Coping with necrotic enteritis – the benefits of isoquinoline alkaloids

Necrotic enteritis (NE) was first reported in literature during the early half of the 20th Century but was not seen as clinically significant until several decades later. With the discovery of effective antibiotics in the 1960s and their subsequent use as antibiotic growth promoters (APGs) throughout the 1990s, the poultry industry has managed to keep cases of NE to a minimum.

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In 2006 however, AGPs were banned throughout the EU and the era of relative calmness quickly came to an end. The situation is further complicated as the public's demand for antibiotic free poultry increases and legislation governing the use of antibiotics becomes stricter. The poultry industry is now faced with finding alternative strategies of coping with coccidiosis and the detrimental effects of NE.

The consequences of NE

Although flocks affected by clinical NE can experience mortality in excess of 30%, even more economically costly is that resulting from subclinical NE.

In research performed by Skinner et al. (2010) when compared to control birds, those with subclinical NE experienced a reduction in body weight (12%) and an increase in FCR (10.9%), respectively.

These changes were thought to be due, in part, to the chronic and continuous damage done to the intestinal mucosa. Based on a review of the current literature, Skinner et al. (2010) estimated an overall incidence in 20% resulting in loss of approximately €0.05 per bird.

NE is mainly seen in birds between 2-5 weeks of age. This is likely due to the lack of maternal antibodies toward the end of the second week and the birds undeveloped immune system

Clostridium perfringens

Clostridium perfringens is a pathogenic, gram-positive, rod-shaped, anaerobic, spore-forming bacterium that is ubiquitous in nature and commonly found within in the hindgut of many poultry species.

Disease results when predisposing factors occur promoting the overgrowth of C. perfringens in the small intestine.

Due to the spore-forming nature of the organism, it is very difficult to fight and control the disease with multiple routes of infection possible (Fig. 1).

α-toxin and NetB (necrotic enteritis toxin B-like) are believed to both be involved in the pathogenicity of C. perfringens in cases of NE. In addition to the toxin, several predisposing factors may influence the occurrence of NE (Fig. 2).

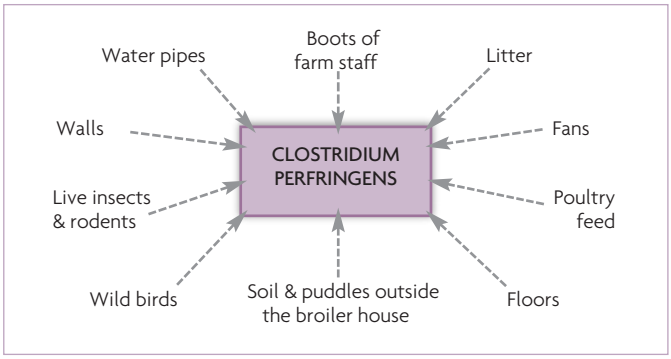

Fig. 1. Possible ways of infection with Clostridium perfringens.

How can NE be prevented?

In addition to a good coccidiosis management (vaccination, and/or a ionophore and chemical program), good husbandry practice and gut health management are the main factors in NE prevention.

By promoting gut health, more nutrients can be absorbed in the small intestine – the prime site of digestion. Consequently, less nutrients will reach the large intestine where C. perfringens physiologically live without causing harm.

As less nutrients reach the large intestine, less nutrients are available for C. perfringens, minimising the risk of an overgrowth.

Gut integrity

The gut is a functional barrier protecting animals from harmful pathogens. While on the one hand the gut must allow absorption of nutrients, on the other hand it must prevent pathogens entering the body. An estimated 70% of the bird's immune system is located in the gastrointestinal tract, underlining the importance of this organ.

Damage to this area can result in increase risk of disease by such pathogenic organisms as C. perfringens.

Bacteria, viruses, feed, and toxins have long been known to cause intestinal inflammation. In poultry such inflammation has been demonstrated to increase protein turnover and result in increased in energy demands by as much as 10-30%.

