Managing chick gut microbiota may be key to reducing APEC

Live production managers face many challenges to prevent chicks from succumbing to disease-causing pathogens. Chick health in the first seven days after hatch is critical for optimal growth and performance, making seven-day mortality rates a key indicator of disease prevalence.

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Among the most disruptive disease-causing pathogens in broiler production is avian pathogenic E. coli (APEC).

The gastrointestinal (GI) tract is a reservoir for APEC pathogens to live and grow, allowing the pathogens to eventually translocate out of the GI tract and cause sepsis.

APEC most often leads to colibacillosis, a systemic infection that can result in airsacculitis, cellulitis, pericarditis or perihepatitis, dramatically impacting morbidity and condemnations.

The pathogen is responsible for detrimental profit losses, decreased chick productivity and, in some cases, death. With an industry that is increasingly shifting to no-antibiotics-ever (NAE) production, the need for new solutions to control APEC is essential.

One solution may lie in supporting a healthy gut microbiota in chicks.

Exposure from day one

From the moment chicks hatch, they are exposed to an abundance of pathogens. Their immune systems are immature and need time to fully develop, which typically occurs within the first two weeks of life – a large enough window for chicks to contract disease.

Microbiota from eggshells and the surrounding environment form the first inoculum and make up the complex community that acts as barriers to infection. But even before hatch, micro-organisms can pass through pores in the eggshell, contributing to the challenges hatcheries face in protecting chicks from pathogens.

In nature, hatchlings are colonised by beneficial bacteria from the hen through transfer from the egg surface and the nest environment. The bacteria make their way through the porous egg surface to the GI tract and set the stage for immune function, bacterial homeostasis and nutritional processing.

In modern production systems, eggs are collected from the breeding facility and transported to the hatchery where they may be sanitised or held in an egg room.

While these steps are crucial in preventing disease-causing pathogens from impacting newly hatched chicks, ultra-sanitisation of eggs does not allow for vertical transmission of good bacteria from hen to chick. This leaves chicks vulnerable to early colonising bacteria like APEC. To prepare chicks' immune systems, some hatcheries rely on in ovo vaccinations, often given with an antibiotic to protect the developing chick. But for facilities that prefer to avoid antibiotic use, managing gut health may be key to robust immune systems and optimal performance.

Early colonising bacteria

The gut is the first line of defence against APEC and other pathogens. Colonisation of the gut by harmful microbiota in the beginning stages of a chick's life negatively impacts development of the GI tract and immune development. Pathogens that colonise first are often the most dominant, making the composition of early colonising bacteria critical to long-term health.

These organisms influence the morphology and physiology of the intestine and bird susceptibility to infectious diseases, as well as impacts to the immune system.

After initial colonisation, the population of microbiota increases as chicks grow until the microbiota reach maturity and stabilise, typically occurring three weeks post-hatch. Imbalances in intestinal microbiota can trigger a host of reactions including a hyper-immune response, causing gut health to deteriorate. That is why proper gut development is dependent on healthy early microbiota colonisation.

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Fig. 1. Levels of avian pathogenic E. coli (APEC) vary by bird in day-old chicks.

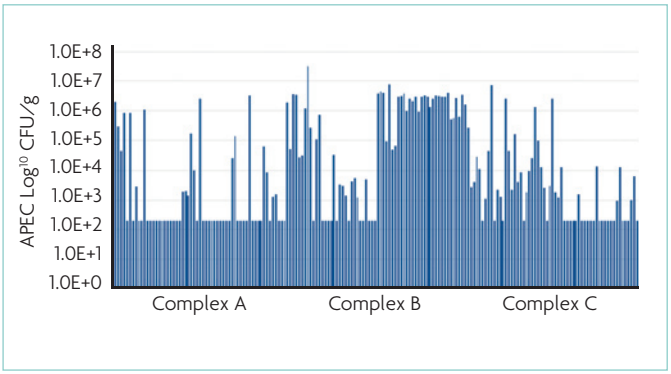
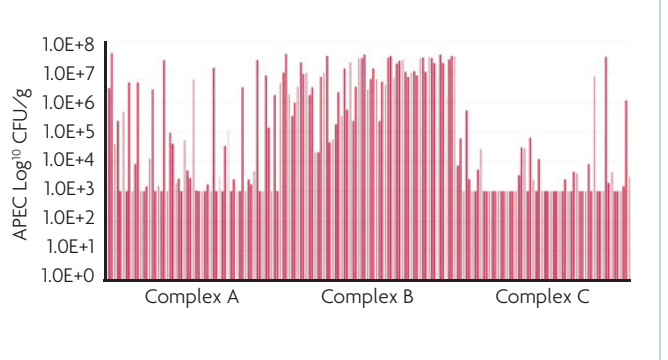


Fig. 2. Levels of lactic acid bacteria (LAB) vary by bird in day-old chicks.



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Understanding broiler gut microbiota

Both beneficial and harmful bacteria, including APEC, are transferred to chicks before the day of hatch. Once hatched, everything from feed to house and litter can affect the type and level of microbiota chicks pick up. The microbiota play a key role in feed digestibility, feed uptake, protein utilisation, immune competence and immune tolerance.

Composition and diversity of gut microbiota influence the bird's productivity and immune system response efficiency. The systemic health of chicks correlates with intestinal health, affecting production efficiency, food safety and environmental impact.

Protecting good gut microbiota, like lactic acid bacteria, is critical for mucin production, which forms barriers to pathogens in the intestine. When mucin production is hindered due to an influx of harmful pathogens, chicks easily fall prey to APEC.

Rather than using energy to fight off pathogens, healthy intestinal microbiomes allow chicks to use their energy for growth and performance.

Bacteria species including Lactobacillus, Streptococcus, Bacillus, Bifidobacterium, Enterococcus, Aspergillus, Candida and Saccharomyces have been shown to benefit poultry performance, intestinal microflora and pathogen inhibition.

These bacteria work proactively in the gut to balance intestinal microbiota, allowing for regulated immune response and boosting overall chick health.

Pathogen levels are not uniform

It is important to understand that bacteria species in the small intestine vary from hatchery to hatchery, chick to chick, and between breeder hens at different production facilities.

Research by Arm & Hammer Animal and Food Production reveals significant variation in levels of APEC among birds and complexes (Fig. 1). APEC levels were tested in day-old chicks at three locations, all yielding various numbers of infected chicks. Even at a single location, infection rates varied among chicks, proving that bacteria in the small intestine vary greatly between chicks and production facilities.

Furthermore, Arm & Hammer research showed that lactic acid bacteria also vary significantly between hatcheries and chicks (Fig. 2). Maintaining a consistent level of these beneficial bacteria is critical in achieving the proper gut health needed to fight off APEC in young chicks.

Overcoming APEC

As the industry seeks non-antibiotic solutions against APEC, maintaining beneficial lactic acid bacteria in the chicks' guts may provide a first line of defence against harmful pathogens.

While poor gut microbial populations increase susceptibility to APEC, managing gut populations through probiotics may help reduce APEC in chicks.

Probiotics deliver beneficial bacteria that the chicks need to build resilient guts and strong immune systems. Developing beneficial bacteria in a chick's gut early on in life will set up good gut microbiota from the beginning.

Protecting your chicks with healthy gut microbiota

Controlling APEC not only improves overall health, it also boosts operational profit through decreased stress. As the industry continues to shift to NAE, probiotics may be an effective solution to fighting APEC. But regardless of your operation's practices, it is important to heighten gut health to reduce pathogenic infections. ■

References are available from the author on request