Key points for control of Gumboro disease

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Gumboro disease or infectious bursal disease (IBD) is caused by a small virus classified as belonging to the family birnaviridae. It was first described in 1962 in the USA by Cosgrove and it has caused huge economic problems to the poultry industry worldwide.

More recently, in the late 80s, a more pathogenic IBD virus, called very virulent IBDV (vvIBDV) was identified and it readily spread to almost all producing areas in the world. Asia was hit by this virus in the beginning of the 90s and, since then, economic problems related to high mortality and poor zootechnical performance have been seen throughout the continent. There are two serotypes of IBDV.

- Serotype 1 includes classical IBDV strains, which cause subclinical disease, and also vvIBDV, which can lead to high mortality. Variant strains of serotype 1 were described.

- Serotype 2 strains are considered apathogenic.

The bursa of Fabricius, which is the primary organ involved in the development of the chicken's immune system, is the main target for the virus. The severity of the clinical signs and lesions depend on the virulence of the field virus, type of birds (broilers or layers), age and the immune status of the affected birds.

A subclinical form of IBD usually occurs in chickens less than three weeks of age and there are no clear clinical signs of the disease, but the birds experience a severe and permanent immunosuppression. In contrast, clinical IBD form frequently happens in birds between three and six weeks old and it has a sudden onset and the mortality rate increases rapidly.

Clinical signs include dehydration, trembling, ruffled feathers, vent pecking and depression. Affected birds experience a transient immunosuppression.

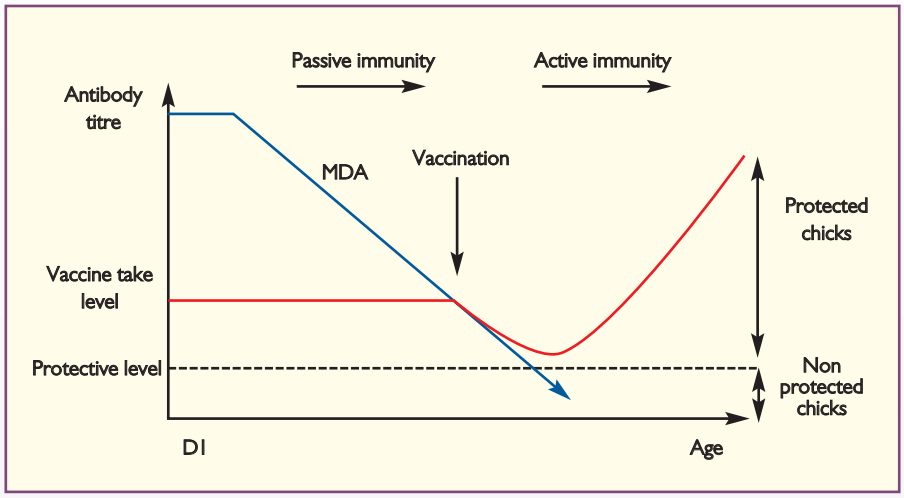

Fig. 1. Maternal derived antibodies (MDA) decrease with time.

Prevention programme

Despite vigorous vaccination programmes, it has been difficult to control IBD as an effective prevention programme against this disease depends on both biosecurity and immunisation of breeders and their progeny. Either biosecurity or vaccination alone is not able to prevent losses due to IBD.

Biosecurity

Because of the huge amount of virus shed during an outbreak and its relative stability to various chemical and physical agents, it is practically impossible to remove all sources of infection once a poultry house has been contaminated and the contact between field IBD virus and subsequent flocks is virtually unavoidable. Furthermore, the vaccination is carried out in a way to reach the bursa of Fabricius before the field virus can colonise it.

In other words, it is a competition between the field virus and the vaccine strain. Thus, a comprehensive biosecurity programme is the most important factor in limiting losses due to IBD by reducing the field virus present in the poultry facilities and it relies on strict cleaning and disinfection procedures, down period and sanitary barriers.

Phenolic, iodine and formaldehyde compounds have been shown to be effective for disinfection of contaminated promises.

Immunisation of the breeders

A comprehensive immunisation programme against IBD starts with a well designed vaccination programme of the both broiler and layer breeders. Numerous vaccine programmes have been proposed worldwide and usually they comprise both live and inactivated vaccines.

These vaccines are administered during the rearing period of the breeders in order to achieve a high and uniform level of active antibodies and consequently transfer them to the progeny.

In certain areas and depending on the antibody titer and its heterogeneity in the breeder flocks, an additional shot of inactivated vaccine is carried out at around 45 weeks of age.

This high and uniform level of maternal

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derived antibodies (MDA) in the progeny aims to protect broilers and layers against subclinical infections in the first days of their lives.

Immunisation of the progeny

Besides having received MDA from parent stock, it is not enough to protect the whole life of the birds. Hence, the active immunisation of the young birds is crucial to protect them against IBD in the farms and it depends on three different critical points: the right vaccine, in the right way and at the right time.

The right vaccine

The right vaccine means the correct choice of the virulence of the strain present in the vaccine. There are four different types of vaccines, according to their virulence-mild, intermediate, intermediate plus and hot strains. The choice should be based on the epidemiology of the region. If only classical IBDV strains are present, mild or intermediate vaccine strains can be used with success.

Alternatively, if vvIBDV is prevalent in the area, intermediate plus vaccines are strongly recommended. In those cases where a variant strain is present, a vaccine containing this variant virus should be used to control this specific situation. So far, these variant strains have not been identified in Asia.

