In-feed solutions to enhance vaccination efficiency

Vaccination plays a vital role in health management of all poultry species – with growing importance since the ban on the use of antibiotic growth promoters – and is an important tool to reduce the use of therapeutic antibiotics.

by Valentine Van Hamme, Kemin, Belgium. www.kemin.com

The primary reason for vaccinating poultry is to minimise the losses due to morbidity and mortality caused by all kind of pathogens. A vaccine helps to prevent a disease by boosting the animals' immune system to produce antibodies that, in turn, fight the invading pathogen, protecting them against disease caused by this specific invader.

Certain diseases are too widespread or difficult to eradicate and require a routine vaccination program. However, vaccination can never provide 100% protection against infectious diseases. It is only one, but a very important, part of a complex preventive policy, of which biosecurity, hygiene and nutritional programs are equally essential components.

Unfortunately, vaccination does not always mean efficient protection. There are a lot of factors determining vaccination efficiency. A vaccination failure is defined as: 'when the animals do not develop adequate antibody titer levels and/or are susceptible to a field disease outbreak, following vaccine administration'. Often the vaccine is blamed, but a lot can go wrong in between vaccine development and preparation, and the production of protective antibodies by the animal, so other factors need to be considered, such as:

- Vaccination program is not adapted to the flock's health situation.
- Wrong administration or handling of the vaccine.
- Interference of maternal antibodies with the vaccine strain.
- Poor management.
- Sanitary status: birds are already infected.
- Vaccine quality or strain is not up to date.
- Impaired immune response of the animal due to stress/disease.
- Immunosuppression in YOPI (young/old/pregnant/immuno-deficient) group.

Managing those interfering factors is not easy but is feasible. A tool in improving vaccination efficiency, not systematically used yet, is the use of an in-feed supplementation modulating the immune system.

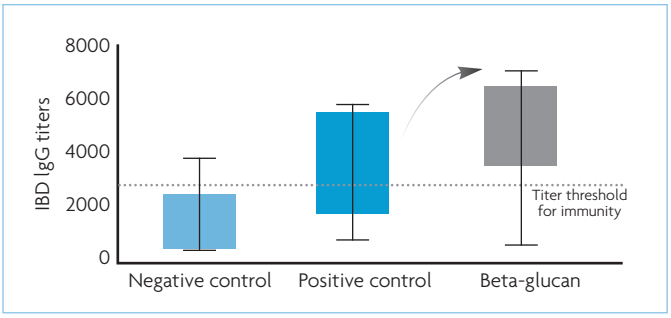


Fig. 2. IBD IgG titers (ELISA units) per treatment at day 35 in relation to the titer threshold for protective immunity.

Research has shown that response to vaccination can be improved by using immune modulating ingredients administered through the feed, such as beta-glucans.

Vaccination and beta-glucans

Beta-glucans are polysaccharide structures found in bacteria, fungi, algae and plants. Those structures can be recognised by a receptor located on immune cells. After recognition, a further immune modulating effect is induced.

Consequently, innate as well as acquired immune responses are fortified. For vaccination in poultry species, usually a slightly deactivated but live pathogen is orally supplied to the bird. This antigen is recognised by the immune system and, as a response, antibodies against that pathogen are produced, protecting the animal against a future threat by this invader.

As vaccination relies on the well-functioning of the immune system, the use of an immune modulating substance, which fortifies innate and acquired immune responses, is beneficial in enhancing vaccination efficiency. A perfect candidate for such an in-feed supplementation is a beta- (1,3)-glucan derived from a new and unique source; an alga, called Euglena gracilis. Several trials have been performed to gain experience in the effectiveness of this algal derived beta-(1,3)-glucan enhancing antibody titers in response to vaccination.

Enhancing IBD vaccination efficiency

One of the most common viral infections in chickens is infectious bursal disease (IBD) (or Gumboro disease) and is caused by the IBD virus, which destroys B-lymphocytes in the bursa of Fabricius leading to immunosuppression and, consequently, poor performance with significant economic impact.

Vaccination is most important in aiding in IBD prevention and control. Any solution that could enhance the vaccine efficiency is worth trying. Therefore, a scientific trial was conducted to test the effect of an algal beta-glucan on IBD vaccination. Some 96 male Ross 308 broilers were divided over three treatments: a negative control group, a positive control group and an algal beta-glucan (Aleta) group (Table 1).

The broilers were orally vaccinated on day 18 with a live freeze-dried IBD vaccine. To monitor vaccination efficiency, blood samples were taken at day 18 and 35 to measure antibody titers (IgG) against IBD.

Measuring antibody titers on day 18 is important to detect if maternal antibodies, which can interfere with the vaccine, are still present, consequently making the bird not susceptible for the vaccination.

During this trial we could observe a

Continued on page 13

Fig. 1. Positive animals after vaccination.

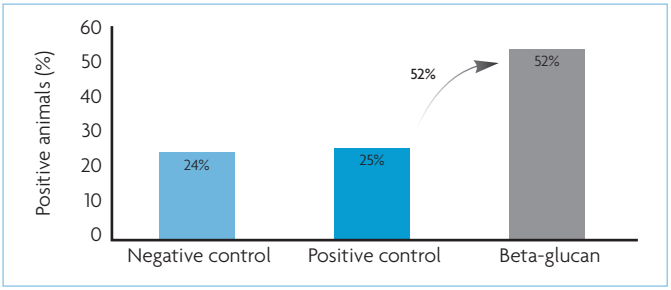


Table 1. Treatments.

