

## Chapter 4 - BROILER HEALTH

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### **A. Introduction**

The main objective of the broiler industry is the production of **SALEABLE chicken meat**. To this end, it is important to minimize the number of condemnations at the processing plant and to maximize meat yield.

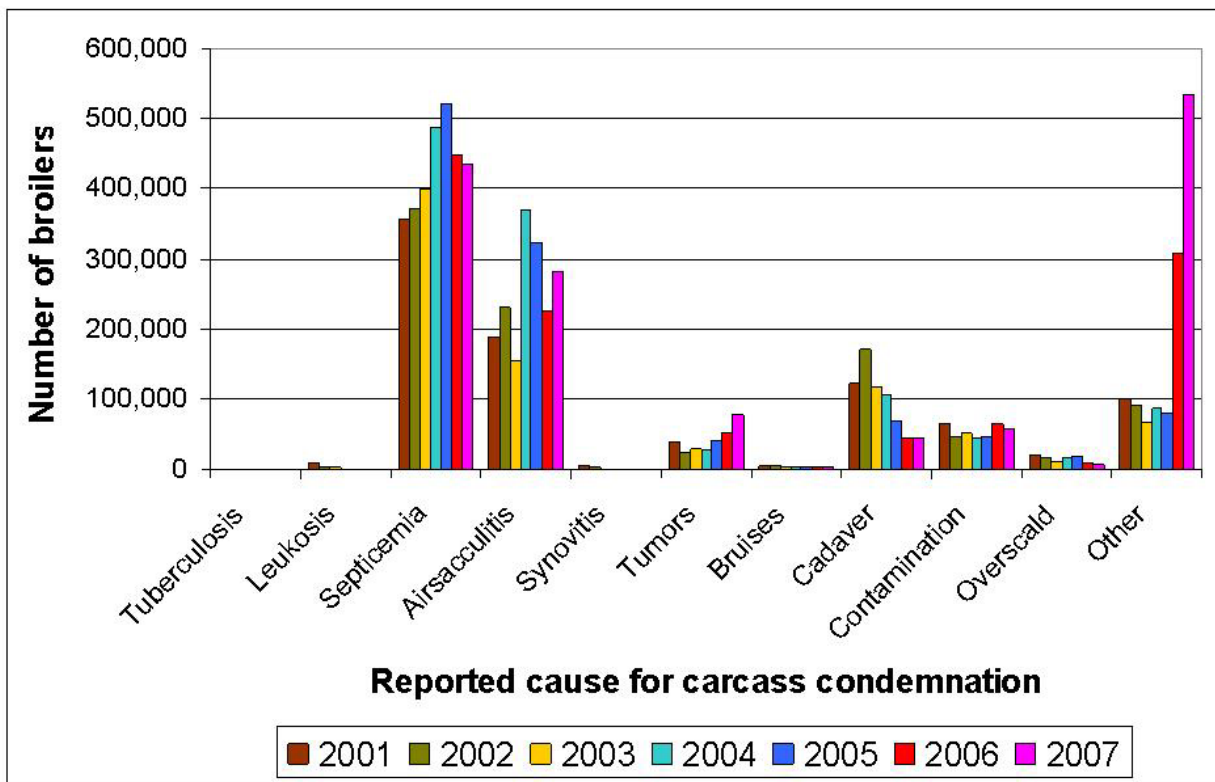
To produce a quality chicken meat product from a live broiler involves a series of efficiently-performed, specific tasks completed in a sanitary manner. Before broilers can be processed, they must be raised to market age, caught, cooped, transported and held, then unloaded at the processing plant. Inside the processing plant, broilers are hung on shackles, stunned, bled, de-feathered, eviscerated, inspected, chilled, graded, packaged and shipped. Because of the complexity of production and processing procedures, several factors may reduce carcass yield and carcass grade.

**Defects** resulting in carcass downgrading and product losses are caused by diseases, damage to the broiler before slaughter, or maladjusted equipment and manual errors during processing.

Individual **carcass inspection** is performed by trained government personnel responsible for ensuring that only wholesome poultry and poultry products, fit for human consumption, reach the market place. Licensed inspectors may be veterinarians or individuals specifically trained to carry out the process.

Figure 4.1 enumerates the most commonly reported causes for condemnation in broiler complexes in the United States. Typically, the main reason for condemnations is septicemia. Both the grower and the processor can play a role in minimizing these costly losses. It is important that biosecurity protocols are developed and implemented in all sections of the broiler industry, including breeders, hatchery, feed mill, grow-out facilities, live-haul, and processing.

