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Science & Solutions

Six Ways to Combat Cellulitis in Broilers

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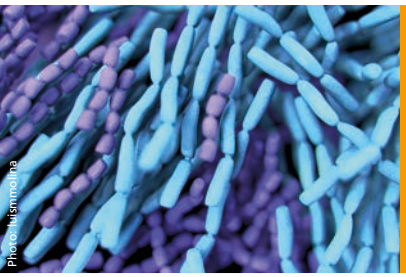

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Using a prebiotic and probiotic combo

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Editorial

Gut Microbiome and Animal Health – a Rediscovered Link

Though overlooked in the past, knowledge of gut microbiome and its relationship to human and animal health is fortunately increasing at an exponential rate. Each day scientific magazines feature articles about microorganisms in the gut and the link to diseases and animal zootechnical performance. Several advanced technologies are now used to demonstrate how the gut microbiome can affect physiological homeostasis, impacting digestive and immune systems, performance or even determining disruption of neuroendocrine pathways.

Factors such as antimicrobials intake, stress, environment and management conditions and lack of microflora establishment can destabilize the balance of gut microflora, leading to enteric dysbiosis. This imbalance is often an important risk factor for disorders such as *necrotic enteritis*, *salmonellosis*, and *E. coli* infections, as well as for vaccine effectiveness.

In the past decade, intensive work was made to identify sustainable ways to combat gut dysbiosis on commercial husbandry systems, including probiotics (beneficial bacteria), or prebiotics that support the growth of beneficial bacteria. A more promising advanced approach, known as synbiotics, combines the two.

In this issue of **Science & Solutions**, we look at how a poultry-specific synbiotic can counteract poultry cellulitis, an important poultry disease caused by *E. coli*. We also examine how the same synbiotic can modulate immune system response, increasing the efficacy of various poultry vaccines.

Finally, this issue brings the fifth part of our series on differential diagnosis covering carcass bruising.

Sit back, relax and enjoy your reading time.

Guilherme BORCHARDT NETO MV, MSc, PhD
Regional Marketing Director - South Latam

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Six Ways to Combat Cellulitis in Broilers

By **Luca Vandi**, Technical Sales Manager

Cellulitis, a leading cause of carcass condemnation in broilers, represents significant economic losses for poultry producers. Here are several methods to curb its incidence.

Photo: sansubbat

In the US, poultry producers incur economic losses due to broiler cellulitis of approximately US$35 million per year, half of the entire value of carcass condemnations there annually. In Canada cellulitis constitutes the predominant cause of condemnation in broilers. It impacts many poultry producers worldwide.

Slaughterhouse surprise

Cellulitis, a chronic skin disease mainly characterized by bacterial infection, is a sneaky disease. *E. coli* is the most often isolated pathogen from the lesions, with the pathogenic serotype O78 being the most commonly isolated (Derakhshanfar *et al.*, 2002). In broilers, cellulitis starts during the growing period on the broiler farm but is only recognized at the slaughterhouse after scalding and plucking the carcasses. Cellulitis-affected carcasses are rejected by the inspection vet and destroyed, resulting in economic losses for producers.

Photo: BIOMIN

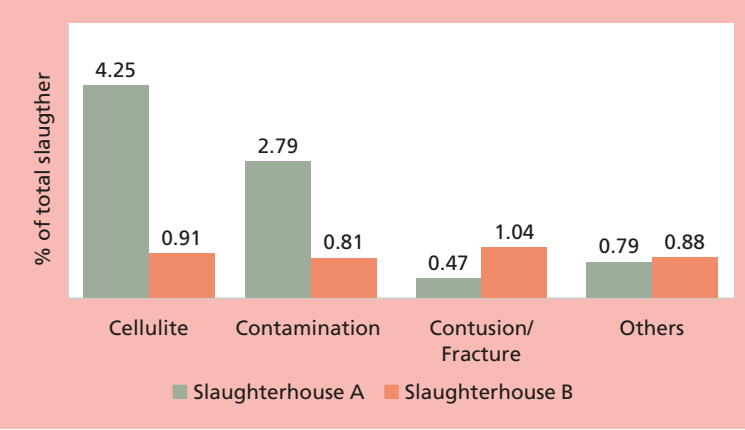
***E. coli* is the most often isolated pathogen from cellulitis-related lesions**

Unnumbered losses

In many countries the estimated market value of losses resulting from carcass condemnations is still unclear, though in many places efforts to identify causes and quantify impacts has revealed cellulitis to be a sizeable problem.