New concepts

In 2014, Khadem et al. demonstrated that plant extracts containing isoquinoline alkaloids (IQ), were capable of eliciting strong anti-inflammatory properties in broiler chickens. To further investigate, a trial examining the effects of the IQ-containing herbal product (Sangrovit) on growth performance of broiler chickens challenged with NE was conducted at the Southern

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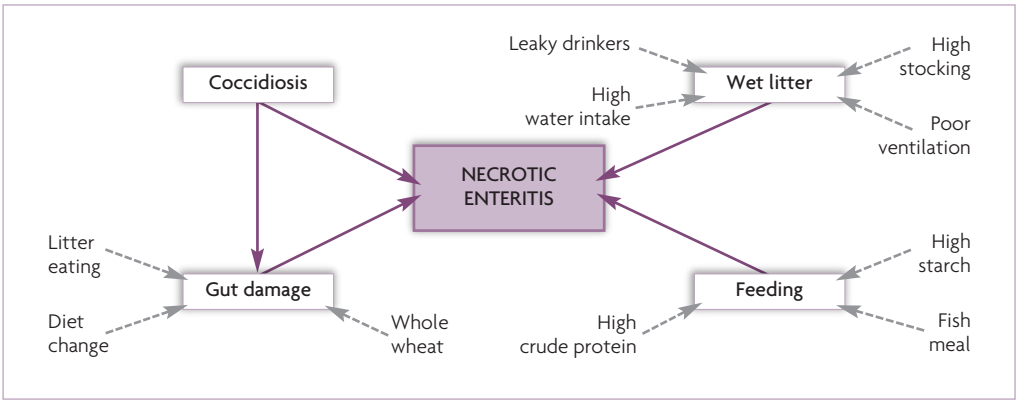
Fig. 2. Predisposing factors for necrotic enteritis (Williams 2005).



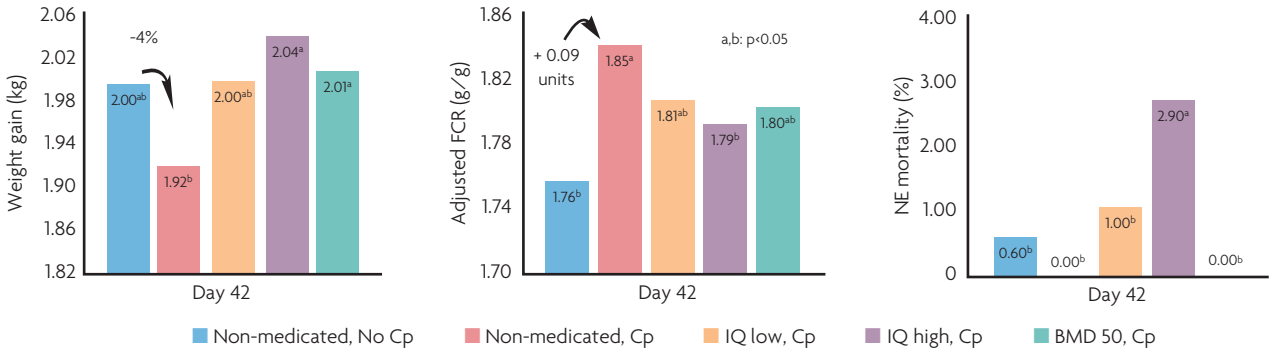


Fig. 3. Body weight gain and FCR were improved when IQ or BMD were applied. NE mortality was efficiently reduced with the use of IQ.

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Poultry Research Group in Athens, Georgia, USA. Some 2,250 male broiler chicks (Ross 708) received non-medicated commercial type diets, according to Brazilian standards.

The following five treatments were chosen:

- 1. No additive, no Cp. challenge.
- 2. No additive, Cp. challenge.
- 3. IQ, low (30g/t).
- 4. IQ, high (60g/t).
- 5. Bacitracin Methylene Disalicylate (BMD 50) (454 g/t).

On day 0, vaccination of all birds took place with a coccidiosis vaccine at twice the normal recommended dosage. On day 18, 19, 20, Clostridium perfringens was added to the feed at a dose of $1x10^8$ cfu/ml/ bird (all birds, except treatment 1). Lesion scoring on day 20 confirmed a subclinical form of NE in all challenged groups.

The detrimental effects of a C. perfringens infection become obvious by comparing the non-medicated, unchallenged group and the non-medicated, challenged group. As expected, body weight gain and FCR were negatively affected (-4% and +0.09 points, respectively). By adding the high IQ dosage to the feed, weight gain was significantly improved and well comparable to the performance of birds which received BMD.

Furthermore, a dose-dependent effect of IQ was observed (Fig. 3).

In addition to economical losses due to lower weight gain and increased FCR, losses of birds further add to the expanses of the disease.

Adding IQ or BMD to the diet improved NE mortality markedly. Again, IQ worked in a dose-dependent way.

Conclusion

Many factors influence the occurrence of NE in broilers. Maintaining gut integrity is – in addition to good husbandry and feed management – an indispensable tool to support animals in times of infection.

Isoquinoline alkaloids offer promising properties to achieve this objective and to contribute to healthy and profitable broiler production. ■

References are available from the author on request