Understanding Ascites is the first step to reducing or stopping its incidence in broiler flocks.

Any factors that increase the workload of the heart by increasing the demand for oxygen (e.g. fast growth, reduced environmental temperatures, low partial pressure of oxygen or respiratory diseases) can lead to Ascites. When the workload on the heart and lungs is increased, a chain of events is triggered (**Figure 1**) that leads to reduced levels of oxygen in the blood. In the initial stages this can be detected by a slight darkening of the comb and wattles. As the disease progresses, fluid (leaked from the liver) accumulates in the abdominal cavity. Eventually this restricts breathing (it is at this stage that the comb and wattles exhibit a dark blue) and ultimately, it is this restriction that leads to death.

Figure 1: Chain of events leading to Ascites





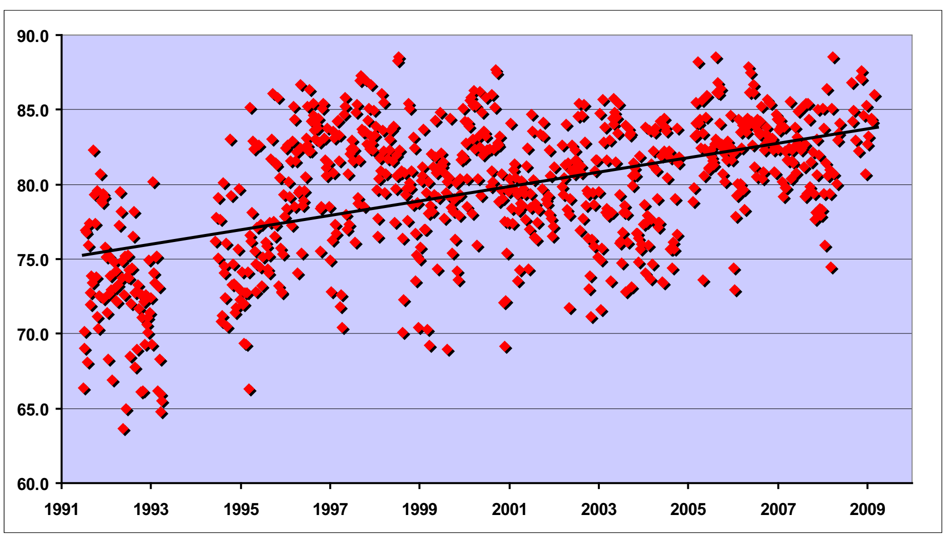
Accumulation of fluid in the abdominal cavity.

Reducing the Occurrence of Ascites in Broiler Flocks

Genetic Factors

Historically, broilers with faster growth rates were more likely to develop Ascites due to the increased demand that this fast growth placed on the heart. However, with appropriate selection strategies, the predisposition of fast growing broilers to Ascites has been reduced. As a direct response to the concerns of the poultry industry over the last two decades, Aviagen has incorporated the routine assessment of birds for the oxygen saturation level in the blood (SaO_2) into its selection strategy. Birds with high levels of SaO_2 have a reduced susceptibility to Ascites and Sudden Death Syndrome. The Aviagen breeding program has an ongoing focus on improving the cardiovascular health of its pedigree populations and hence their products. This is done by removing individuals and families with below average levels of SaO_2. Over time this has led to a significant increase in the SaO_2 levels of the blood (**Figure 2**) thus reducing the susceptibility of Aviagen products to Ascites. This selection policy has allowed a long-term genetic trend of improvement in key broiler traits while at the same time reducing the incidence of metabolic disorders and improving livability.

Figure 2: Changes in percentage oxygen saturation in the blood over time



Influence of Environment on Ascites

Ventilation and Ascites

The most influential environmental factor affecting Ascites in broilers is the oxygen content of air brought into the poultry house.