In many places efforts to identify causes and quantify impacts has

Figure 1. Causes of carcass condemnation in two Brazilian slaughterhouses.



Source: Santana A. P., et al.*, 2008*

In Brazil a study was carried out in two slaughterhouses to classify the reasons for condemnation (*Figure 1*). In slaughterhouse A, a vertical integrator, condemnations due to cellulite accounted for 4.25% of the total slaughter and 51% of all condemnations. In slaughterhouse B, a vertical integrator, condemnations due to cellulite accounted for 0.91% of the total slaughter and 25% of all condemnations. The disparity of results is most probably due to different farm management practices.

Fighting back

Producers can take a number of actions to combat cellulitis on the farm. These measures include promoting feather coverage, monitoring bird density, reinforcing biosecurity, adjusting the timing of vaccinations, updating management practices and ensuring good gut health.

1. Promote feather coverage

The introduction into the market of slow-feathering broiler genetic lines increased the broiler cellulitis problem. Modern broilers have a more prominent abdomen that expose them to more scratches. There are studies showing that feathering at 28 days is the most predisposing factor of broiler cellulitis. So, a good broiler management that supports proper feathering is of great importance. Avoiding a too hot environment, especially between 2 and 4 weeks of age, is also helpful to stimulate feathering and thus minimize cellulitis.

2. Monitor bird density

A greater number of birds per pen (higher density) is associated with a higher incidence of scratches which makes birds more vulnerable to cellulitis. This simple relationship (more birds = more scratches = more cellulitis) is very important —especially in farms where bird density is increased without additional feeding and drinking lines which increases competition among birds for feed and water access.

3. Reinforce biosecurity

Poor litter quality is also associated with higher incidence of cellulitis. A wet litter constitutes an ideal environment for bacterial growth. The frequent contact of the bird's abdomen to the wet litter increases the bacterial contamination frequency and thus, through scratches, the transmission of pathogens from the litter to the bird. Wet litter conditions also result in dirty claws with higher bacterial contamination and are more likely to infect any scratches. Consequently, cleaning and disinfection of barns during the withdrawal period are of great importance. Ensuring a withdrawal period of more than 15 days can also help reduce the incidence of cellulitis.

4. Adjust timing of vaccinations

Conducting broiler vaccinations at the hatchery can contribute to a reduction of total broiler carcass condemnation –including broiler cellulitis–at the slaughterhouse (Paniago M., CEVA bulletin, 2009). Results of a trial conducted in southern Brazil showed that earlier application of the IBDV vaccination, at the hatchery instead

Luca Vandi
Technical Sales Manager

revealed cellulitis to be a sizeable problem.

of on the farm, reduced most causes for carcass condemnation, especially broiler cellulitis (*Figure 2*).

It's important to note that any changes to the vaccination program should be discussed with the vet team and the vaccine supplier first.

5. Update management practices

For sure, an improvement at management level in the farms must be considered. Updating equipment and farm design to fit the needs modern broiler strains in terms of ventilation, feeding and water supply is a must.

6. Ensure good gut health

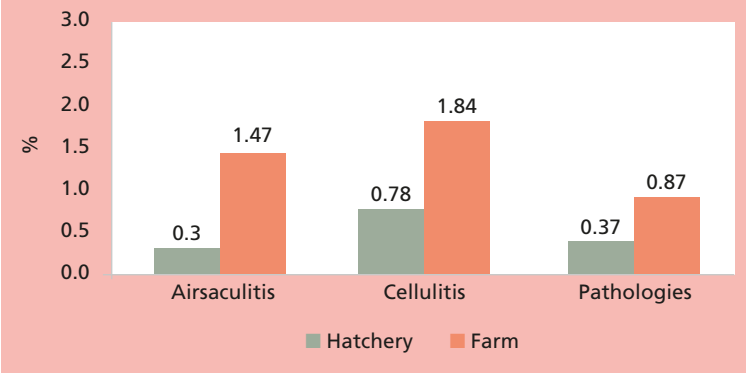
E. coli, the main agent for broiler cellulitis, is an opportunistic pathogen living in the chicken's gut that spreads through the feces onto the litter. A probiotic, or beneficial bacteria, can modulate the gut microflora and reduce the spread of *E. coli* in the environment. Through competitive exclusion (preventing pathogens from attaching to enterocytes, or intestinal absorptive cells) and the production of natural antimicrobial substances such as organic acids and bacteriocines, these microorganisms make it more difficult for *E. coli* to replicate and grow. This reduces the spread of *E. coli* into the environment and, consequently, lowers the probability of *E. coli* infection through scrapes and skin abrasions.

