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PASSIVE IMMUNITY: PART 2

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INTRODUCTION

The first part of the article “Chicken Passive Immunity” described how hens transfer their antibodies to their progeny and how important such antibodies are for the protection of the chicks against some major respiratory diseases during the first few weeks of their lives.

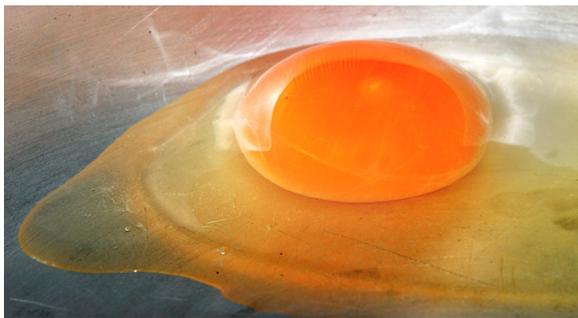
In this second part, it will be described the importance of the passive immunity in terms of protection against Infectious Bursal Disease (IBD), Chicken Infectious Anemia (CIA) and Marek’s Disease (MD).

1. INFECTIOUS BURSAL DISEASE

Importance of IBD Passive Immunity

IBD virus infections within the first week do not entail any noticeable clinical signs or mortality. However, they cause severe immunosuppression if chicks are not protected by passive immunity.

The immunosuppressive effect of sub-clinical IBD decreases in intensity or vanishes as birds grow older. Therefore, in order to prevent losses arising from early challenges, it is a common practice in the poultry industry to hyperimmunise breeders (through a combination of live and inactivated vaccines) with a view to maximizing, in terms of quantity and quality, the passive immunity transferred to their progeny.



Most IBD immunoglobulins (Ig) are transferred from the egg yolk to the offspring via embryonic circulation before hatching. However, part of it is transferred after hatching through the resorption of the yolk of the egg. As a consequence, the level of maternally derived antibodies (MDAs) remains approximately stable in the first four days after hatching, regardless of their natural metabolism.

Several publications have described the percentage of IBD antibodies transferred from dams to their progeny (60-80%). However, it is not possible to assess accurately the quantity of MDAs transferred from hens to chicks without resorting to a test at day-old.

Serological monitoring via ELISA or VN tests is usually carried out in order to determine the level of maternal antibodies in young birds and to determine whether flocks are adequately protected.

The duration of the protection provided by MDAs may vary depending on the level of MDAs transferred and the breed of the chicken. Broadly speaking, the half-life of MDAs in broilers varies between 3 to 3.5 days.

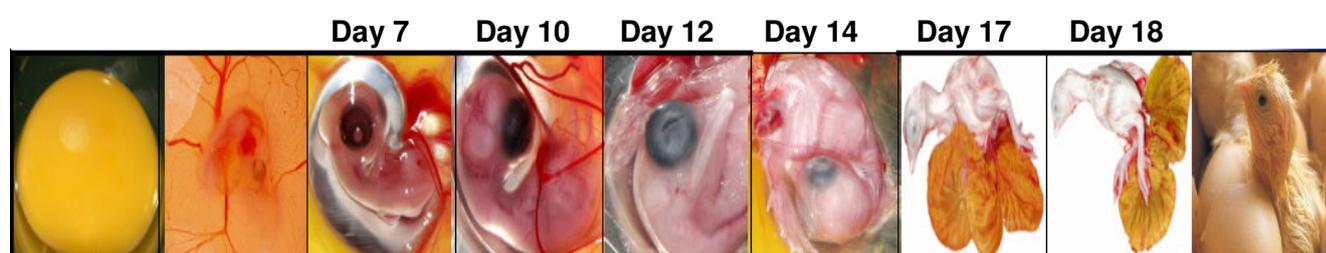
However, regarding long living birds like breeders and layers MDAs' half-life lasts 4.5 days and 5.5 days respectively.

Normally, the level of MDAs, measured by ELISA or VN tests, decreases by half per half-life time four days after hatching. Based on such information, the approximate period of time after which chicks become susceptible to IBD viruses is foreseeable.

The protective capacity of IBD passive immunity depends on several factors e.g. the type of the strain (classical or variant) and the virulence and the pressure of the virus. Usually, however, a MDA titre below 1:100 (ELISA) means that there is no more protection.

Because variants may break through a higher MDA level induced by classical strains and may cause early infections and as a consequence entail immunosuppression, in areas where IBD variant strains are present, it is necessary to vaccinate breeders with an inactivated vaccine containing homologous variant strains.

Interference of IBD Passive Immunity with IBD Active Immunisation



As with many diseases, passively acquired immunity to IBDV interferes with stimulations of active immune responses. This is a common problem for those who vaccinate against Gumboro as they always face the following issues: determining when is the right time (age) to vaccinate their flocks and determining which strain should be used to overcome MDAs in accordance with the levels of MDAs.

Timeliness regarding IBD vaccination is of the essence. On the one hand, IBD vaccines administered to chicks with a high level of MDAs will be neutralised by the antibodies. On the other hand, vaccinating a flock with a lower level of MDAs may result in that flock being left without protection and, as a consequence, the birds may become infected.

