

## **CPRC Update – Probiotic formulations with immune enhancing activities for chickens**

Probiotics are live organisms that, when administered in adequate amounts, confer a health benefit on the host through improvements to the intestinal microbial balance. Several species of bacteria have probiotic activities. In poultry production, interest in probiotics stems from their use as alternatives to antibiotic growth promoters and also as a strategy for control of intestinal colonization with enteric microbes that cause food-borne illness in humans, e.g. *Salmonella*. The mechanism of action of probiotics in poultry is thought to include the maintenance of normal intestinal microbiota, changes in metabolism and improvements to feed intake and digestion. Administration of probiotics has been shown to improve weight gain and feed utilization and to decrease mortality of poultry. Treatment with probiotic bacteria, particularly *Lactobacilli*, is capable of modulating multiple aspects of immune responses and can also enhance immune competence in chickens.

### **The Approach**

Despite the beneficial effects, a limited number of probiotic products are currently available with proven immune enhancing capabilities in chickens. Dr. Shayan Sharif and his research team from the University of Guelph have developed a defined probiotic formulation containing several *Lactobacilli* with the ability to enhance immune responses and reduce *Salmonella* burden in chickens. These *Lactobacilli* were obtained from the intestines of healthy chickens, as these bacteria are normal inhabitants of the chicken intestine. Effects on growth, feed efficiency, immune system development and immune responsiveness of birds were measured to further evaluate this probiotic formulation and to determine its safety and optimal route of administration. The long-term objective of this research is to develop cost-effective probiotic formulations for chickens that can enhance production, reduce colonization of food-borne pathogens and enhance immune competence.

### **The Experiments and Results**

The safety of the selected probiotic formulation was assessed to ensure its suitability for use as a probiotic product. Laboratory (*in vitro*) and live-bird (*in vivo*) trials demonstrated that the probiotic formulation was capable of decreasing *Salmonella* colonization at specific doses, and could be delivered via a number of ways without reducing its effectiveness. Administration of this probiotic formulation into eggs (*in ovo*) had no adverse effects on hatchability and general condition of the hatching chicks. Chicks all had *Lactobacillus* present in their intestines at the time of hatch. The post-hatch growth performance of broilers that received probiotics was examined and the overall body weight gain, feed intake and feed conversion ratio were comparable to those of the chickens receiving growth promoting antibiotics in their rations. Chicks received the probiotic treatment on day of hatch or *in ovo* to determine how early colonization with probiotic *Lactobacilli* affects the development of the intestine. Overall the results demonstrate the ability of probiotic formulations to promote the development of the intestine.

In order to determine the effects of early administration of the probiotic formulation on the stimulation of immune response and protective immunity, the researchers measured the antigen-specific antibody response to Avian Influenza Virus in chickens treated with the probiotic on the day of hatch. Results show that probiotic treatment improves the overall immunity of chickens and their ability to fend off influenza virus. The immune enhancing activity of the probiotic formulation was not limited to immunity against avian influenza virus and similar results were obtained when the probiotic formulation was used with a *Salmonella* vaccine. Overall, this study showed that under normal conditions, there is virtually no difference in some of the key production parameters in broilers fed antibiotic- or probiotic-supplemented diets. Also, chickens fed probiotics had lower *Salmonella* burden in their intestines and also had higher immunity against avian influenza virus and *Salmonella*.

### **The Findings**

The findings show that this probiotic formulation is safe and highly effective in terms of reducing *Salmonella* burden in broiler chickens. This *Lactobacillus*-based probiotic has the capacity to enhance broiler immune competence of broilers. Comparison of the effects of probiotics and antibiotics on production parameters found that probiotics and growth promoting antibiotics had comparable effects on these parameters. This research demonstrates that probiotics can provide a safe and effective feed supplement in broiler production.

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