A study conducted by Estrada *et al.* in 2001 showed that administering a *Bifidobacteria* strain to broilers reduced the incidence of cellulitis in slaughtered carcasses. The *B. Bifidum* treatment group had a lower whole carcass condemnation rate (2.8% vs. 4.4%) and a lower incidence of broiler cellulitis (32.1% vs. 55.4%) as a percentage of the whole population compared to the control group (*Figure 3*).

Conclusion

Broiler cellulitis constitutes a major cause of carcass condemnation at slaughterhouses worldwide, representing significant economic losses for producers. Producers can take a number of actions to combat cellulitis including promoting feather coverage, monitoring bird density, reinforcing biosecurity, adjusting the timing of vaccinations, updating management practices and ensuring good gut health through the application of probiotics.

Figure 2. Earlier vaccinations reduce the rate of carcass condemnation.



Source: Paniago, 2009

Figure 3. Probiotic application can reduce broiler cellulitis.

Condemnations	*B. Bifidum*-Treated- 8,537 Birds	Control- 8,470 Birds
Cellulitis	77***	205
Ascites	46	42
Mutilation	34	27
Pendulus crop	34	47
Cyanosis	36	32
Nephritis	5	4
Hepatitis	4	2
Yalgus/varus deformation	2	3
Salpingitis	1	3
Abscesses	1	3
Peritonitis	0	1
Emaciation	0	1
Total	240***	370

***P < 0.001.

Source: Estrada et al., *2001*

Boosting Vaccines' Effectiveness Using Synbiotics

By **Wael Abdelrahman**, Technical Consultant, Poultry Probiotics

Recent evidence demonstrates that supporting poultry gut health with a combined prebiotic and lactic acid bacteria-based probiotic can improve an animal's immune response.

Birds are highly susceptible to many infections and diseases which are caused by a variety of micro-organisms such as bacteria, viruses, fungi and parasites. The birds' vulnerability to these infections is particularly high in intensive commercial poultry rearing systems worldwide. Without their effective immune systems birds would hardly be able survive in such a hostile environment.

Photo: luismmolina

The avian immune system

Avian species' immune system is quite unique as they don't possess lymph nodes but instead they have lymphoid aggregations along the gastrointestinal tract (GIT) and other mucosal surfaces. The GIT-associated lymphoid tissue (GALT) has about 65-70% of the birds' immune system. This means that in addition to the digestive and absorptive functions, the gastrointestinal tract is also considered the major immune organ in birds.

Natural immune system development

Under natural conditions, chicks hatch in close proximity to the mother hen, allowing them to eat and drink as soon as they are hatched. Microflora from the mother hen also colonizes the gastrointestinal tract of young chicks. Early feeding and microflora colonization have very positive effects on birds' performance and on the maturation of the birds' immune systems.

Modern, slower colonization

Poultry production under modern husbandry practice does not allow newly hatched chicks to come into contact with mother hens, slowing the development of gut microflora and the immune system by 3 weeks or more. The lack of the gut microflora establishment opens the door to enteric colonization by pathogens, making the chicks susceptible to infections and diseases.

Probiotics' positive effects on immunity

Lactic acid bacteria-based probiotics support a bird's immune system in several ways. They play an important role in the development and establishment of gut microflora and encourage rapid maturation of the immune system. This helps the birds to respond better to vaccines and also defend themselves against infections. Probiotics also have an important role in combating diseases and infections.

Commensals and probiotics are always sensed by immune cells, where antigen presenting cells such as macrophages, dendritic cells and B-cells sample these beneficial bacteria and induce specific local immune modulation with the activation of B-cells to produce secretory IgA against these beneficial bacteria which can be considered harmless and non-inflammatory in the mucosal and the systemic environment (oral tolerance). Probiotics help the host's immune cells to better recognize and eliminate harmful pathogens. Improved tolerance coincides with less energy expended on inflammation, leaving more energy directed towards growth.

Probiotics and vaccine interaction

More in-depth work has been done in humans looking at the effect of probiotics on vaccine response. For instance, a large increase in vaccine-specific serum IgA and IgG antibodies titres was observed in individuals that received *Lactobacillus*- and *Bifidobacterium*-based probiotics with *Salmonella typhi* and Cholera vaccines compared to those who received the vaccine alone (Paineau *et al.*, 2008, Maidens *et al.*, 2012).