Treatments	Starter (0-21 days)	Grower (22-42 days)	Vaccination
Negative control	–	–	–
Positive control	–	–	+
Aleta-50	50g/ton	50g/ton	+

Continued from page 11
16% higher IBD specific antibody titer (IgG), and 52% more positive birds, in response to vaccination, in the algal beta-glucan supplemented group compared to the non-supplemented, vaccinated group (positive control).

The negative control group, although not vaccinated, also showed some positive (vaccinated) birds, but with lower average antibody titers, as we could not fully stop the spread of the vaccine virus in the house.

The algal beta-glucan group showed that 52% of all susceptible birds at time of vaccination (without maternal antibodies), reacted positively to the vaccination with an average IgG titer of 4,564 ELISA units.

The positive control group consisted only of 25% of all susceptible birds at time of vaccination with a positive response to the vaccination with an average IgG titer of 3,906 ELISA units.

Consequently, algal beta-glucan supplementation can enhance IBD vaccination efficiency.

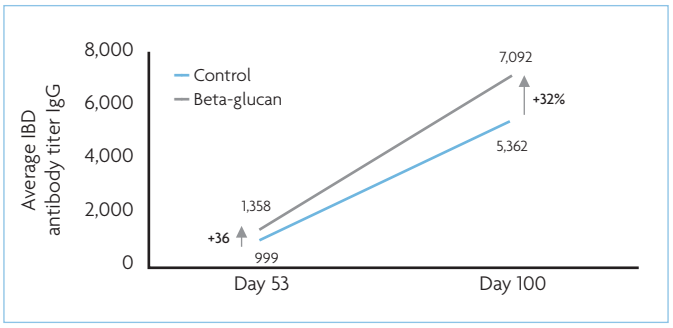


Fig. 3. Average HEV antibody titer (IgG).

Enhancing HEV vaccination efficiency

Another important disease in poultry production is Haemorrhagic enteritis (HEV). It is caused by an adenovirus and it targets young turkeys, causing an acute haemorrhagic gastro-enteric disease (clinical), but also suppresses the immune system (subclinical). Disease prevention and control is mainly performed by vaccination.

At a commercial farm, the effect of an algal beta-glucan on HEV vaccination was monitored. The farm contained two houses, one supplied with the algal beta-glucan (100g/ton Aleta), the other not.

All animals were orally vaccinated at day 28 with a live attenuated vaccine, and antibody titers in response to the vaccine were monitored at 53 and 100 days.

At 25 and 72 days after vaccination the antibody titers (IgG) in response to vaccination were respectively 36% and 32% higher in the algal beta-glucan supplemented group compared to the non-treated group.

Due to the improved immune status and disease resistance, mortality was reduced by 32% in the supplemented building compared to the control building.

Consequently, this farm is using algal beta-glucan supplementation as a part of their vaccination program.

Enhancing ND vaccination efficiency

Newcastle disease (ND) is a very contagious viral disease in poultry. Clinical signs depend on the virulence of the strain and the health status of the bird.

To prevent outbreaks and disease spread, vaccination is obliged in European countries.

Turkeys are vaccinated at two or three weeks of age and at eight weeks of age with an inactivated vaccine. Unfortunately, vaccination is not always providing the desired protection level. Consequently, all tools to support turkeys during those intensive vaccination programs are explored.

ND vaccination efficiency was monitored in two comparable turkey farms, by measuring the specific antibody (Ig) titers in response to vaccination for ND. One farm is using algal beta-glucan in feed during the full production cycle, the other farm not. A standard vaccination scheme was performed on both farms.

Blood samples were taken at 100 days of age and analysed for Newcastle disease virus (NDV) IgG titer. Again, the beta-glucan supplied farm showed higher average antibody titers compared to the non-supplemented farm, showing algal beta-glucan could be used as a supportive tool for vaccination programs in commercial turkey production.

Fig. 4. Cumulative mortality (%) at the end of the fattening period.

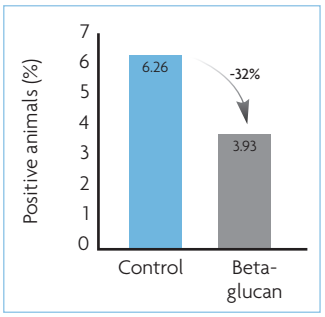
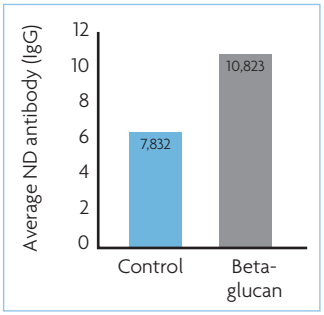


Fig. 5. Average Newcastle disease antibody titer (IgG).



Conclusion

Vaccination is gaining more and more interest in disease control and prevention. All tools to improve vaccination efficacy are welcome.

A tool not systematically used yet, but needs to be taken into consideration, is the in-feed supplementation of algal derived beta-glucans. They modulate the immune system, preparing it for a response to immunisation, consequently increasing vaccination efficiency. ■