Another common issue is to determine the strain that should be used to overcome the MDAs, intermediate or intermediate plus. It is important to bear in mind that MDAs in levels exceeding the ELISA mean titre of 500 units are likely to neutralize most of the attenuated IBD vaccine strains. Therefore, vaccines of the "intermediate plus" and the "intermediate" types should be used only when the ELISA mean titres are inferior to 500 and 250, respectively. In addition, vaccines that are efficient enough to overcome MDAs in high levels may cause bursa damage in young chicks.

To address such issues, several mathematical formulas have been developed. The "Deventer formula" is among them. It was developed by The Netherlands Animal Health Service. This formula takes into account the level of MDAs (obtained by the sampling of a flock) and the types of vaccine required (i.e. intermediate or intermediate plus). The formula is based on a default percentage of 75%. That means that 25% of the birds may not get the appropriate protection as a consequence of their high levels of MDAs.

At present, a new generation of IBD vaccines is available. Such vaccines can be safely administered *in ovo* or at day-old regardless of the level of MDAs. This new generation of vaccines includes vaccines of the immuno-complex type like Cevac[®] Transmune IBD and vaccines of the vectorised type like Vectormune[®] HVT-IBD.

2. CHICKEN INFECTIOUS ANEMIA (CIA)

Importance of IBD Passive Immunity

CIA virus infections may occur vertically or horizontally. Typically, strategies in terms of CIA virus control regarding broilers are based on the natural infection of breeders by CIA viruses or flock vaccination before the beginning of egg production.

The presence of maternal derived antibodies is critical in terms of protection against vertical and early horizontal transmissions. It also reduces the population of birds hosting the virus responsible for horizontal transmissions.

Chicks without maternal CIA antibodies that become infected vertically or horizontally in the first 2 weeks of their lives may develop clinical diseases that are characterized by anemia, lymphoid depletion, hemorrhages, and immunosuppression. Chicks that benefit from passive immunity and that are infected vertically may develop sub-clinical diseases when their levels of maternally derived antibodies wane.

The half-life (VN) of CIA maternal antibodies has an approximate duration of 7 days. The protection offered by CIA passive immunity against experimental challenges lasts for three weeks approximately. However, MDAs remain detectable for up to five weeks when chicks are born to hens with a VN titer of 640 (Smith, 2006).

According to Malo & Weingarten (1995) birds should have a minimum VN titer of 9 in order to prevent horizontal infection. However, according to Markowski-Grimsrud and Schat (2003) the protective effects of CAV maternal antibodies are still present when chickens that are no longer CAV antibody-positive, as determined by ELISA, are challenged at the age of 30 days.

In comparison with flocks without MDAs, flocks with passive immunity regarding CIA may yield better economical results as a consequence of an improved survival rate, bodyweight and a better FCR. Therefore, the main reason to vaccinate breeders before the onset of their egg production is to ensure that the progeny will have high and uniform levels of protective passive antibodies.

Marek's Disease

Regarding commercial chicks, maternally derived antibodies to all MD viral serotypes are ubiquitous. This situation is a consequence of the natural exposure of breeders to MD viruses and/or the vaccination of breeders via serotype 1, 2 and 3 viruses.

When a flock of chicks lacks passive immunity regarding Marek's disease early mortality syndromes and also transient paralysis may be observed.

Passive antibodies reduce and delay MD mortality and virtually all other manifestations of the disease, probably by hindering the spread of the virus within the tissues during the first few days following the exposure to the virus.

The adverse effects of homologous MDAs on vaccination are generally known. MDV antibodies interfere with (cell-free) HVT vaccines at a low level and delay the viremia phase of vaccine virus. Thus, unlike some other virus infections, passive antibodies do not provide a sterilizing immunity, and antibody-positive chickens may be infected and vaccinated successfully, albeit with reduced responses.

CONCLUSION



The passive immunity is protective during the first 2 to 5 weeks for most of the viral diseases in chickens. The protective capacity and the duration depend on the level of MDAs transferred. Therefore, accurate and uniform immunization of the breeders is fundamental in order to provide high and uniform titers in day-old chicks.

The MDAs interfere also with active immunization with live vaccines. Therefore, this should be considered in the set up of a vaccination program. Despite of MDAs interference, some vaccines are used in the presence of high passive immunity with objective to stimulate the local protection.

Figure 1: MDAs protection and interference with active immunization for the major viral diseases in chickens.

Disease	Protective	Interfere with active immunization
Newcastle Disease	Yes	Yes
Infectious Bronchitis	Yes	Yes
Infectious Laryngotracheitis	No	No
Avian Influenza	No	Yes
Infectious Bursal Disease	Yes	Yes
Chicken Infectious Anemia	Yes	No Info
Egg Drop Syndrome	Yes	Yes
Avian Encephalomyelitis	Yes	Yes
Viral Arthritis (Reovirus)	Yes (1 st day)	No Info
Marek's Disease	No	No

Source: Disease of Poultry, 11th Ed;

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