# The contribution of in ovo vaccination to chick quality

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Twenty five years ago the only way to vaccinate broilers against Marek's disease was to give day-of-hatch chicks a subcutaneous injection by hand. It was labour intensive, stressful for the chicks and delayed their transfer into the growing environment.

In 1992 a company named Embrex (now part of Zoetis Inc) introduced the first commercial in ovo vaccination device and this new technology not only revolutionised hatchery vaccination, but also had a fundamental impact on chick quality and the way hatcheries operate.

## Hatchery hygiene

It is well known that poor hatchery hygiene will compromise the quality of the day old chick, and in turn lead to poor performance later in life.

Because egg injection may exacerbate certain issues of poor hatchery sanitation, a risk analysis is normally conducted prior to incorporating in ovo vaccination technology into hatcheries. The risk analysis includes both a physical and microbial site survey. The surveys are used as a tool to outline problem areas of the hatchery environment that may affect the injection process so that corrective measures can be imposed prior to initiation of egg injection.

The microbial risk analysis is based on the amount of fungi found during the survey of the various environments within the hatchery.

Generally, high levels of fungi indicate a problem with the sanitation, maintenance, and/or design of the ventilation systems of the hatchery. When present in high enough levels, Aspergillus spp can cause mycotic infections in the young chick.

Addressing this issue before the installation of any in ovo vaccination systems is one of the first benefits this technology provides to improve chick quality.

## Vaccine preparation

Field observations have shown that microbial contamination of vaccine may produce a small to large loss in hatchability with a subsequent increase in early mortality.

Vaccine contamination negatively impacts chick quality, as it introduces one or more pathogenic bacterial organisms or inappropriate vaccine virus in ovo.

Since the in ovo vaccination procedure applies only 50 microlitres in contrast to the 200 microlitres in the subcutaneous vaccination, any vaccine contamination during in ovo vaccine preparation will result in four times more negative impact. For example an 800 millilitres diluent bag is good for 4,000 subcutaneous injections but would be sufficient for 16,000 in ovo injections. Knowing the magnitude of this difference in calculation and as in ovo vaccination becomes the new vaccination standard, the direct impact of the adoption of in ovo has become a more careful, hygienic and safe vaccine preparation process.

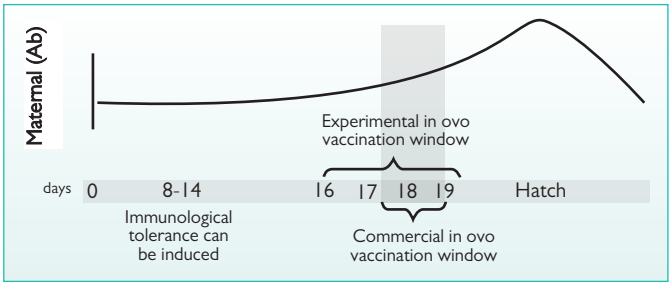


***Fig. 1. Illustration of chicken maternal derived antibodies dynamic and in ovo injection window.***

## Early immune response

Along with the benefits of a more automated hatchery, the introduction of in ovo devices also heralds a more effective way of delivering vaccines to broilers.

At 18-19 days of incubation, some but not all of the maternal antibodies in the yolk have been absorbed by the embryo – full maternally-derived immunity does not develop until a few days post-hatch.

If a live vaccine is given to the embryo during this 'window', then the virus can replicate without too much interference from maternal antibodies and thus triggers a good immune response. At the same time the embryo has enough maternally-derived immunity to protect it from developing disease as a result of being vaccinated. The result is a chick which has the earliest possible immune response and thus protection against disease when it moves into the growing environment.

In collaboration with the North Carolina State University's College of Veterinary Medicine, the research

