

In ovo probiotic injection linked to higher post-hatch performance

The perinatal period – encompassing the last four days before hatch and the first four days after – is the most critical time for the development and survival of commercial broilers.

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During this time, physiological and metabolic transitions occur that determine the expression of the bird's genetic potential and, ultimately, its economic performance.

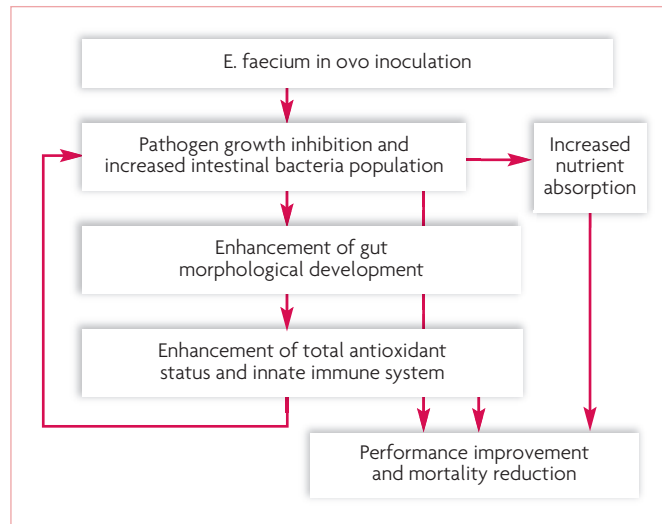


Fig. 1. Enterococcus faecium mechanisms of action.

In ovo probiotic administration

One of the most significant developments that occurs during the perinatal period is the microbial colonisation of the gut. By promoting intestinal integrity and function, initial microbe colonisation helps ensure optimal supply and absorption of needed nutrients in young birds with high growth rates.

Beneficial gut bacteria also stimulate immune development and limit the growth of bacterial pathogens – many of which chicks are exposed to before leaving the hatchery.

Early gut colonisation therefore critically influences perinatal health and performance, but in modern

hatcheries, this is often delayed due to lack of contact with adult birds.

However, recent research by Chr. Hansen shows that in ovo injection of GalliPro Hatch – a new probiotic formulation containing Enterococcus faecium M74 – can help broiler chicks establish healthy intestinal microbiota before hatch.

Furthermore, a recent study at Mississippi State University (MSU) demonstrated that in ovo inoculation with GalliPro Hatch improved livability in the first week of life – a trend that points toward improved health and performance throughout the production cycle.

In chickens, the gut microbiome

develops primarily after hatch, but small numbers of live bacteria can be found in the embryonic chick's gut, indicating that intestinal colonisation begins in ovo.

Ingestion typically begins around day 12 of incubation in chickens, when amniotic fluid is consumed before shell snacking starts. In ovo feeding – the administration of exogenous nutrients and other agents into the amnion of the late-term avian embryo – can advance the development of the growing embryo before and after hatch. Thus, it is possible to introduce external probiotics to the chicken embryo's digestive tract prior to

hatch. GalliPro Hatch contains a unique strain E. faecium (M74) that moves rapidly from the injection site to the developing chick's gut.

Confirming this, Chr. Hansen researchers presented a paper at the 2017 International Poultry Scientific Forum demonstrating that in ovo inoculation with E. faecium M74 resulted in the presence of the probiotic strain in yolk sac, caecal and intestinal samples from day-old and seven-day-old chicks.

Concentrations of the strain were particularly robust in the intestinal samples, indicating that E. faecium M74 successfully reproduced and was therefore active in the guts of the newly hatched chicks.

Modes of action

Unlike many other probiotic strains, which can be harmful when applied in ovo, E. faecium M74 has been found to be safe for in ovo injection and embryonic development.

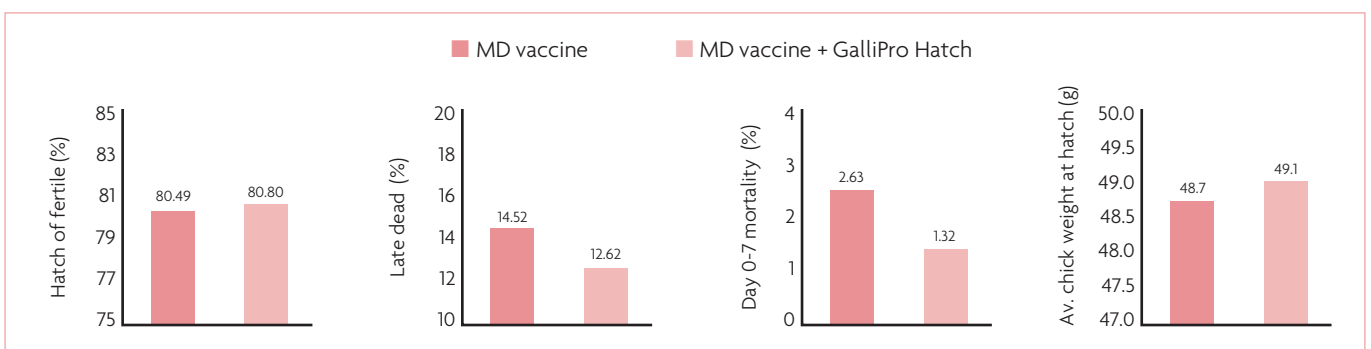
Administered orally or in ovo, it has also been shown to enhance gut function and boost overall health through several proven modes of action (Fig. 1).

