Gumboro disease – countering the hidden threat

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Gumboro disease or infectious bursal disease (IBD) is a viral infection that affects the immune system of poultry. It causes the destruction of the lymphoid organs, in particular the bursa of Fabricius, which is where B-lymphocyte formation and differentiation takes place.

The virus's main target cell is the B-lymphocyte in an immature stage. The disease causes severe clinical signs. The affected birds are lethargic, pale, they ruffle up and show whitish diarrhoea. The lesions of Gumboro disease are very typical and they mainly consist of haemorrhagic and oedematous bursae.

High mortalities are experienced and, after recovery, the surviving birds might suffer from immunosuppression. The younger the birds get infected, the more severe is this immunosuppression.

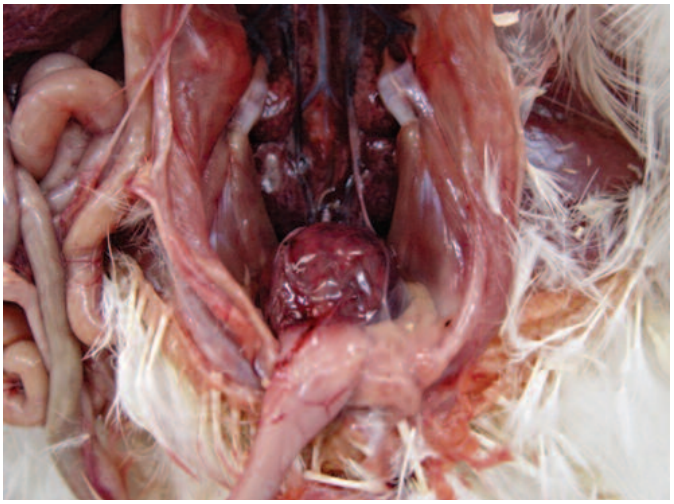
European experience

European poultry producers have already been affected for a long time by the emergence of IBD strains which have spread all over the world including most of the Asian countries. Since the end of the 1980s, acute and severe IBD outbreaks, with up to 30% mortality in broiler flocks, have been experienced in several European countries.

The high mortalities indicated an increase in the virulence of the IBD strains which were classified as very virulent IBD (vvIBD). Most of these vvIBD virus strains belong to the same lineage and they may share a common ancestor.

The hidden threat of Gumboro disease becomes critical to the profitability of any poultry operation, and should therefore, be taken very seriously.

Controlling Gumboro disease is only achievable when taking into account the most determining factors, such as good level of biosecurity, proper chick quality, suitable vaccines and correct vaccination techniques. Biosecurity, cleaning and disinfection are vital factors to prevent Gumboro disease.



Haemorrhagic bursa of Fabricius.

In the first place, strict biosecurity, improved sanitation and hygiene practices are essential to preventing the disease, especially as the virus is particularly resistant in the farm environment.

Biosecurity

Basic biosecurity rules should include that visitors, equipment and vehicles are not allowed to enter the farm without the proper disinfection procedures. Such procedures include change of shoes and clothes, showers and fumigation.

In cases where vvIBD virus infection has been experienced in previous flocks, it is recommended that down-time between cycles is increased. The virus remains viable for a very long time in organic matter and it should be properly eliminated from the chicken house and its surroundings. Mammals, birds, rodents and insects (Alphitobius diaperinus) are effective carriers of the virus, and therefore, it is essential that they are properly eliminated from the chicken house before a new batch is placed.

Reducing the virus load in the chicken house will increase the chances of the vaccine building up sufficient immunity for the flock to confront field exposure to vvIBDv.

This is particularly important because the younger the birds become exposed to the field virus, the more severe the damage to their immune system and the more limited the benefit of vaccination.

Control

High chick quality provides a solid base for controlling Gumboro disease.

Chick quality should already start at the breeder farm, where a solid vaccination programme, based on live and inactivated vaccines, should be implemented.

Hatching eggs should be incubated properly, avoiding at all times contamination at the hatchery.

Thirdly, hygiene measures should be maintained during transport to and arrival at the broiler farm.

Finally, broilers should absorb the yolk sac, which will give them a good and uniform amount of maternal antibodies. This passive immunity protects the chicks during the first weeks of life and plays an essential role in the early neutralisation of the field virus.

However, maternal immunity has a short duration and solid active immunity needs to be established before the chicks become infected by the field virus. Such active immunity can be achieved by the administration of different commercial live vaccines during the first few weeks of life.

