TRANSMUNE IBD

STOP THE GUMBORO CYCLE

Controlling Gumboro Disease

1 – IBDV Challenges

One of the reasons why Gumboro disease continues to challenge birds is that the virus is very persistent and can easily survive in the environment even in the absence of chickens during a downtime period.

On the other hand, the presence of vvIBDV (very virulent infectious bursal disease virus) and variant strains has been detected not only in broilers, but also in laying pullets in all areas with industrial poultry.

Complete Gumboro disease control is only possible with an application of an efficacious and well applied Gumboro vaccine, to not just protect the birds against clinical signs, but to also prevent the risk of challenge in the following flocks.

Biosecurity, with a strong focus on cleaning and disinfection, as well as a solid breeder vaccination programme to provide maternally derived antibodies (MDA) in order to prevent early infection of the field Gumboro virus, are essential tools for the proper control of infectious diseases. Additionally, the concepts of vaccination have undergone such a revolution that they have required the definition of new health strategies.

Active immunity (or vaccine immunity) induced by the administration of a vaccine will develop according to the vaccine(s) employed, the quality of the application, and the immune status of the chickens at the time of the vaccination.

The level of MDA is variable or unknown at the time of vaccination. For this reason, if the vaccine is applied in the field, the delivery of the vaccine is not uniform in all the birds in the flock. Without the precise determination of the MDA level for Gumboro, there are two risks:

- **Vaccine viruses are neutralised by MDA.**
- **When vaccines are applied late, the field virus will replicate in the bursa before the vaccine strains.**

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2 – Field Conventional Vaccines

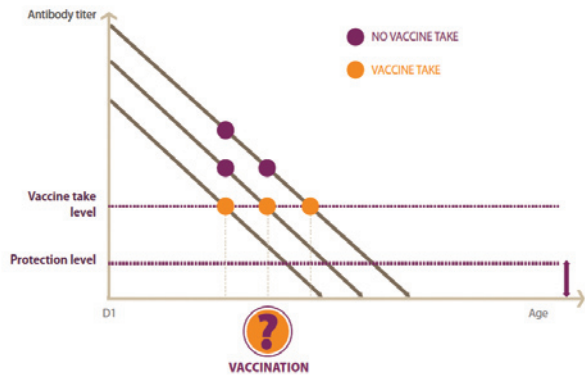
Conventional live attenuated Gumboro vaccines are live attenuated Gumboro viruses that replicate in the bursa of Fabricius, resulting in immunity generated by the replication of the whole virus. There are different Gumboro disease virus strains used in the vaccines and there are different levels of attenuation.

Vaccine types are categorised into four groups:

- **Mild** which are highly attenuated.
- **Intermediate** which are very attenuated.
- **Intermediate Plus** which are moderately attenuated.
- **Hot** which are poorly attenuated.

For this type of vaccine, the maternally derived antibody (MDA) levels should be monitored. If given too early, in the presence of an excessively high level of MDA, the virus in the vaccine is neutralised or its replication is delayed.

If it is given too late, a window of opportunity (also called the protection gap) is offered to the farm virus to infect the flock. This optimal timing depends on the level of MDA and the invasiveness of the vaccine, that is, its capacity to overcome a given titer of MDA.



Care to be taken for the field vaccination procedure:

- **Optimal vaccination age calculation.**
- **Monitor the drinking water quality.**
- **Neutralisation of chlorine.**
- **Uniform delivery of the vaccine solution bird to bird.**
- **Total coverage, ie ensure proper vaccine take by every bird.**

This vaccination procedure should be followed by monitoring and auditing. To analyse the efficacy of vaccination, monitoring can be done by serology or by PCR.

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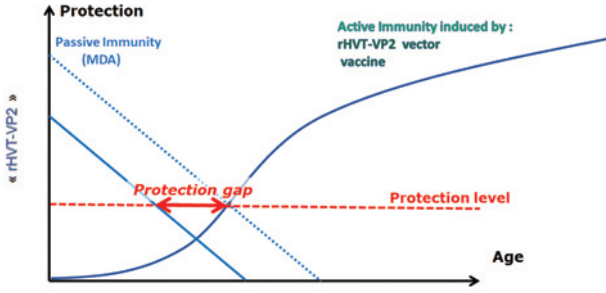
3 – Vector IBD Vaccines (HVT IBD)

Vector IBD vaccines are constructed from a genetically engineered virus (the vector) whose genome contains a gene from a specific IBDV (the donor) encoding for the VP2 capsid protein. As of today, the Herpes Virus of Turkey (HVT) is mainly used as a vector. Although these vaccines provide proper protection against clinical signs of IBDV, they do not fully colonise the bursa, leading to field IBD viruses being able to enter and replicate in the bursa.

