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FACTSHEET # 31
September 2008

Prevention of Necrotic Enteritis in Broilers with Beta Glucan and Mannan Extracts

Introduction

Low levels of antibiotics have been added to broiler chickens diets as a preventative measures to reduce the incidence of infectious disease. The use of antibiotics in human and animal populations has led to an increase in bacterial resistance to these drugs. As of January 1, 2006 the European Union imposed a complete ban on the use of antibiotics in animal feed as growth promotants.

Many alternatives have been investigated to reduce the use of antibiotics in commercial production. Enhanced biosecurity, genetic selection for disease resistance, and vaccination to pathogenic microbes have successfully protected poultry production from disease loss. Numerous dietary alternatives to antibiotics are emerging, however, research is needed to evaluate their effectiveness in reducing disease outbreaks such as Necrotic Enteritis (NE).

Yeast beta-glucans (YBG) and mannanoligosaccharides (MOS), both extracts of the yeast cell wall, are feed additives which have shown promise in stimulating the immune system of broilers, as well as promoting growth. Previous studies at the Nova Scotia Agricultural College (NSAC) have shown that supplemental YBG can effectively replace antimicrobials in broiler diets, without adversely affecting growth or production.

The objectives of the following study were to examine the effects of YBG and MOS on the intestina morphology and intestinal microbiota, specifically *Clostridium perfringens*, of broiler chickens to determine how these products may provide protection against disease outbreaks such as NE.

Trial – Intestinal Morphology

A total of 900 day-old male Ross x Ross broilers were assigned to 36 floor pens with 25 birds per pen ($0.073 m^3$/bird). Birds were fed corn-soybean-based diets with factors predisposing to Necrotic Enteritis (NE), including high wheat (35%), fishmeal (3%) and animal fat. Seven antibiotic free diets were formulated to contain high or low levels of a mannanoligosaccharide product (MOS), a yeast beta-glucan (YBG) product, or a combination of the two. There were two control diets, including a standard diet with no growth promotant and a standard diet with added antibiotic. Each diet was fed to four replicate pens.

On d 19 and 33, intestinal sections (0.5 -1.0 cm section of the distal ileum) were collected from two birds per pen. These tract sections were analyzed macroscopically and scored according to the number and severity of lesions. Slides were prepared from preserved intestinal cross-sections and various microscopic measurements were made on the finger-like protrusions that cover the intestinal wall. These protrusions, know as villi, increase the surface area of the intestine to allow for better nutrient absorption. Measurements were also taken of the crypts, or valleys, between the intestinal villi. The depth of these crypts indicates the amount of tissue turnover occurring to replace damaged villi.

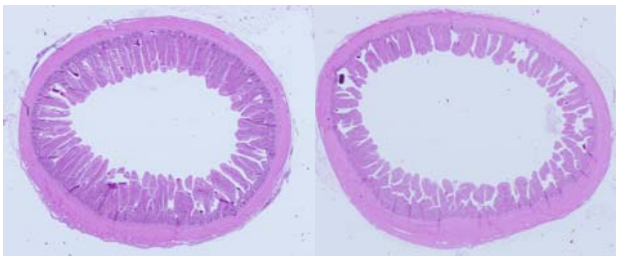
Trial 2 – Gut Microbiotia

A total of 900 day-old male Ross x Ross broilers were reared under similar conditions and fed similar diets to Trial 1. As in Trial 1, these diets were formulated with factors predisposing to NE, and contained varying levels of YBG and MOS without added antimicrobials.

On d 19 and 33, small intestine and caeca samples were collected from two birds per pen. Intestinal and caecal samples were homogenized and diluted in an appropriate buffer and plated in duplicate on Petrifilm™ plates for detection of aerobic bacteria, total coliforms, and *E. coli*. Prepared intestinal and caecal samples were also plated on specialized agar for *Clostridium perfringens* detection. All microbiological analysis was performed at the NSAC's Level 2 Containment biosecurity laboratory.

Results

There was no effect of dietary treatment on the presence of lesions or on the morphology of the ileal portion of the broiler intestine. Villi height, width, and area, and crypt depth remained unchanged regardless of the level of YBG or MOS or the addition of antimicrobials. However, an increase in intestinal damage was noted from d 19 to 33, suggesting that there may have been a sub-clinical NE response as the birds aged. Figure 1 below illustrates the increased number of damaged villi from d 19 to 33.



(a) **(b)**

Figure 1. Intestinal cross sections (ileum) showing increasing villi damage from d 19 (a) to d 33 (b) in broiler chickens fed a diet predisposing to Necrotic Enteritis.

Numbers of bacteria in the broiler caeca and intestine were similar between the antibiotic diet and the diets containing YBG and/or MOS. The low MOS (1kg/tonne starter, 0.5 kg/tonne grower, 0.25 kg/tonne finisher) and YBG (40g/tonne starter and grower, 20 g/tonne finisher) diets significantly reduced *C. perfringens* bacteria in the small intestine compared to other dietary treatments. These results indicate that YBG and MOS have the potential to manipulate broiler gut microflora.

Industry Impact

The YBG and MOS yeast cell wall extracts used in the current study provide promise as replacements for antibiotics in broiler production. Dietary factors used in this study were not sufficient to initiate clinical Necrotic Enteritis (NE). The basal diet appears to have caused the sub-clinical form of NE, due to the increasing villi damage noted from d 19 to 33. Further research is needed to determine the ability of supplemental YBG and MOS to replace dietary antibiotics for broilers in a clinical disease situation.

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Funding Provided By: Funding was provided by the Nova Scotia Department of Agriculture and Fisheries and Agriculture and AgriFood Canada. YBG and MOS were provided by Progressive Bioactives Inc., Prince Edward Island, Canada, and Alltech, Kentucky, USA.

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