Growing at higher altitudes (1000 m / 3280 ft or above) is common place in some regions of the world. Ascites symptoms are more acute at high altitudes as the air has a lower partial pressure of oxygen than that at sea level. Exposure to a lower partial pressure of oxygen will lead to an increased workload on the heart. In this situation it is critical to ventilate correctly and provide as much oxygen to the flock as possible.

Suboptimal ventilation in broiler houses leads to low environmental oxygen and higher toxic gases such as carbon monoxide, carbon dioxide and ammonia. This will put extra pressure on the cardiovascular system thus reducing its capacity to carry oxygen and increasing Ascites. Ventilation rates must supply enough air to replenish the oxygen consumed and ensure the adequate removal of waste gases. Managers who run a constantly increasing, pro-active ventilation program, linked with total house biomass, have no or much-reduced levels of Ascites in their flocks.

A good way to manage the ventilation program is by using fan cycle timers; increasing "on" time as the flock gets older and house biomass increases. The example in **Table 1** (next page) explains how this can be done. Often fans can be inefficient compared to the declared ratings (due to baffles, age, etc.). Fans should be checked regularly and the ventilation program adjusted accordingly.

Table 1: Methodology for calculating minimum ventilation rates based on house biomass and percentage time for running fans to achieve that ventilation rate at **sea level**

Live Weight kg	(lbs)	Min. Ventilation Rate m^3/hr	(ft^3/min)	Max. Ventilation Rate m^3/hr	(ft^3/min)
0.050	(0.110)	0.074	(0.044)	0.761	(0.448)
0.100	(0.220)	0.125	(0.074)	1.280	(0.754)
0.200	(0.441)	0.210	(0.124)	2.153	(1.268)
0.300	(0.661)	0.285	(0.168)	2.919	(1.719)
0.400	(0.882)	0.353	(0.208)	3.621	(2.133)
0.500	(1.102)	0.417	(0.246)	4.281	(2.522)
0.600	(1.323)	0.479	(0.282)	4.908	(2.891)
0.700	(1.543)	0.537	(0.316)	5.510	(3.245)
0.800	(1.764)	0.594	(0.350)	6.090	(3.587)
0.900	(1.984)	0.649	(0.382)	6.653	(3.919)
1.000	(2.205)	0.702	(0.413)	7.200	(4.241)
1.200	(2.646)	0.805	(0.474)	8.255	(4.862)
1.400	(3.086)	0.904	(0.532)	9.267	(5.458)
1.600	(3.527)	0.999	(0.588)	10.243	(6.033)
1.800	(3.968)	1.091	(0.643)	11.189	(6.590)
2.000	(4.409)	1.181	(0.696)	12.109	(7.132)
2.200	(4.850)	1.268	(0.747)	13.006	(7.661)
2.400	(5.291)	1.354	(0.798)	13.883	(8.177)
2.600	(5.732)	1.437	(0.846)	14.42	(8.683)
2.800	(6.173)	1.520	(0.895)	15.585	(9.180)
3.000	(6.614)	1.600	(0.942)	16.412	(9.667)
3.200	(7.055)	1.680	(0.990)	17.226	(10.146)
3.400	(7.496)	1.758	(1.035)	18.028	(10.618)
3.600	(7.937)	1.835	(1.081)	18.817	(11.083)
3.800	(8.377)	1.911	(1.126)	19.596	(11.542)
4.000	(8.818)	1.986	(1.170)	20.365	(11.995)
4.200	(9.259)	2.060	(1.213)	21.124	(12.442)
4.400	(9.700)	2.133	(1.256)	21.874	(12.884)

Using the table to the left, calculate the total ventilation rate required for the house (total cubic meters per hour [cmh] or total cubic feet per minute [cfm]) as:

$$\frac{\text{Minimum Ventilation} \times \text{Number of Birds in the House}}{\text{Rate per Bird (from table)}} = \text{Total Minimum Ventilation}$$

Calculate the percentage time for running the fans as:

$$\frac{\text{Total Ventilation Needed}}{\text{Total Capacity of the Fans Used}} = \text{Percentage of Time}$$

Multiply the percentage of time needed by the total fan timer cycle to give the time that the fans require to be on in each cycle.