Using a vector vaccine, the immunity does not come from replication of a complete virus, triggering all the arms of the immune system ('complete' immunity), but essentially from an antibody response to the VP2 antigen of the IBD virus expressed by the recombinant HVT vector.

That way, when considering protection against the Gumboro virus, the useful part of the immune response is mostly of the humoral type. Protection against Gumboro disease comes from the expression of the VP2 by rHVT-VP2 -infected cells, and is a much slower process. Onset of immunity against IBD requires much more time than for MD.



Finally, it is established that the level of protection induced by rHVT-VP2 vaccines is dependent on the IBDV strain challenging the chickens. As has already been said, protection comes from stimulation of the immune system with a specific VP2 protein and not with the whole virus, making this protection more effective against field viruses carrying a similar VP2.

As protection is partial, the IBDV strains that are different will escape vaccine protection and this will favour the emergence of new variant IBDV strains. These new strains will have the ability to break through MDA earlier than before, meaning that the challenge will come earlier, which will then increase virus pressure and allow Gumboro disease to become out of control.

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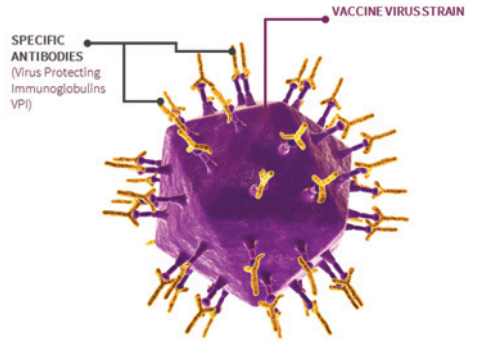
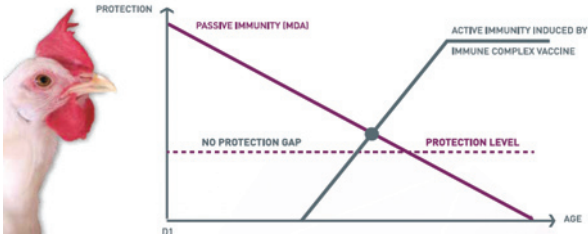
4 – Immune Complex Vaccines

Immune-complex IBD vaccines are prepared from live attenuated IBDV strains of the intermediate plus type, mixed in with specific anti-IBDV serum to regulate the safety and release of the vaccine once the MDA levels of the bird are reduced. A correct balance between the IBD virus and the anti-IBDV antibodies is of crucial importance for the efficacy and safety of these vaccines.

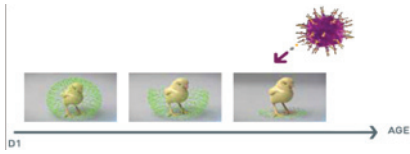


These vaccines have the ability to fully colonise the bursa and to protect against all field IBD viruses. The 'take' depends on the quality of application – the objective of a proper vaccine administration is not only to reach every chicken, but also to ensure that the full dose is received by each of them.

The capacity of a vaccine strain to overcome MDA is one of the key advantages of the immune-complex vaccines. From the first day, the MDA levels will decrease. This decrease is variable according to the starting MDA level at hatch.



The vaccine take occurs when the MDA level decreases to a point that allows the vaccine virus to be released and to reach the bursa of Fabricius. From this moment, the vaccine strain will replicate in the bursa of Fabricius, and the chicken will be immunised against any type of IBD virus (active immunity).