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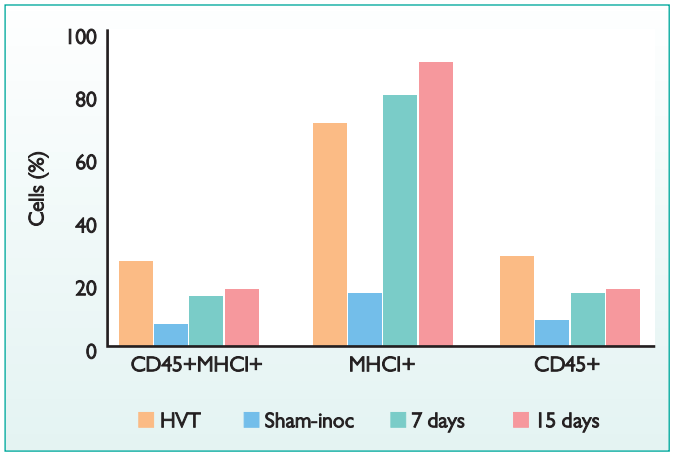
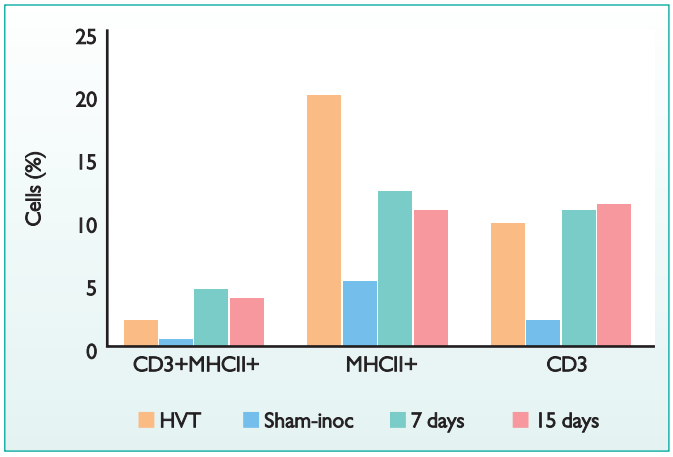
***Fig. 2. In ovo vaccination accelerates the expression of MHCI, MHCII, CD3 and CD45 on splenocytes from D1 ET chicks. HVT and sham-inoc values are significantly different at P<0.05.***



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team demonstrated that using specific pathogen free (SPF) egg type (ET) chickens with in ovo administration of HVT, renders chicks at hatch more responsive to an unrelated antigen 'keyhole limpet hemocyanin' (KLH).

The administration of HVT at 18 days of incubation in ovo, accelerated appearance of splenic immune cells at hatch. The percent positive cells were greater than or equivalent to the percent positive cells found in chicks assayed at seven and 15 days following hatch.

This interesting experimental finding suggests that immune priming of late stage chick embryos produces chicks that are more immunocompetent at hatch and better able to cope with infection. More research is needed to better understand these findings and their implication for the immune activation in late stages of chicken embryos.

## Hatchability

On 'pair type' studies where all the possible sources of variation are equalised between the in ovo vaccinated and the conventional vaccinated groups, shows improvements in the percent of hatch, mortality, bodyweight and feed conversion with in ovo vaccination.

When the oxygen levels were increased (25%) on overheated embryos (38.9°C) a positive effect over the yolk free body mass (YFBM) and the chick length was observed, suggesting a better yolk utilisation.

Similarly, this may occur with the eggshell perforation during in ovo vaccination, facilitating additional gas exchange during the last moments of incubation, which will benefit those embryos that were on overheating conditions and increasing their probability to complete their development and hatch.

## Early placement

Vaccination via in ovo enables downstream process improvements in the hatchery, such as automated chick counters, high speed separation of chicks and unhatched eggs, chick and box conveyors, hatcher trays destackers, paper padders, boxing systems and more, which at the end is translated into rapid placement or reduced time from the hatchery to the farm.

A recent study comparing performance between in ovo and subcutaneous vaccinated broilers with different processing times between hatch and placement showed that birds with chick processing placement time of four hours weighed significantly more than birds with processing placement time of 18 hours.

All the automation processes that in ovo vaccination technology triggers in the hatcheries fosters chick welfare and improves health significantly. ■

*References are available from the author on request*

| | 1993 | 2000 | 2005 |
|---|---|---|---|
| Difference in hatchability (%) | +0.04 | +0.88 | -0.14 |
| Difference in mortality (%) | 0.00 | -0.19 | -0.21 |
| Difference in bodyweight (g) | +9.10 | +50.00 | +16.00 |
| Difference in feed conversion | -0.019 | -0.020 | -0.012 |

***Table 1. Performance parameters for in ovo vaccinated birds versus subcutaneous vaccinated birds in three separate, controlled trials.***

***Fig. 3. Bodyweight differences between two different placement times.***