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The effect of hen-egg antibodies on *Clostridium perfringens* colonization in the gastrointestinal tract of broiler chickens

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Abstract

We evaluated the ability of hen-egg antibodies (HEA) to reduce intestinal colonization by *Clostridium perfringens* in broiler chickens. Antibodies against *C. perfringens* or cholera toxin (negative control) were obtained from the eggs of laying hens hyperimmunized using a *C. perfringens* bacterin or cholera toxin. Eggs were collected, pooled, and egg antibodies were concentrated by polyethylene-glycol precipitation. An initial experiment was conducted to determine the in vivo activity of the administered antibody along the length of the intestine. Thereafter, two feeding trials were performed to assess the efficacy of feed amended with the egg antibodies in reducing the level of colonization of *C. perfringens* in challenged birds. Antibody activity declined from proximal to distal regions of the intestine but remained detectable in the cecum. In the first experiment there was no significant reduction in the number of *C. perfringens* in the birds fed the diet amended with the anti-*C. perfringens* egg antibody, compared to the birds that received the anti-cholera toxin egg antibody ($n = 10$), at any of the sampling times. In the second experiment there was a significant decrease in *C. perfringens* intestinal populations 72 h after treatment ($n = 15$) as assessed by culture-based enumeration, but there was no decrease as measured by quantitative PCR based on the *C. perfringens* phospholipase C gene. Intestinal-lesion scores were higher in the birds that received the anti-*C. perfringens* HEA. Our work

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suggests that administration of HEA did not reduce the level of *C. perfringens* intestinal colonization and conversely might exacerbate necrotic enteritis.

Keywords: Necrotic enteritis; *Clostridium perfringens*; Hen-egg antibodies

1. Introduction

Intestinal pathogens result in economically important losses to poultry producers annually. *Clostridium perfringens*, the causative agent of necrotic enteritis (NE), is one such pathogen. Presently, the incidence of NE is effectively controlled through the use of antibiotic feed additives; however their outright ban in Europe, as well as consumer concerns in North America, has led to an increased interest in alternatives for the control of intestinal pathogens. The use of orally administered antibodies to control both bacterial and viral intestinal pathogens has been examined in various animal and avian species, with mixed results.

Some studies reported that pathogen-specific HEA can confer protection to pigs experimentally challenged with enterotoxigenic *Escherichia coli* (Imberechts et al., 1997; Marquardt et al., 1999; Wiedemann et al., 1991; Yokoyama et al., 1997, 1992), neonatal calves experimentally challenged with *Salmonella typhimurium* and *Salmonella dublin* (Yokoyama et al., 1998), rainbow trout from *Yersinia ruckeri* infections (Lee et al., 2000), and rotavirus infections in mice (Bartz et al., 1980). In contrast to these positive results however, Fulton et al. (2002) reported that ducks administered anti-*Salmonella enteritidis* antibodies in drinking water were only partially protected against a *S. enteritidis* challenge, and Letellier et al. (2000) examined the use of HEA to control *S. typhimurium* in swine with results that suggested there was no significant reduction in the infection of experimentally challenged pigs. Kobayashi et al. (2004) found that that HEA were incapable of eliminating a *Cryptosporidium parvum* infection in experimentally infected mice, and Kassaify and Mine (2004) recently demonstrated that HEA from non-immunized hens confer the same level of protection to laying hens when challenged with *S. enteritidis* as HEA from hens immunized against *S. enteritidis*.

The use of specific HEA to reduce *C. perfringens* colonization in the intestinal tract of broiler chickens, however, has not been fully explored. We evaluated the ability of anti-*C. perfringens* specific HEA to decrease the number of *C. perfringens* cells in the gastrointestinal tract of broiler chickens, and thereby reduce an important predisposing factor for the development of NE.

2. Materials and methods

2.1. Bacteria and culture conditions

A *C. perfringens* Type A isolate isolated from a field case of necrotic enteritis was obtained from Dr. Manuel Chirino, Department of Microbiology, Western College of Veterinary Medicine, University of Saskatchewan, SK, Canada. To ensure maximum