Air Quality and Ascites

Correct litter management in conjunction with appropriate ventilation helps to maintain air quality. Suboptimal ventilation and inadequate litter management leads to problems of wet litter and increased ammonia levels. Dust within the environment will be inhaled by the birds thus leading to irritation and reduced efficiency of the airways.

Poor air quality, dust and respiratory diseases all predispose birds to Ascites by causing respiratory damage thereby reducing the efficiency of respiration and blood oxygen levels. For the same reasons it is important that the litter material is clean and free from mold or contamination at the time of placement.

Table 2 (next page) shows the common air contaminants present in the poultry house and the effect that they have on bird health. All the contaminants listed below either predispose or lead directly to Ascites.

Table 2: Common house air contaminants that can increase Ascites susceptibility

Contaminant	Effect
Ammonia	Can be detected by smell at 20ppm or above >10ppm will damage lung surface >20ppm will increase susceptibility to respiratory diseases >50ppm will reduce growth rate
Carbon Dioxide	>3500ppm causes Ascites and is fatal at high levels
Carbon Monoxide	100ppm reduces oxygen binding and is fatal at high levels
Dust	Damage to respiratory tract lining and increased susceptibility to disease
Humidity	Effects vary with temperature. At >29˚C (84˚F) and >70% relative humidity, growth will be affected

Temperature and Ascites

Maintaining adequate brooding temperatures are critical to the prevention of Ascites. Exposure to cold periods that place birds outside their thermo-nuetral zones will increase the demand for oxygen as birds are forced to use energy to keep warm. This increase in metabolic rate can lead to Ascites later in the production period. Correct and monitored temperature during brooding, along with a good minimum ventilation program from placement, will help reduce and in some cases eliminate any Ascites problems seen later in the grow-out period.

At placement, floor temperatures should be 28-30^{o}C (82-86^{o}F) and air temperature (measured at bird level) should be 30^{o}C (86^{o}F) with relative humidity between 60 and 70%. **Table 3** (next page) shows a good brooding temperature profile for the broiler house. The temperatures recommended in **Table 3** assume an ideal relative humidity (RH) of 60-70%. If RH is outside this ideal range, the temperature of the house at bird level should be adjusted accordingly. For example, if RH is below 60% or above 70%, the dry bulb temperature may need to be increased or decreased respectively.

Table 3: Correct brooding temperature profiles assuming an ideal RH of 60-70%

Age (days)	Whole-house Brooding	Spot Brooding	
	Temp	Temp	
		Brooder Edge (A*)	2 m (6.6 ft) from Brooder Edge (B*)
Day Old	30°C (86°F)	32°C (90°F)	29°C (84°F)
3	28°C (82°F)	30°C (86°F)	27°C (81°F)
6	27°C (81°F)	28°C (82°F)	25°C (77°F)
9	26°C (79°F)	27°C (81°F)	25°C (77°F)
12	25°C (77°F)	26°C (79°F)	25°C (77°F)
15	24°C (75°F)	25°C (77°F)	24°C (75°F)
18	23°C (73°F)	24°C (75°F)	24°C (75°F)
21	22°C (72°F)	23°C (73°F)	23°C (73°F)
24	21°C (70°F)	22°C (72°F)	22°C (72°F)
27	20°C (68°F)	20°C (68°F)	20°C (68°F)

**These brooding temperatures are a recommendation. Actual brooding temperatures will depend on environmental and management conditions in the house. For more information on brooding temperatures, consult your local Arbor Acres technical representative.*

Duration of cold stress is much more critical than temperature itself. Metabolic stress and risk of Ascites will be increased with duration of cold stress. It is therefore vital that if periods of cold stress do occur, they are rectified as quickly as possible.

Influence of Growth Rate on Ascites

There is a direct correlation between metabolic rate and Ascites levels. A fast growth rate increases the demand for oxygen and hence the workload of the heart. Therefore adapting good management practices is vital for fast growing broilers.