● Pathogen inhibition.

By promoting the growth and diversity of beneficial gut microflora, E. faecium M74 limits pathogen growth through multiple modes of action. Oral administration of E. faecium M74 from the first day of life has also been found to reduce

Continued on page 16

Fig. 2. Results from a research trial at Mississippi State University.



Continued from page 15
 certain pathogens, such as *E. coli* and *Clostridium perfringens*. In challenge studies, in ovo inoculation with *E. faecium* resulted in a significant reduction in the number of *Salmonella enteritidis*-positive chicks.

● **Immune stimulation.**
E. faecium M74 supplementation has been shown to promote the development of immune organs and increase total antioxidant status. High antioxidant status is related to the enhancement of non-specific immune defence mechanisms, which provide the first line of defence against foreign challenges.

● **Enhancement of gut morphology.**
 Oral and in ovo administration of *E. faecium* have been shown to increase the length of intestinal villi and decrease the depth of crypts. Increased villus length suggests greater intestinal surface area with increased nutrient absorptive capacity. The intestinal crypt is where enterocytes (cells of the intestinal lining) proliferate to replace cells lost at the villus tip due to normal sloughing or inflammation from pathogens. Longer villi and shallower crypts are related to decreased cell replacement, longer

enterocyte lifespan, faster healing of damaged enterocytes and improved performance.

● **Increased mineral and nutrient absorption.**
 When added to water, *E. faecium* M74 has been found to increase calcium absorption. In ovo probiotic inoculation may also improve nutrient utilisation, potentially improving post-hatch growth.

Positive effect on hatchability and livability

A research trial at MSU has demonstrated the safety and efficacy of GalliPro Hatch in commercial-like conditions, as well as its compatibility with simultaneous Marek's disease vaccination.

The study was conducted in 2,604 fertile hatching eggs from a 55-week-old broiler breeder flock. On day 18, half the eggs were injected with a commercial Marek's disease vaccine and the other half were injected with both the vaccine and GalliPro Hatch. The injections were given with commercial in ovo technology according to manufacturer's instructions. Results (Fig. 2) indicate that GalliPro Hatch does not impair hatchability and may improve post-hatch performance.

Compared to the vaccine group, the vaccine with GalliPro Hatch group had fewer late-dead mortalities before hatch and 50% lower mortality 0-7 days post-hatch. Chicks that received GalliPro Hatch also had numerically higher average weights at hatch than those that received the vaccine alone.

What starts well, ends well

The ability to safely and effectively administer probiotics in ovo has important potential implications for the health and performance of commercial poultry flocks, especially as the industry comes under increased pressure to reduce antibiotic use.

Typically, probiotics are administered through feed and water, but chicks are exposed to many pathogens while still at the hatchery, before they begin feeding.

Environmental stresses, combined with the transition to breathing oxygen, drinking water and eating solid food, present further challenges to the chick's developing immune system. Colonising the embryonic chick's gut with beneficial bacteria before hatch may help it to better manage these stresses, while keeping harmful pathogens in check.

Giving chicks a head start on gut health may also help improve livability in the first week of life, which is a major indicator of health and performance for the remainder of the production cycle.

The 50% reduction in seven-day mortality observed in the MSU study thus has important potential economic benefits not only for the hatchery sector, but to the entire poultry production chain.

It should be noted that GalliPro Hatch should not be combined with antibiotics in the hatchery setting, but may provide a viable substitute for antibiotics as the industry seeks effective and sustainable alternatives.

By stimulating immune development and limiting pathogen growth, probiotics have been shown to reduce the incidence and severity of common intestinal disorders.

In ovo and oral administration of probiotics may therefore help reduce the need for therapeutic doses of antibiotics that are important to human medicine, while limiting costs associated with treatment, mortalities, morbidities and condemnations at processing. ■

References are available from the authors upon request

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