Table 1. The number of vaccinations is related to the IBD field challenge and the coefficient of variation of titres.

MDA titres/Field IBD	High challenge	Low challenge
Good uniformity (CV <30%)	1 or 2 vaccinations	1 vaccination
Poor uniformity (CV >30%)	2 vaccinations	1 vaccination

IBD vaccine

The appropriate IBD vaccine should be administered at the right time.

An ideal Gumboro vaccine is able to replicate well in the presence of high levels of maternal immunity and able to colonise the bursa rapidly after vaccination.

It is preferable that vaccines show a good persistency in the chick resulting in lasting stimulation of the immune system. They should be able to spread to the non-vaccinated chicks in order to confer a better protection to the flock.

At the same time they should be safe, stable and easily applied by mass methods.

Different types of Gumboro vaccines are required to confront the diverse epidemiological situations.

In general, intermediate vaccines are administered as a routine vaccination in farms where the challenge is relatively low and vvIBD virus is not present.

The so called 'strong Gumboro vaccines' have the feature that they are able to break through higher levels of maternal immunity (ELISA titres <500) than milder vaccines

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(ELISA titres <125-250). Strong IBD vaccines are administered earlier, colonise the bursal tissue rapidly, replicate massively, and stimulate humoral, cellular and mucosal elements of the immune system. Due to these properties strong vaccines are ideal to control the challenge of vvIBD.

The vaccination programmes should be customised to each particular farm. In some farms different combinations of intermediate and stronger vaccines are applied in order to homogenise the maternal antibodies and achieve a better control of the infectious bursal disease challenge.

Vaccination time

It is critical to determine the optimal vaccination time.

As mentioned above, maternal immunity protects birds against the field virus. However, maternal immunity may affect the vaccine virus when vaccination is performed too early. In such case, the vaccine becomes neutralised and it is ineffective vaccinating the flock as a whole.

This is because the bird's immune system might not be able to discriminate the vaccine virus from the field virus and will exert the same neutralising effect.

The vaccine neutralisation is avoided by delaying the vaccination until the chicks become susceptible to the vaccine and are able to respond to the vaccine virus.

Maternal antibody half-life

The maternal immunity is a kind of 'solid wall' which is very thick at the hatching time and declines linearly. In this respect it has been calculated that the half-life of the maternal antibodies is 3.5 days.

Thus, it is possible to determine the specific moment when the vaccine will be able to break through the maternal barrier and generate active immunity.

However, vaccination should not be delayed too long or field virus can penetrate before the vaccine virus does. There is a so-called 'immunity gap' where there will be a 'competitive race' between the vaccine and the field viruses. The objective for the vaccine virus is to win this race.

There are several formulas for calculating the right vaccination time, such as the 'Kouwenhoven formula' and the 'Deventer formula'.

However, these formulas do not take into account certain variables and some adjustments could be required depending on the flock and farm peculiarities.

This could be the case with broiler flocks originated from different sources and consequently with heterogeneous maternal titres, or with multi-age farms where chicks are exposed to high loads of vvIBD virus on arrival at the farm.

Day old monitoring

Regular monitoring of day old chicks is highly recommended to predict the vaccination time. Fig. 1 shows a good level of titres and high uniformity. In this instance chicks should be protected with a single vaccination applied at 12 days of age.

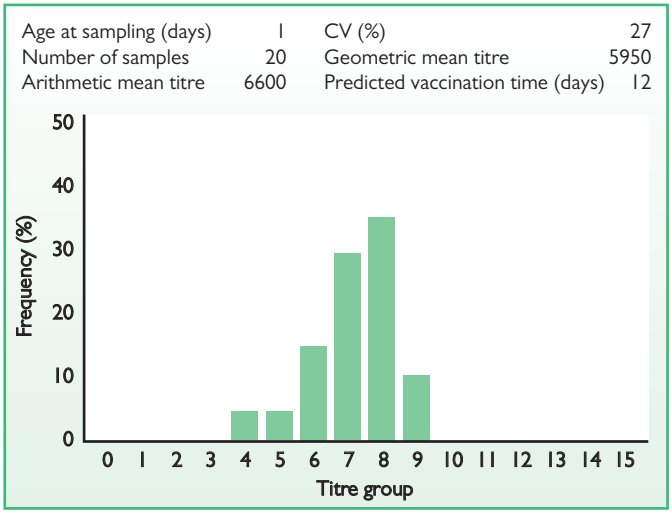
Technical programmes should provide an integral framework for controlling Gumboro disease.

