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Introduction

The use of ELISA serology in Poultry Health Management has been shown to be a useful tool to monitor the immune response following vaccination. Often the veterinarian judges the success of a vaccination by looking at two main components of a vaccination response: the Mean Titer Response (mean antibody level of a flock) and %CV (value that measures uniformity). As the relationship between Mean Titer and % CV is important for evaluation of vaccine responses, the idea was born to look at the ratio between Mean Titer and % CV. The ratio between mean titer and % CV was expressed in a new parameter, Vaccination Index (VI) :

$$VI = \frac{(\text{Mean Titer})^2}{(\text{St Dev} \times 100)} = \frac{\text{Mean Titer}}{\% \text{ CV}}$$

The VI seems to be a logical parameter, as VI is expected to give a high score with a good vaccination (high mean titer, low % CV) and a low score with a poor vaccination (Low Mean Titer, high % CV).

In order to test the concept of VI, vaccination results from flocks were examined after live IBV and NDV vaccination. The VI for all the flocks were calculated for healthy non-infected flocks and for confirmed clinically infected flocks after live and/or inactivated vaccination.

Materials and Methods

In total more than 500 individual broiler flock results for BioChek ELISA were examined following different live IBV, NDV, and IBD vaccination schedules. Also before - and post-Infection Titer results were compared from 3 Broiler Breeder flocks for IBV after live priming and inactivation. Selection of flocks were based on the following criteria:

1. Mean titers in expected range for normal flocks and significantly elevated titers for clinically infected flocks.
2. Presence and absence of clinical symptoms to differentiate between normal healthy flocks and clinically infected flocks.
3. Reference controls were used and were in range, indicating proper reproduction of ELISA titers.

Results

Results are summarized in table 1 for IBV, table 2 for NDV, table 3 for IBD in broiler flocks, and table 4 for broiler breeder flocks.

Table 1. Vaccination Index (VI) results for live IBV vaccinated Broilers at 35-45D.

Vaccination Program	VI Normal	VI Clinical Infection
H120, IB primer, Ma5	10-90	>100
H120 + CR88 or 4/91	50-200	>200

Table 2. Vaccination Index (VI) results for live NDV vaccinated Broilers at 35-45D.

Vaccination Program	VI Normal	VI Clinical Infection
up to 3x live Clone 30, VH, Hitchner B1, LaSota, Avinew, NDW	20-250	> 300
Inact 01D + 3x live	50-280	> 300

Table 3. Vaccination Index (VI) results for live IBD vaccinated Broilers at 35-45D.

Vaccination Program	VI Normal	VI Suspect Infection
Bursine2, Bursine Plus 1-2x	50-300	> 300
Gallivac IBD, D78 1-2X, Avipro Precise	100-400	> 500
Cevac IBD L , Bursa F ,Hipra GM97 1-2 X	100-500	> 500
Avipro IBD extreme 1-2x	200-500	> 500
228E 1-2x	200-550	> 600
Tabic MB 1-2x	200-600	> 700
Vaxxitek @ 01D S.C./ or In-Ovo @ 18D incubation	10-90	> 200
Cevac Transmune IBD @ 01D S.C./ or In-Ovo @ 18D incubation	100-500	
Bursaplex @ 01D S.C./ or In-Ovo @ 18D incubation	100-500	

Table 4. Vaccination Indexes (VI) of live primed and inactivated IBV vaccinated Broiler Breeder flocks before and after IBV infection. Age of BB flocks before infection was 34-52W. Post-Infection titers taken at 3-6 W after first clinical symptoms.

Mean Titer		% CV		VI	
Before Infection	After Infection	Before Infection	After Infection	Before Infection	After Infection
4850	16036	75	38	65	425
5288	15145	46	15	115	1010
5937	23456	58	28	102	838

Discussion & conclusions

The above data shows that the Vaccination Index (VI) can be helpful to differentiate between:

1. Good vaccination responses (high VI score) and poor vaccination responses (low VI score).
2. Normal vaccination responses and possible field challenges of vaccinated flocks.

Traditional ELISA evaluation of vaccination responses include the comparison of obtained mean titer results with the expected mean titers after vaccination, the so called “vaccination baselines”.

As the VI score takes Mean Titer response and % CV in to account, it can make serological ELISA evaluation of vaccination more simple and complete than looking at “baseline titers” alone.

Also, the VI score has a logical dimension, in the fact that increasing scores indicate better and stronger immunological responses after vaccination and/or infection.

Although the data show that excessive VI scores seem to correlate well with the presence of a field challenge after vaccination, it should be stressed, however, that VI scores by itself, cannot be used to establish diagnosis. **Diagnosis can only be established when one combines VI scores with clinical symptoms and isolation of the pathogen and/or confirmation testing with PCR.**

Table 5. Vaccination Indexes (VI) of vaccinated BB flocks from 5 different operations.

Test	VI Index BB at Age in Weeks			
	14W-18W	22W-24W	30W-40W	45W-60W
IBD	100-500	300-1500	300-1000	200-1000
NDV	100-400	300-2000	300-1000	200-1000
IBV	50-300	50-300	50-300	50-200
REO		200-800		
CAV	100-300	100-250	100-200	
AE	50-500			
ART		100-500	50-300	50-250