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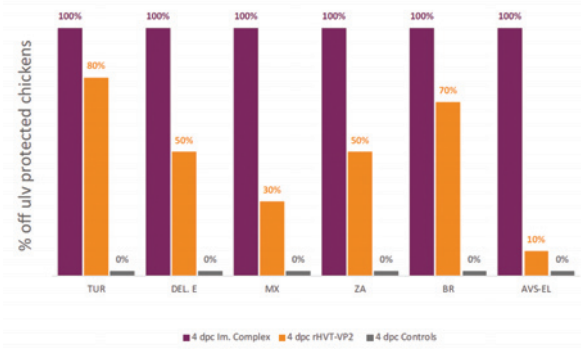
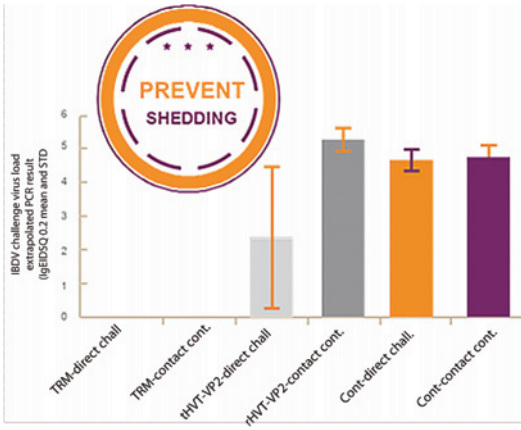
5 – Comparative Results

COMPARISON OF THE PROTECTIONS INDUCED BY AN IMMUNE COMPLEX OR rHVT-VP2 GUMBORO VACCINES AGAINST CHALLENGES WITH VARIOUS IBDVs



Histopathology lesions four days' post-challenge with different IBDV strains

PROTECTION AGAINST VIRUS SHEDDING TO PREVENT FIELD VIRUS ON THE FARMS



Transmune group:

No vvIBDV replication was detected either in vaccinated and direct challenged birds, and its contact control group.

✔ Reduction of 5 log of vvIBDV amount.

rHVT-VP2 group:

✔ Variable level of vvIBDV replication in the majority of vaccinated and challenged birds.

✔ Contact control bursas contained high amount of challenge virus, comparable to non-vaccinated challenged groups.

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6 – How to detect Gumboro disease in poultry

There are three main forms of Gumboro disease – immunosuppressive, clinical and subclinical – that are defined by the variability of the virus, age of the chicks and define the pathogenic consequences.

A key symptom observed in chickens is the reduction of feed and water consumption due to the morbidity caused by the process of the immune response.

Other related symptoms that can be observed include mucoid diarrhoea (viscous), apathetic and sleepy birds, goosebumps, and sleeping with their beaks touching the ground.

Clinical signs of deep depression are not always clear and present.

The virulence of field strains varies considerably; very virulent (vv) strains of the virus cause higher mortality and morbidity. After an incubation of 3-4 days, in clinical infections, the symptoms will start, with mortality usually up 20%, but with some cases of much higher mortality, depending on the virulence of the IBD virus involved.

As IBD is caused by an Avi-birnavirus which replicates on the bursa of Fabricius, it is important to analyse this organ, understanding that the damage in an organ responsible for the microenvironment for B-lymphocytes is crucial.

When the virus strain infection damage is reversible, the histological regeneration of the bursa of Fabricius will bring about a full restoration of the humoral immune functions, followed by restoration of bursal B-cell activity, and repopulation.

Bursas from broilers vaccinated with live immune-complex vaccine.

The aspect of the bursa will be related to the IBD vaccine used too. When using a live vaccine, applied in the field by drinking water application, or immune complex applied in the hatchery, the IBD vaccine virus will replicate in the bursa.

So it is expected to detect the virus, that means vaccine take, and correct protection. A PCR can be useful to clarify the strain present and replicating in the bursa.

The results expected by different vaccination programmes can be seen below:

Vaccines	Immune complex	rHVT-IBD	Field vaccine
Live attenuated virus (Intermediate-plus)	YES	NO	YES
Replication in the bursa	YES	NO	YES
Blocking any type of IBD virus infection	YES	NO	YES
Prevention of shedding field viruses and mutation	YES	NO	NO

At the same time is important to analyse the results of blood sampling by serology to check the immune response of the chickens. By serology analyses of blood samples at slaughter age it is possible to detect the replication of the IBD virus. When titers are detected by IBD ELISA, it means that a live virus is replicating in the bursa cells. It can be due to the field virus infection or vaccine virus replication.

The results expected by different vaccination programmes are shown below:

Vaccines	Immune complex	rHVT-IBD	Field vaccine
ELISA IBD titers	YES	NO	YES

In this way, when the chicks are vaccinated by a live vaccine (on the farm, or hatchery immune-complex) ELISA IBD titers are expected, meaning active immunity.

But when the chicks are vaccinated by a rHVT-IBD vaccine, the titers are not expected, and when they are present, it means field virus infection. In all situations it is important to combine the available tools to correctly diagnose Gumboro disease – bursa analysis in the field, serology and PCR – for a better understanding of the IBD pressure situation.