

Yeast Cell Walls for Intestinal Health of Broiler Breeders

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Key Points:

- Yeast cell wall beta-glucans and mannan-oligosaccharide provide intestinal health benefits
- Beta-glucans in feed function to stimulate the immune system without a fever response
- Mannan-oligosaccharide (MOS) binds certain enterotoxic pathogens in the gut
- Maintaining breeder intestinal health ensures less transmission of pathogens to broiler progeny and better food safety

Cell walls derived from *Saccharomyces cerevisiae* or “molasses yeast” are thick and composed of high amounts of β -glucans and mannan-oligosaccharide (MOS) which are beneficial to intestinal health of broiler breeders. Using a blend of yeast cell walls/prebiotic and a directfed microbial/probiotic offers a dual mode of action to enhance breeder health and live performance. Chickens, similar to mammals, have both innate and adaptive immune systems, with the innate being responsible for primary general responses (which are immediate and nonspecific, with no memory against recontaminations) whereas the adaptive responses are specific and over time develop antibodies against each “non-self” pathogen. If dietary yeast cell walls are supplied to broiler breeders, their immune systems are placed on alert or primed for better, faster, and more effective responses against infections. These preliminary actions of the beta-glucans without inflammatory cytokine (fever) production avoid a greater expenditure of energy in mobilizing the immune system and ensuring that any declines in the performance will be minimized.

The β -glucans are among the most effective natural stimulants of the innate immune system and when in contact with phagocytic cells, which recognize β -1-3 and β -1-6 linkages, these phagocytes are stimulated to produce a variety of cytokines. The cytokines trigger a “chain reaction” inducing a higher immune status in broiler breeders, making them better able to fight against opportunistic

pathogens. One of the reactions of the immune system to yeast cell walls is an increased number of goblet cells in the intestinal wall that are responsible for mucus production. With the increased production and release of mucus in the intestinal lumen, the mucosa (protective barrier of the villi and medium that allows the action of several enzymes) is increased, resulting in greater protection for the intestinal cells and villi. These immune responses are especially meaningful during reproductive phases, early stages (prestarter period), stress, or in a disease challenged environment (such as on built-up litter).

Yeast cell walls contain MOS which is known for its capacity to agglutinate or bind pathogens. This prevents pathogen colonization as it offers alternate binding sites to harmful bacteria such as enterotoxic *E. coli* or *Salmonella* species present in the intestinal tract. The absorbed bacteria that are tightly bound are excreted together with the yeast cell walls and other indigestible fecal material. It is important to remember that, to reach its full functionality, the yeast cell walls must have a low digestibility in the intestine, or in other words, enzymes should not be able to degrade their structural carbohydrates very well.

Broiler breeders are typically under several kinds of challenges (pathogenic, stress, environmental, food restriction, vaccinations, egg production, etc), and yeast cell walls help these birds to strengthen and modulate the immune system, and reduce the pathogen contamination. The contamination of broilers with pathogens such as *Salmonella*, *Campylobacter*, and *E. coli* on the farm is a reality in commercial broiler production and is a major concern to consumers who worry that these pathogens may infect ready-to-cook meat. Thus, pathogen control in broiler breeders and broilers is essential to ensure food safety. Yeast cell walls demonstrate a high capacity to agglutinate these pathogens in the intestinal contents of breeders and their broiler progeny, significantly reducing the presence of pathogens in or on eggs and meat.



A research trial conducted by Rahimi et al. (2014) with turkey poultlets showed that 21 days post *Salmonella* infection, *Salmonella* in excreta samples decreased to zero when the birds were fed diets containing a yeast cell wall product. Ferreira et al. (2014) found similar results in a trial with a yeast cell wall product in which broilers infected with *Salmonella Heidelberg* had a 50% reduction in pathogen presence in their crop and ceca compared to infected birds without yeast cell walls in their diets.

Rahimi et al. (2014) also studied the effects of a yeast cell wall product on gut integrity in turkey poultlets infected or not infected with *Salmonella*. For birds not infected with *Salmonella*, the group fed a diet with yeast cell walls had significant ($P < 0.05$) increases in mucosa thickness (44%), villus surface area (33%), and villus height (52%), when compared with control group. For birds that were infected with the pathogen, a significant increase ($P < 0.05$) was observed in villus surface area (12%) for the group supplemented with yeast cell walls versus control. The scanning electron microscopy (SEM) photos of the ileum sections of birds fed the 2 treatments were also taken (see Figures 1 and 2).

Figure 1: Scanning electron microscopy photographs of ileum sections showing differences between the 2 dietary treatments without *Salmonella* challenge.

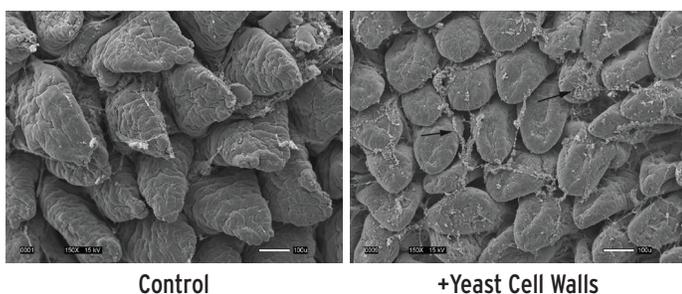
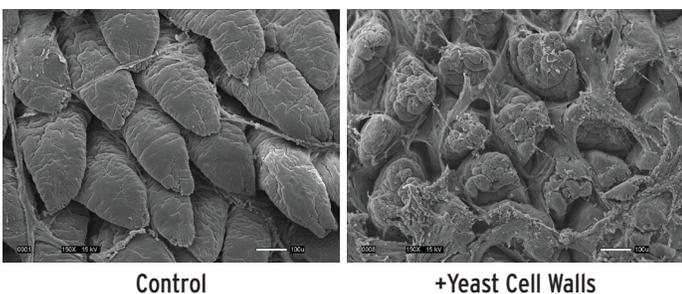


Figure 2: Scanning electron microscopy (SEM) photographs of ileum sections showing differences between the 2 dietary treatments and with *Salmonella* challenge.



The SEM photographs above confirm the live performance data found by the authors. Visually there was a higher presence of mucus in the yeast cell walls supplemented birds versus control. In addition, the villus surface area was greater for yeast cell wall supplemented groups, infected or not with *Salmonella*. These results are important to show the β -glucans and MOS modes of action and benefits during a pathogenic challenge situation.

Besides the benefits of balanced nutrition, a well-run sanitary plan, and good management, yeast cell wall supplemented breeders and/or broilers are better prepared for fighting against opportunistic pathogens, avoiding major production losses, and more fully expressing genetic potential. Research indicates that yeast cell walls, besides being a 100% natural ingredient, are successful in broiler breeders due to immune response and pathogen agglutination actions, helping reduce the use of antibiotics. BacPack™ ABF product from QTI, Inc. is a blend of CALSPORIN® (Calpis USA, Inc.) direct-fed microbial and IMW50™ (ICC Brazil) yeast cell walls which provides a highly effective additive for broiler breeders and/or broilers to improve gut health, feed utilization, livability, and food safety.

Acknowledgement

Adapted from a technical paper, “Yeast cell wall in broiler breeder diets: immunomodulation and food safety” (2015), by Dr. Melina Bonato, R&D Coordinator, ICC Brazil, São Paulo, SP, Brazil.

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