**Figure 4.1 - Reported causes for condemnation of broiler carcasses processed in the United States 2001-2007.**



### **B. Tuberculosis**

USDA inspectors will condemn any carcasses with gray to yellow nodules attached to the intestine as this could be an indication that the broiler was infected with avian tuberculosis (TB). The disease has been found worldwide, including the U.S. where most of the incidences have occurred in flocks of the north-central states. Today TB has been largely eradicated in broilers in the U.S. (see Figure 4.1) but may still be found in mature chickens. Diet and feed management may play roles in the incidence of the disease. Most of the recent outbreaks have occurred in chickens reared outside in fenced pens or ranging free around buildings and were maintained on mixed cereal grains only. Feeding chickens on the ground, and their habit of digging in the dirt, are obvious contributory factors of infection from the environment. Feeding a complete and well-balanced ration significantly reduces the incidence of avian tuberculosis in broiler flocks.

Avian tuberculosis is a bacterial infection caused by *Mycobacterium avium* which is closely related to the human and bovine tuberculosis bacteria. Morbidity and mortality are often high in infected flocks. Transmission is via fecal excretion, ingestion, inhalation, offal and fomites (i.e., inanimate objects that can transmit infectious material such as boots, overalls, equipment). The disease has a slow course through a flock. The bacterium resists heat, cold, water, dryness, pH changes and many disinfectants.

Clinical signs of avian tuberculosis include:

- Severe loss of weight with no loss of appetite
- Pale comb
- Diarrhea
- Lameness
- Sporadic deaths

The common localization of tuberculosis nodules in the abdominal organs occurs because birds acquire tuberculosis through ingestion of the organism rather than through inhalation. This route of infection also helps to explain the low incidence of pulmonary lesions in birds when compared to mammals in which the lung is infected first. Avian TB can infect humans but is not considered a threat to people with healthy immune systems. In birds, *M. avium* causes a chronic debilitating disease with tubercular nodules. In humans, *M. avium* infections can cause local wound infections with swelling of regional lymph nodes. The infection is most severe in immunocompromised individuals. *M. avium* is spread by ingestion of food or water contaminated by feces from shedder birds.

### **C. Leukosis**

This condemn category includes several neoplastic diseases caused by various viruses. All of them produce tumors in domestic poultry and present similar gross lesions. The age and species of bird affected by the leukotic tumors suggest which viral agent is involved. This information can only be used to make a presumptive diagnosis, however, because there is considerable overlap. The most common manifestations of the leukosis complex are as follows:

- Marek's disease, which is an important disease found only in chickens less than six months of age
- Lymphoid leukosis, which is most common in semi-mature and mature chickens
- Reticuloendotheliosis, which occasionally produces liver and spleen tumors in turkeys and, rarely, runting disease in chickens
- Lymphoproliferative disease, which affects turkeys, producing a greatly enlarged spleen as well as tumors in other organs.

There is no evidence that viruses of the leukosis complex are pathogenic for humans.

As shown Figure 4.1, the incidence of carcass condemnation due to leukosis is very low, and has continued to decrease overtime (0.92% of total condemnations in 2001 to 0.06% in 2007).

## **D. Septicemia**

As previously indicated, septicemia is typically the main cause for carcass condemnation in broiler processing plants in the U.S. (see Figure 4.1). Septicemia, also known as toxemia, is general condemnation category that includes clear signs of systemic disease involvement. Septicemia is manifested by a group of clinical signs, not all of which will be present in a single carcass. Therefore, judgment plays an important part in correct dispositions for this condemn category. Septicemic carcasses frequently have petechial (pin point) hemorrhages on the heart, liver, kidneys, muscles and serous membranes. Blood-tinged exudates are often present in the body cavity. The liver and spleen are often swollen and hyperemic (contain an excess of blood), because they remove most of the bacteria from the circulating blood. Kidneys may appear swollen and congested. The skin of septicemic birds may be hyperemic. Depending upon the cause and duration of septicemia, carcasses at the time of slaughter may be hyperemic, cyanotic, anemic, dehydrated and edematous or exhibit some combination of these signs. No single carcass will shown all of these signs.

Septicemia/toxemia is commonly referred to as 'sep/tox.' If a carcass shows systemic change, it is condemned. This category is a catchall for those carcasses that have septicemia, toxemia or a combination of septicemia-toxemia.

## **E. Airsacculitis**

Airsacculitis, or inflammation of the air sacs, is also one of the more common causes for condemnation (see Figure 4.1). In the live bird it is characterized by watery eyes, coughing, and generalized respiratory distress. Although improper vaccine selection or administration may be involved in triggering airsacculitis, it is *usually the result of poor air quality, improper temperatures, poor drinker management, and/or severe environmental stress.*

Numerous microorganisms can produce airsacculitis and more than one infectious agent is often identified in an outbreak. Members of the genus *Mycoplasma* are frequently involved. Birds are more susceptible to infections of the air sacs when they are under stress. Vaccination, presence of another disease, poor nutrition, unsanitary conditions and poor ventilation may all be contributing factors.