The ultimate aim of vaccination is to ensure profitable poultry production.

Regretfully the effectiveness of the vaccines depends on other factors that go beyond the vaccine itself. These have already been discussed.

A good practice to ensure the success of the vaccination is to confirm that the vaccine virus has been able to reach the bursa which can be determined with molecular techniques.

Fig. 1. ELISA testing of 20 serum samples of broiler day-old chicks to assess the maternal antibodies level.



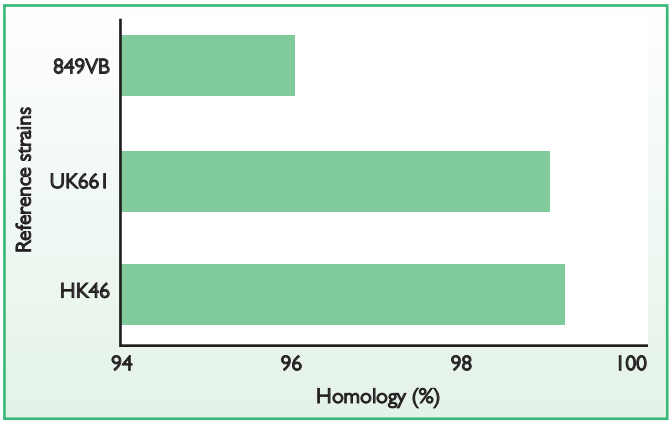


Fig. 2. Sequencing and comparison with reference strains is performed in Lymfos broilers and Lymfos vac. In this the percentage of homology of vvIBD field strain against reference strains is calculated. This phylogenetic study demonstrates that the vvIBDV strain is closely related to the very virulent reference strains.

From experience, it is known that it is essential to identify the characteristics of the Gumboro viruses that circulate in the broiler farm during the grow-out period. Furthermore, it is crucial to determine the time when the birds could become infected and to define the sources or reservoirs of the field infectious bursal disease virus.

Unveiling the threat

In short, the aim is to unveil the 'hidden threat' and adjust our disease management strategies.

Therefore, technical programmes offer a general framework for an integral Gumboro disease strategy. These programmes aim to understand and follow up possible Gumboro disease infections.

Currently, Hipra offers two different programmes, Lymfos vac and Lymfos broilers, both of which have already been successfully implemented worldwide.

These programmes provide longitudinal studies based on weekly samplings of bursas of Fabricius. The samples are evaluated by means of molecular diagnosis such as reverse transcription-polymerase chain reaction (RT-PCR) combined with restriction enzyme analysis (REA).

The sequencing of the VP2 and phylogenetic studies are performed, with a view to determining the relatedness of the circulating IBD viruses with other reference viruses.

Molecular techniques such as RT-PCR followed by REA are implemented in Lymfos broilers and Lymfos vac.

Sequencing and comparison with reference strains is performed in Lymfos broilers and Lymfos vac (see Fig. 2).

The Lymfos vac programme begins at the vaccination time, which is when the first samplings should be performed.

Once it is confirmed that the flock is not contaminated by vvIBD or other circulating IBD viruses, the bursas are uninfected and ready to be populated by the beneficial vaccine virus.

On the other hand, if the bursas are already infected, it can be concluded that the chances for the Gumboro vaccine controlling the disease will be limited.

Finally, the sampling will help to determine whether cleaning and disinfection programmes have been working efficiently to eliminate vvIBD virus and in avoiding the early exposure of the young chicks to the field IBD strains.

Subsequent samplings will take place at three and seven days and then weekly after vaccination to confirm whether the vaccine virus has been able to successfully colonise the bursa.

Should the outcome show that the vaccine has not been able to replicate in the bursa, there is still time to revaccinate the birds and ensure a satisfactory protection of the whole flock.

Dynamics of infection

With the Lymfos broilers programme, the weekly sampling begins at the vaccination time and may continue until the end of the growing period in order to define the dynamics of infection and to determine exactly the time when the broiler flocks become infected.

This information will be essential for the implementation of control strategies in the subsequent flocks.

In addition, bursas are studied to evaluate bursal damage and determine the pathogenicity of the field virus.

In this way the technical programmes Lymfos vac and Lymfos broilers will allow us to identify the 'hidden threat' and thus guarantee success in dealing with Gumboro disease. ■