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Clostridia: Impact and Mitigation

Could Controlling Clostridia Start with Animal Feed?

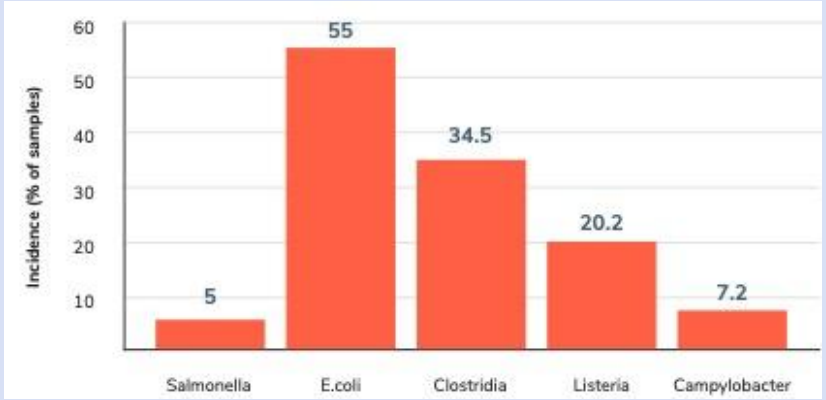
C. perfringens, a spore-forming gram-positive bacterium, is ubiquitous, naturally occurring in soil and water[1].

The spores are resistant to high temperatures and chemical treatments, so contaminated feed is a particularly acute problem.

The severity of a Clostridium infection has been demonstrably tied to animal feed.[2]

Clostridia has the second highest average incidence rate among foodborne pathogens found in animal feed.[3]

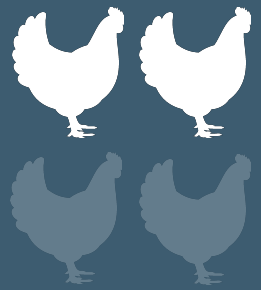
Feed type	Incidence%
Broiler breeder	14.3
Broiler	22
Turkey	55
Swine (non-pelleted)	38.8
Swine (pelleted)	3.6



1 Davies & Wray, 1996; Thakur & Grover, 2001; Desmarais et al., 2002.
2 Kohler, 1999.
3 Richardson, 2009

What is Clostridia's Impact on Food Producers?

In poultry, *C. perfringens* causes the disease clinical necrotic enteritis (NE) which in its acute form is highly fatal in broiler birds. In its chronic (often undetected) subclinical form, NE is one of the world's most common and financially crippling poultry diseases.

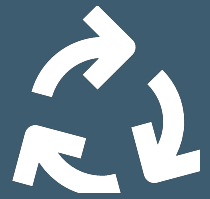


Up to 50% mortality rates[1]

The clinical form of NE can account for 1% of losses per day for several consecutive days during the last weeks of the rearing period.[2]

$6 billion annually

Combined with the subclinical manifestation of the disease, NE imposes a significant economic burden on the poultry industry worldwide, estimated at over $6 billion annually.[4]



Decreased digestion and absorption of nutrients

Intestinal mucosa caused by *C. perfringens* leads to decreased digestion and absorption of nutrients, reduced weight gain and increased feed conversion ratio.[3]

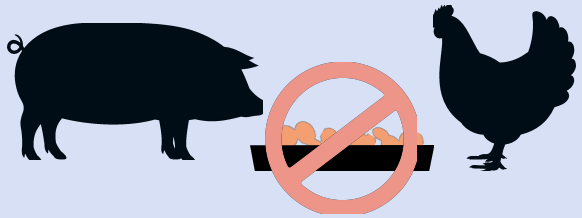
Feed: #1 cost in animal production

The ability of animals to effectively process feed (i.e. digest and absorb the nutrients contained in feed) dictates the productivity (as measured by feed conversion rates) and, ultimately, profitability of livestock operations.

1 Wijewanta & Seneviratna, 1971; Riddell & Kong, 1992.
2 Kaldhusdal & Løvland, 2000.
3 Davies & Wray, 1996; Thakur & Grover, 2001; Desmarais et al., 2002.
4 Kohler, 1999.

How Can Clostridia be Mitigated?

There are three primary intervention strategies to mitigate Clostridia related to feed (outside of nutraceuticals):

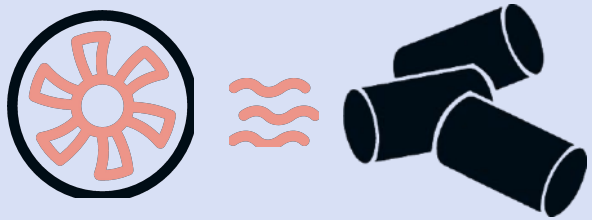


Exclusion of high-risk ingredients from feed formulation

High levels of animal protein, fat and cereals, which contain increased content of non-starch polysaccharides, are well known NE risk factors.[1]

Effectiveness: may not be successful.

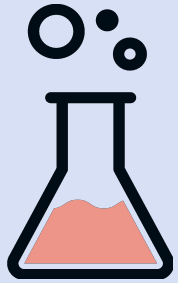
Based on the incidence of Clostridia in other non-animal origin ingredients and the fact that ingredient contamination is not necessarily related to feed contamination.



Heat treatment of feed

Effectiveness: limited to vegetative form.

Heat treatment of feed kills the vegetative form of Clostridia but spores can survive pelleting temperatures of up to 90°C[2] and the pelleting process heat can stimulate the spore germination.



Chemical preservatives

Organic Acids Effectiveness: Organic acids have been reported to partially inhibit spore germination (at levels ranging from 2.5 to 10kg/ton) but are ineffective in killing spores.[4]

Termin-8 Effectiveness: In non-pelleted feed, Termin-8 is effective in eliminating high levels of Clostridia spores, and even more effective in pelleted feed.[3]

1 Williams, 2005; McDevitt et al., 2006
2 Maciorowski et al., 2007
3 Richardson, 2009
4 Juneja and Thippareddi, 2004