Long-term exposure to ammonia concentrations breaks down a chicken's first defense against infection in the respiratory system. Ammonia-laden air destroys cilia in the trachea, which impairs mucus flow and thickens tissue around the alveoli. This damage makes poultry more susceptible to respiratory infections, such as Newcastle disease and air sacculitis. There are several methods that may be used to reduce aerosol generation or reduce aerosol concentrations. **Proper ventilation** is essential for bringing clean outdoor air into a poultry house to replace contaminated air. If houses are under-ventilated, aerosol concentration will continue to increase as more particles are produced by the birds without a means to dilute particle concentration.

The lesions of airsacculitis can be acute or chronic. Their appearance can range from slight clouding of air sac membranes and small amounts of watery exudate to thickened, opaque membranes and large amounts of thick, white-to-cream colored and/or cheesy exudates. The exudates can be confined to the air sacs and their diverticula, or they may be found in other areas if the air sac membranes are ruptured. Pneumonia, pericarditis (inflammation of tissue around the heart) and perihepatitis (Inflammation of the serous or peritoneal covering of the liver) might be present. In some cases, all portions of the respiratory tract (nasal membranes, sinuses, trachea, bronchi, lungs and air sacs) are affected. In other cases, little involvement beyond the air sacs is evident.

One organism that can cause airsacculitis in birds, *Chlamydia psittaci*, can cause disease in humans. *Chlamydia psittaci*, an unusual bacteria-like organism, occurs worldwide and affects more than 100 avian species. It causes a disease called psittacosis or parrot fever when it occurs in psittacine birds (curve-beaked, like parrots, parakeets, etc.) and the disease is called ornithosis when diagnosed in all other birds or in humans. Chlamydiosis is primarily transmitted by inhalation of contaminated fecal dust and is spread by carrier birds, which act as the main reservoirs for the disease. The organism is excreted in both the feces and nasal secretions. Shedding is sporadic and is usually induced by stress. A carrier state can persist for years. The organism survives drying, which facilitates oral spread and allows transmission on contaminated clothing and equipment. Chlamydiosis can be transmitted bird to bird, feces to bird, and bird to human. Human to human transmission can occur, mainly by exposure to patient's saliva.

Chlamydiosis is an occupational hazard for persons working with psittacines (parrots, parakeets, etc.) and pigeons, or for people working in turkey slaughter plants and avian diagnostic laboratories.

## **F. Synovitis**

Synovitis may be caused by a number of organisms, most often members of the genus *Mycoplasma*. Injury and nutritional deficiencies can also lead to Synovitis. The result is acute or chronic inflammation of the membranes lining one or more joints and tendon sheaths. Joints are often noticeably swollen and may contain exudate of variable amounts and consistency. The liver, kidneys and spleen may be swollen, and the liver is sometimes stained green with bile stasis. Lesions vary depending upon whether or not the condition has been confined to the joints without affecting the overall health of the bird or has overwhelmed the bird's defense mechanisms and caused systemic changes. A carcass that has synovitis and also shows signs of sep/tox or systemic change is condemned. In other words, *a whole carcass with synovitis is not condemned unless it also shows systemic change.*

## **G. Tumors**

Several types of tumors besides those of the leukosis complex affect domestic poultry. Some of the more common ones include:

- Squamous cell carcinomas – skin tumors found in young chickens
- Adenocarcinomas - malignant tumors originating in glandular tissue and are common in older birds
- Leiomyomas – benign tumor of smooth muscle, usually in the uterus or digestive tract
- Fibromas – benign, usually enclosed tumors composed primarily of fibrous tissue and more common in older birds
- Other - numerous other types of tumors occur in domestic poultry but at a low frequency.

There is no evidence that any of these types of tumors are a health threat to humans. Carcasses with tumors are condemned only if there is 'gross evidence' of metastasis present. The general rule:

- One tumor → trim and pass inspection
- Two or more tumors → condemned if there is evidence of metastasis.

## **H. Bruises**

If bruises are the reason for systemic change in a carcass, then the carcass is condemned and recorded under the bruises category. The level of bruising in broiler carcasses has declined steadily the last few years, from 0.55% of condemned carcasses in 2001 to 0.16% in 2007.

Broilers may be bruised at any time during production and even up to the time of slaughter. Minimizing bruises requires a clear understanding of when and how it occurs. Research has shown that there is a relationship between the age of the bruise and its visual appearance. As bruises age, breast bruises become darker whereas wing and drum bruises become lighter in color. With increasing bruise age, wing bruises become less red and less yellow, and drum bruises become more red and more yellow.

At the grow-out house, market-age broilers are caught by the live haul catch crew, loaded into coops and transported to the processing plant. During catching, it is important to minimize bruising because it results in carcass downgrading and yield loss. *Ninety percent of bruising occurs within 12 to 24 hours before processing.* Areas most frequently bruised are the breast (42%), wings (33%), and legs (25%).