In the right way

Drinking water is the most recommended method for massive vaccination against IBD in the farms. However, this technique presents clear limitations as unevenness of water consumption by the birds and possibility of inactivation of the vaccine virus by chlorine or any other disinfectant present in the water. Thus, at the right way means to follow good procedures of vaccination in order to minimise all these aforementioned problems related to the technique and consequently to achieve proper immunisation of the flock.

In addition, cares related to cold chain, preparation and distribution of the vaccine and deprivation time, are also crucial to reach good results with this vaccination method.

At the right time

Among these three key points, the most difficult to be properly applied at farm level is the correct time of vaccination and doubtless it can lead to failures in the prevention of IBD.

The precise determination of the 'optimum' time of vaccination is necessary because there is a strong interference between MDA and the vaccine virus.

It means that, if the vaccine is given when the level of MDA is still high, the vaccine would be neutralised and consequently the flock will be unprotected later on. In contrast, if the vaccine is administered too late, the field virus can infect the birds before the vaccine strain causing an outbreak.

Hence, this 'optimum time' depends on the MDA level at day old and thus it varies from flock to flock.

MDA decrease with time in a quite regular rate of decay, mostly related to breed and growth rate (Fig. 1). The rate of decay of these antibodies can easily be characterised through 'half life' values. For example, the half life of MDA detected by ELISA in broilers is about 3.0-3.5 days, it means that it takes 3.0 -3.5 days for MDA level evaluated at a certain time to be divided by two.

As the vaccine take level is known, with these serological results in hands, it is possible to determine the correct age of vaccination. Moreover, based on the coefficient of variation (CV) of the antibodies, it is also possible to decide whether it is necessary to add an extra vaccination to protect those birds with low level of MDA.

In summary, since the optimum time to vaccinate can vary from flock to flock, it is advisable to determine it flock by flock and it can be done by measuring the level of MDA in the first days of the birds' life through a quantitative serological test (ELISA test). Hence the age(s) of vaccination should be decided according to the level and homogeneity of MDA present in the sampled chicks.

However, in the farms, usually it is not possible to take samples from each flock to accurately calculate the day(s) of vaccination. In these cases, the vaccination is done at a date which is valuable for the majority of the flocks. For example, vaccinate broil-

ers using intermediate plus strain at around 14-16 days of age. This vaccination scheme works properly for most of the flocks, but, by adopting this programme, it is necessary to accept the risk of 'missing' some flocks. Thus, flocks with too high or too low MDA level at day old and flocks with poor homogeneity of MDA could face outbreaks of IBD.

In addition, another common field condition is to place day-old chicks from different breeder flocks and consequently with high heterogeneity of antibody titres.

In the same way, by using an ELISA test, it would be possible to identify this condition and set up a proper vaccination programme. However, it is not done routinely.

In order to minimise the risk of outbreaks due to these aforementioned conditions, even in areas in which vvIBDV is prevalent, it is advisable to use an intermediate strain at around 7-10 days of age and an intermediate plus vaccine at 14-16 days.

The intermediate vaccine would stimulate earlier the immune system of those birds with lower level of MDA and the intermediate plus strain would afford protection to those birds with higher level of antibodies against vvIBD.

Trends of IBD vaccination

To overcome the two major difficulties related to IBD immunisation (prediction of the proper time for vaccination and limitations of the drinking water method), new vaccines were developed to be used in the hatcheries regardless of the MDA level or its heterogeneity. These new developments include recombinant and immune complex vaccines.

Recombinant vaccines can be defined as live vaccines which use a vector's genome to carry selected gene's sequence(s) from a donor that encodes for protective antigen(s).

Following vaccination, the recombinant virus would replicate and present the protective antigens of both the vector and the donor to the host's immune system, thus stimulating events leading to protective immunity against diseases caused by the vector and the donor. In this category, one vaccine was developed by inserting genes which encodes the IBDV capsid protein vp 2 into Marek's disease virus (HVT).

Immune complex vaccines are based on a well balanced combination of the IBD vaccine virus and its antiserum (antibodies) and this immune complex limits and postpones the virus's effects for at least seven days, thus ensuring that the strain is safe for chicks with low level of antibodies.

At the same time, the immune complex protects the vaccine virus from being neutralised by the MDA.

Thus, this immune complex does not prevent replication of the virus and subsequent antigenic stimulation, but just postpones it.

After hatching, whilst the MDA declines over time, the immune complex breaks down gradually and the vaccine virus starts to replicate and stimulates the immune system, affording protection against IBD.

Conclusions

A comprehensive prevention programme against IBD must involve an effective immunisation of both broiler and layer breeders, a strict biosecurity programme and well designed immunisation programme for broilers and layers.

Furthermore, to achieve the proper immunisation of the flocks, it is necessary to vaccinate at the right time, neither too early (to prevent the vaccine virus neutralisation by MDA) nor too late (to avoid the risk of field infection), using the right vaccine and administering it in right way.

In order to overcome the main constraints related to IBD vaccination (determination of the proper vaccination time and limitations of the drinking water technique) immune complex and recombinant vaccines were developed to be used in the hatcheries.

Last, but not least, it is also important to mention that vaccination results can be deeply affected by mycotoxins, concurrent immunosuppressive virus infection like Marek's disease or CAV and environmental factors. All these factors must be taken into account to target the best protection against IBD challenge. ■