

# The application of probiotics in the hatchery

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Poultry was domesticated thousands of years ago. The Asian Red Jungle fowl (*Gallus gallus*) is a wild bird that lives in Southeast Asia. Domestication of this fowl, as well as turkeys, started in prehistoric times as people captured and raised these species for food.

Archaeological evidence suggests that the Asian Red Jungle fowl was domesticated in China about 8,000 years ago. Gradually these captured birds became the modern chicken. In the sixteenth century, domesticated chickens were introduced into Central America from Europe. Turkeys were domesticated in Mexico and were used by Native Americans, and were then introduced into Europe after the European colonisation of Central America.

## Breeding for success

Farmers often breed domestic animals for favourable traits. For example, many farmers allowed only the largest turkeys to breed. Over time, this led to domestic turkeys being much larger than their wild relatives. Today, millions of chickens and turkeys are raised on commercial farms and they outnumber their wild relatives.

The modern poultry industry is a well developed business. It began in the late nineteenth century in Europe and America as producers started to realise the importance of poultry meat and egg production. Although the artificial incubation of eggs had been practised in ancient China and Egypt, this method of hatching poultry eggs was not used commercially until the 1870s.

Under natural conditions, chicks hatch in very close proximity to the mother hen, which allow them to eat and drink as soon as they are hatched. Microflora from the mother hen also colonises the gastrointestinal tract (GIT) of these young chicks. Early feeding and

microflora colonisation have very positive effects on birds' performance and also the maturation of the birds' immune system.

When birds hatch, their GIT is anatomically but not functionally complete. In order for the function to fully mature, young birds need early access to feed and water as soon as they hatch, as happens under natural conditions. It is noteworthy that the GIT has about 65-70% of the birds' immune system. This means that in addition to the digestive and absorptive functions, the GIT is also considered the major immune organ in birds.

Birds are hatched with incomplete immune systems that take about three weeks to fully develop.

Poultry production under modern husbandry practice does not allow newly hatched chicks to come into contact with mother hens. This lack of contact slows the development of GIT microflora and the immune system.

Another point worth mentioning is that in addition to the time chicks spend in the hatcher, which could take up to one-and-a-half days, chicks might take up to two or three days until they reach the production farm. The delay in feeding and drinking delays the maturation of their digestive and immune system.

Besides the lack of the GIT microflora establishment, this opens the door to pathogen colonisation in the gut, making the chicks susceptible to disease and preventing them from achieving their genetic potential.

## Probiotics in hatcheries

Because the early development of a well balanced gut microflora is important for adequate health and high performance, feeding strategies have been directed towards controlling the microbial environment of the GIT through nutrition.

In particular, the use of probiotics and prebiotics has shown to be an effective means of manipulating or managing the composition of the microbial population in the GIT of

animals, and thus protecting young animals from colonisation by harmful bacteria. Through the combination of probiotics and prebiotics in so-called synbiotics, synergistic effects can be achieved.

Early observations that consuming certain live micro-organisms could improve intestinal health and well being of the host began in the beginning of the twentieth century, when the Russian scientist and Noble laureate Élie Metchnikoff (1907) suggested that it would be possible to modify gut flora and replace harmful microbes with useful microbes.

According to the FAO and WHO, probiotics are live mono- or mixed-culture of micro-organisms feed supplements which, when taken in sufficient quantities, beneficially affect the host animal by improving its intestinal microbial balance. Probiotics application has a very important role in the quick development and establishment of GIT microflora and its role in re-establishing microflora after the therapeutic use of antibiotics.

Not only this, but probiotics application also helps greatly in the rapid maturation of the immune system, which helps birds respond better to vaccines and also defend themselves against infections.

Due to the important role that probiotics play in developing the immune system of newly hatched chicks, the term immunobiotics has been used to describe these beneficial bacteria.

Probiotics strengthen the immune system quickly, thus enabling newly hatched chicks to fight infection.

The effects that probiotics have on the immune system can be summarised as follows:

- Enhancement of cytokines, chemokines, Toll-like receptor and T cell-related mRNA gene expression.
- Improvement of lymphocytes function and number in newly hatched chicks.
- Enhancement of the systemic antibody response.
- Increase in the number of IgA producing cells accompanied by the production of secretory IgM and

IgA that are particularly important for mucosal immunity.

- Improvement of mucin gene expression and production.
- Strengthen the production and functioning of tight junction proteins.

## Method of application

Under commercial conditions, probiotics can be applied to drinking water, mixed with feed, or sprayed in hatcheries.

Applying probiotics in hatcheries during the early stages of chick growth, as discussed above, is very important. Continued application at the farm level is equally important because of frequent changes in the GIT microbial profile due to feed changes, infection or stress.

In the hatchery, probiotics are most commonly applied via coarse water spray using a special spray cabinet or handheld sprayer.

However, this method of application, if not performed properly, has the disadvantage of possibly drenching newly hatched chicks, which makes them more susceptible to respiratory tract infections and diseases.

It should be noted that using water as a carrier for probiotic strains only provides the newly hatched chicks with probiotics and does not give them any other nutrients that could help the chicks in their several hours journey until they reach the production farms.

Another method of probiotics application in hatcheries is the gel droplet method which uses a nutritive gel as a carrier for the probiotic, delivered via a gel applicator. This method has several benefits over the water spray such as:

- Early delivery of nutrient mix to hatchlings which will improve chick liveability especially during and after long transportation periods
- Early feeding and development of the chick GIT for better growth and immunity.
- An easy, uniform and rapid delivery of probiotics without the risk of drenching the hatchlings.
- Can be combined with coccidia vaccines. ■