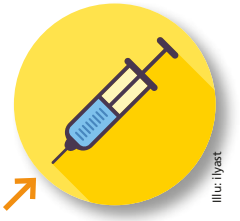
Similarly, but to a lesser extent, some work has been done in birds. For example, Methner and others (2000) found out that the administration of the live *Salmonella* vaccine before or at the same time as probiotics offered the best protection against experimental *Salmonella* challenge as a result of the development of a stronger immune response.

Synbiotics build on the success of probiotics

The benefits of probiotics, or beneficial bacteria, in supporting gut microflora are well documented. Prebiotics are non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth or activity of one or several beneficial bacteria in the gut. Synbiotics combine prebiotics and probiotics in order to deliver further benefit to animals.

IBD vaccine trial

A study performed at Kasetsart University, Thailand, evaluated the effect of



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One of the greatest advances in immunology is the discovery and use of vaccines, which have dramatically reduced the incidence of many diseases.

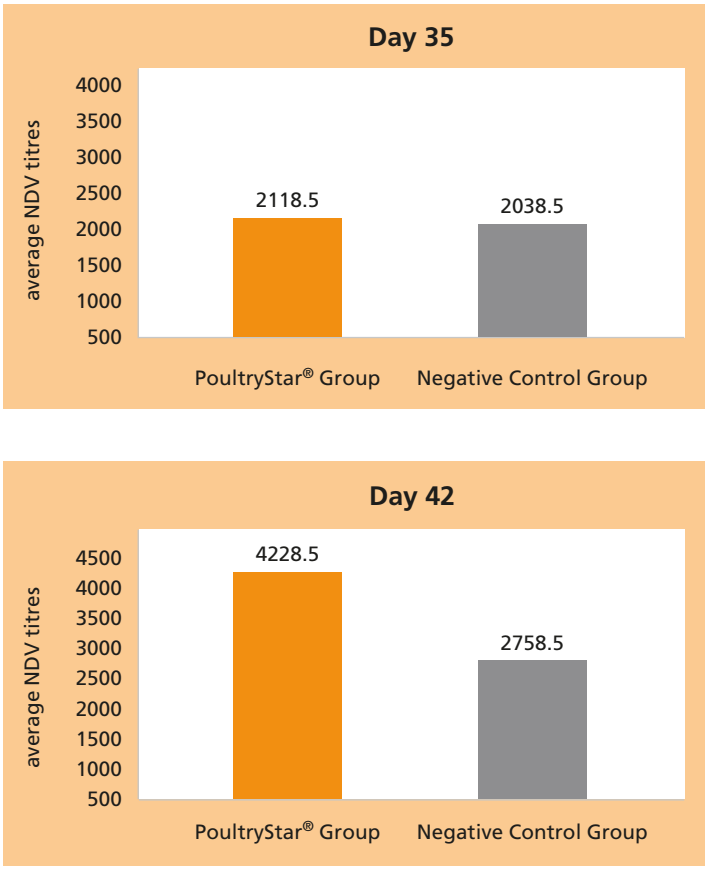
Poultry production under modern husbandry practice does not allow newly hatched chicks to come into contact with mother hens, slowing the development of gut microflora and the immune system by 3 weeks or more.

Table 1. Performance parameters after 45 days and immune status after IBD vaccination program.

Performance parameters	Negative Control	Positive Control	PoultryStar®
Number of birds	600	600	600
Duration of trial (days)	45	45	45
Live weight (g)	1894	1979	1947
Feed intake (g)	3352	3449	3358
Mortality (%)	1.12	0.59	0.53
FCR	1.77	1.75	1.73
IBD titres	1281	2304	3385
PI*	235	250	249

*PI (Broiler Productivity Index) = (Livability [%] x Live weight [kg]/age [d]/FCR) x 100
Source: BIOMIN trials, Kasetsart University, Thailand, 2005

Figure 1. Effects of PoultryStar® administration on NDV vaccine titres at days 35 and 42 vs. control group.



Source: BIOMIN trials, Poulpharm, Belgium, 2014

PoultryStar® — the first poultry-specific, multi-species synbiotic product to be authorized by the EU — against flavomycin — an antibiotic — and negative control on broilers' performance and immune status following infectious bursal disease (IBD) vaccination on day 14. Compared to the other trial's groups, PoultryStar® increased performance in addition to increasing IBD antibody titres, indicating an up-regulation of the birds' immune status (*Table 1*).