Growers who have recurring problems with Ascites may find it beneficial to control early growth rates. The first 3 weeks of a bird's life are metabolically stressful as bone and muscle growth are greatest at this time. If growth is reduced during this period, oxygen demand will also be reduced. Birds whose growth is controlled early on may have a stronger cardiovascular system going into the finisher phase. However, any restriction of early growth should be exercised with caution. Achieving adequate growth during the first 7 days is vital and so any growth control should be implemented **after** 7 days of age. Starter diets should remain unchanged to ensure that the day-old chick has the best possible start.

Effective control of growth rate after 7 days of age can be achieved by reducing nutrient intake either by reducing the nutrient density of the diet or by changing feed form from a pellet to a mash. Any feed program must be managed properly and should only be considered once optimal management is assured. It is also important to consider that feed control may result in an overall reduction in growth rate. Any management strategy aimed at reducing early growth is therefore only likely to be economically viable when it is properly managed and where the occurrence of Ascites is severe.

Lighting and Ascites

Many growers in high altitude areas use lighting programs to help reduce early body weights and hence Ascites levels in their flocks. However, lighting programs are often too severe (e.g. the use of natural daylight only).

At low altitudes, lighting programs to control Ascites are unnecessary for Aviagen products as they can have a negative impact on growth rate and breast meat yield. High altitudes do change the situation, with lower partial pressures of oxygen and absolute humidity levels. Examples of typical good lighting programs are given in **Table 4**. If Ascites is a problem under high altitude conditions, some increase in the dark period (an additional 1-2 hours added to those recommended in **Table 4**) may help reduce Ascites mortality. To help ensure proper heart and lung development in growing birds it is essential that 7-day body-weight targets are achieved and that lighting programs are not implemented until **after** 7 days of age.

Table 4: Basic light intensity and photoperiod recommendations to optimize live performance

Live Weight at Slaughter	Age (days)	Intensity	Day Length (hours)
<2.5 kg / 5.5 lbs	0-7	30-40 lux 3-4 fc	23 light 1 dark
	8-slaughter	5-10 lux 0.5-1 fc	20 light 4 dark
>2.5 kg / 5.5 lbs	0-7	30-40 lux 3-4 fc	23 light 1 dark
	8-slaughter	5-10 lux 0.5-1 fc	18 light 6 dark*

**The EU Broiler Welfare Directive requires a total of six hours darkness, with at least one uninterrupted period of darkness of at least 4 hours.*

Incubation and Ascites

It has already been mentioned that an increased metabolic rate, paralleled with a shortage in oxygen supply, will lead to Ascites. One of the most demanding stages of chicken development is in the incubator. Chickens incubated at high altitudes may be predisposed to Ascites because the partial pressure of oxygen is lower. It is therefore important that adequate ventilation in the incubator is achieved. Achieving adequate ventilation may be a particular issue in single stage machines; in the setter, the air vents should be left fully opened for the last 3 days to ensure that ventilation, and thus oxygen levels, are optimal.

Conclusions

Ascites is a multi-factorial syndrome caused by interactions between physiological, environmental and management factors. The incidence of Ascites can be reduced by ensuring that good basic management practices are adhered to.

- If incubating at high altitudes, ensure adequate ventilation is achieved.
- Achieve appropriate ventilation in the poultry house from placement through to depletion is essential, particularly at high altitudes. Ventilation rates must supply enough air to replenish the oxygen consumed and ensure the adequate removal of waste gases.
- Prevent unnecessary increases in the birds' metabolic rate due to periods of cold stress, particularly during the brooding period. This will help reduce or even eliminate the occurrence of Ascites later in the growing period.
- Well managed growth control programs implemented **after** 7 days of age may also help where the incidence of Ascites is high.

A better understanding of what Ascites is and how it is caused, and the implementation of management factors that reduce the predisposing factors to Ascites, will ultimately help to control the occurrence of Ascites in broiler flocks.

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