## ***I. Cadaver (i.e., Dead on arrival, DOA)***

Broilers that die from causes other than slaughter are condemned under the 'cadaver' category. The effect of live haul on the number of DOAs is not reflected in the condemnation records since the dead birds do not enter the processing line. Typically, a chicken is not dead at the time of entering the scald vat and, upon submersion into the scald water, drowns. The presence of cadavers in the processing line is also an animal welfare issue. Improvements in stunning and processing equipment have resulted in a major decline in the number of cadavers condemned in broiler processing plants in the U.S. (from 13.51% of condemned carcasses in 2001 to 3.13% in 2007) but more improvement is required.

Processing of cadavers results in inadequate bleeding of the carcass – a pumping heart is required to get an adequate bleed out.

## ***J. Contamination***

Carcasses that are contaminated to the extent that valid inspection cannot be made are condemned. An example would be a carcass contaminated with bile or feces to the extent that the inspector cannot determine whether the carcass is wholesome. Carcasses that are mishandled and fall into open sewers or evisceration troughs are also condemned under the contamination category.

A **feed withdrawal program** plays an important role in reducing the level of contamination in broiler processing plants. Removal of feed and water from market-aged broilers before catch and live haul is a standard management practice that has been used by the poultry industry for more than 40 years. During this feed withdrawal time, broilers will evacuate their digestive tracts, and carcass contamination in the plant will be reduced.

Feed withdrawal refers to the total length of time a flock is without feed before processing. This includes the time the broilers are in the house without feed, as well as the time they are in transit and in the live hold area at the plant. Length of feed withdrawal is important because it affects the following:

- Carcass contamination and yield (reprocessing and live weight losses)
- Plant line efficiency (removal of contaminated carcasses)
- Grower payments (live weight loss)
- Product safety and product quality (pathogenic and spoilage bacteria)

Live production management practices can affect the results of feed withdrawal by altering the broilers' eating patterns or by changing the rate at which feed passes through the broilers' digestive tract. In order for a feed withdrawal program to work as designed, broilers must have normal feed consumption pattern and normal feed passage during the week before feed withdrawal. Changes in lighting or temperature regimes (hot or cold), a disruption immediately after feed is removed, and the stressors of catching

and holding can slow feed passage in broilers. When the rate of feed passage is slowed, it may not be possible to correct this problem simply by holding the broilers for a longer period of time before processing. It is best to minimize exposure to any condition that slows the passage of feed or causes the broilers to gorge immediately prior to feed withdrawal.

### ***K. Over scald***

Birds that spend too much time in the scald tank will become slightly cooked – referred to as an ‘over scald’. This usually occurs due to a break in the line or to poor adjustment of the scald temperature and line speed.

Carcasses that are cooked are condemned. Many times, these carcasses will also be machine-mutilated by picking machines. The skin of an affected carcass feels slimy to the touch and slips from the underlying meat which is much whiter than usual.

### ***L. Other***

There are several other subgroup categories for carcass condemnation:

- **Inflammatory process** – In the U.S., ‘inflammatory process’ is the term used for **cellulitis** which is literally an inflammation of connective tissues. It typically occurs between skin and muscles and between muscles. It can be a major cause of condemnation in broiler chickens. The condition is caused by infection of skin wounds (even minor ones) by particular strains of *E. coli* which can replicate in the tissues. The incidence of this condition in poultry slaughtered in North America has increased recently. A seasonal pattern has been observed, with a higher rate during the winter months. Affected flocks tend to have poorer than average productivity and uniformity, but the affected birds are not readily detectable prior to slaughter. Toe scrapes at 15-25 days of age when feather cover is poor are the most likely predisposing factors. Careful flock management with a view to reducing toe wounds has the greatest impact in controlling cellulitis. Routine monitoring of skin damage at about 25 days of age may be helpful in fostering good practices, though most of the broilers showing toe scrapes will not go on to develop cellulitis.
- Carcasses are condemned when there are **no viscera available to inspect**. Disposition of no-viscera carcasses are determined by the veterinarian in charge and are based upon flock incidence of disease.
- **Xanthomatosis** – Xanthomatosis is a rare condition of mature birds and is characterized by swollen wattles, thickened yellow areas of skin, and cutaneous swellings. In early stages, the swelling consists of a honey colored transudate; in later stages, this transudate becomes firm and fatty. Skin lesions contain 10-15 times more cholesterol than normal skin. Xanthomatosis is most likely attributed to contaminated feed fat with toxic aromatic hydrocarbons. The White Leghorn breed of chicken is the most commonly affected.
- **Parasites** – If the infestation is generalized, the carcass is condemned.