IBV and NDV trial

A similar effect on vaccine response was noticed in a recent field study where birds were divided over two houses, each house was divided into two groups; a PoultryStar® group and a control group. On the first day, all the groups received Newcastle disease virus (NDV) and infectious bronchitis virus (IBV) vaccines in the hatchery followed by NDV vaccine on day 15. On days 35 and 42 NDV vaccine titres were found to be higher in the synbiotics treated groups (*Figure 1*).

More to discover

How synbiotics enhance vaccines response is not fully understood. The positive effects of synbiotics might be due to the fact that probiotics work as adjuvants for vaccines (directing immune response) and as facilitators of a return to tissue homeostasis following pathogen challenge. Moreover, the diversity and composition of the gut microflora also may influence the efficacy of oral vaccines. The failure to develop protective immunity to vaccines in particular geographical areas could be due to intestinal microflora composition among other reasons (Valdez *et al.*, 2014). Combining probiotics with vaccines has a positive effect or sometimes no effect on the vaccine response as the response is dependent on the probiotic strains used (Maidens *et al.*, 2012).

Conclusion

With the increasing interest in the use of probiotics in animal production, it is important to understand the role they play in modulating the bird's immune system. Although the immuno-modulatory activities of probiotics are not yet fully understood, they can increase birds' immune response following vaccination.

What's wrong with my birds? Part 5: Carcass bruising

Cut & Keep Checklist

The consumer's decision making process when purchasing poultry products mainly takes into account appearance, hygiene and flavor. To help guarantee that the best quality product reaches consumers, several procedures should be in place.

Veterinary inspection at the time of slaughter aims to guarantee that poultry carcasses are free from disease or fecal contamination. In the presence of one (or both) contaminations, carcasses are condemned and withdrawn from the food chain.

Carcass bruising/hemorrhaging is one of several reasons leading to carcass downgrading (reduced quality) or condemnation in the slaughterhouse. It is caused by the breakage of blood vessels and subsequent leakage of blood into tissues without skin rupture.

It is difficult to determine whether they occur at the farm, during transport or at the plant; therefore, any major financial losses that result are usually absorbed by the slaughterhouse.

According to scientific literature, the colour of the bruise may be indicative of the age of the injury with red to dark red being recent bruises (≤ 12 hours) and light green, yellow-orange and yellow ones being older (≥ 24 hours).

Some 90% of bruising occurs within 12-24 hours before processing, with breast, wings and legs being the most frequently affected parts. The potential causes are inadequate flock density in the grow-out house and/or the failure to properly adjust pickers at catching.

Inadequate stunning (voltage and time) can lead to petechial hemorrhages usually occurring in the breast and legs. The presence of pathogens in the farm, such as IBDV (Gumboro disease), may increase capillary weakness which leads to carcass bruising.

Mycotoxins such as aflatoxins work in a similar way by reducing the force required to produce bruises due to increased capillary fragility. Usually these occur in the thighs. For mycotoxin-related problems, prevention can be undertaken through the use of a proper mycotoxin risk management tool which relies on complementary detoxification strategies (biotransformation, adsorption, bioprotection) to eliminate the toxic effects in the animals, while guaranteeing liver and immune protection.

Photo: sansubba

Checklist	Corrective action
Potential cause: MANAGEMENT: Stunning system	
• Voltage of stunning system • Duration of electric shock	• Correct voltage and timing of electric shocks
Potential cause: PATHOGENS: Infectious bursal disease (IBDV/Gumboro)	
• Blood spots mainly located in the legs and the breast • Necropsy: Bursa of Fabricius is swollen, enlarged and bloody • Maternal antibody titres are very low in day-old chicks	• Change from mild to strong-reaction vaccine • Correct vaccination age (Deventer formula) • Increase biosecurity level • Implement/correct vaccination program in breeders
Potential cause: MYCOTOXINS: Aflatoxins	
• Detection in raw materials (ELISA) or feed (HPLC) • Animals present jaundice-like symptoms, are dehydrated and emaciated. They present purple-reddish areas in the carcass. • Raw materials originating from supplier/region with history of aflatoxin contamination • Histopathology: Check other target organs (for example liver) • Decrease in overall performance of the flock	• Check average contamination levels. • Use Mycofix® at a correct dosage level. • Avoid feed bins or feed/water lines becoming contaminated by stale, wet or moldy feed
Potential cause: MANAGEMENT: Animal density	
• High flock density at grow-out house	• Adjust flock density
Potential cause: MANAGEMENT: Catching	
• Poor catching procedures	• Adjust picking machines and/or catching procedure

For more information, visit **www.mycotoxins.info**

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