Polish Journal of Veterinary Sciences Vol. 19, No. 2 (2016), 425–427

DOI 10.1515/pjvs-2016-0053

Short communication

Practical aspects of estimation of optimal time for vaccination of chicken against IBD with use of „Deventer formula"

M. Śmiałek[1], A. Śmiałek[2], A. Koncicki[1]

[1] Department of Poultry Diseases, Faculty of Veterinary Medicine, University of Warmia and Mazury, Oczapowskiego 13, 10-719 Olsztyn, Poland
[2] Private Veterinary Practice „Punkt Weterynaryjny", Leszczynek 11A, 99-300 Kutno, Poland

Abstract

One of the most commonly applied vaccination strategies against chicken infectious bursal disease (IBD) is the use of live vaccines at the optimal time estimated with the use of Deventer formula. The present study investigated the impact of different factors on maternally derived antibodies decline and therefore on the vaccination schedule against IBD. Our results suggest that blood collection from birds older than 3 days is more reliable in order to estimate the optimal date for IBD vaccination, due to disturbances in yolk sac resorption early after hatch.

Key words: chickens, Gumboro disease, vaccination, Deventer formula

Introduction

Infectious bursal disease (IBD), also known as Gumboro disease, is a highly infectious, viral (IBDV belongs to the *Birnaviridae* family) disease of chickens. The greatest susceptibility to the clinical course of IBD is observed in birds infected between 3 and 6 weeks of age (Müller et al. 2012) which results from the maturation of B lymphocytes (target cells for IBDV) in the bursa of Fabricius. While in older birds the damage caused by IBD is less prominent, IBDV infection of 3-6 week old and younger poults is responsible for immunosupression resulting from B cell depletion (Müller et al. 2003, Withers et al. 2005). Considering the above and IBDV worldwide distribution as well as their great resistance to environmental and chemical agents, IBD is one of the most economically important diseases of chickens.

A number of IBD vaccination strategies have been applied in the field and new generation IBD vaccines (vector and complex vaccines) are available on the market (Müller et al. 2012). So far, one of the most commonly applied vaccination strategies of broiler chickens is the application of live conventional vaccines, characterized by different maternally derived antibodies (MDA) titer break – through (most commonly 250 or 500). The basic assumption of „Deventer formula" is that serological examination of chicken poults enables determination of the optimal day for vaccination of chickens against IBD with the use of known MDA half-life (de Wit 2001). Recent studies demonstrated the significance of Deventer formula

Correspondence to: M. Śmiałek, e-mail: marcin.smialek@uwm.edu.pl

Table 1. Summary of origin of broiler chickens examined within the study.

Province	Number of cases
Mazowieckie	76
Wielkopolskie	18
Warmińsko-Mazurskie	16
Świętokrzyskie	13
Łódzkie	11
Opolskie	2
Total	136

use in vaccination strategy against IBD (Block et al. 2007).

Materials and Methods

The study was carried out with broiler chicken (from 136 broiler houses) blood samples (20-23 blood samples from each broiler house were examined), collected between September 2014 and July 2015. Each broiler house originated from a different Polish breeder flock situated in 6 different provinces (Table 1). Broilers were hatched at 8 different commercial hatcheries. Serum samples were stored at -20°C until analysis.

Serological examination of serum samples was performed with a commercial ELISA kit specific for detection of chicken anti-IBD antibodies (IDEXX, USA) according to the manufacturer's instructions. ELISA was carried out using an Eppendorf epMotion 5075 LH automated pipetting station (Eppendorf, Germany), BioTek ELx405 automatic plate washer and BioTek ELx800 plate reader (BioTek, USA). Estimation of the optimal time for IBD vaccination with the use of intermediate plus vaccine („500" – MDA break-through titer = 500) was established according to the basic assumptions of Deventer formula (all results had CV% < 40) (de Wit 2001). The results were expressed as percentages of cases of vaccination on different days of broiler life. Results were also analyzed based on the birds age at blood sampling (0-3 or 4-7 days of life), the hatchery from which the birds originated and the distance between the hatchery and the broiler house (different ranges were considered: 0-60; 60-120; 120-180; 180-240; 240 km and more).

Results and Discussion

The general layout of the optimal day for vaccination of broiler chickens against IBD with the use of intermediate plus vaccine is summarized in table 2. Block et al. (2007) demonstrated that vaccination against IBD 24 hours before or 3 days after the estimated optimal time for vaccination resulted in a satisfactory serological response (14 days post vaccination) in evaluated chicken flocks. In the field „500" vaccines are most often given to birds on the 16th day of life, as a routine, in cases where Deventer formula is not implemented. In the light of the above these routine vaccinations would result in satisfactory vaccine-induced immunity in 66.39% of the analyzed cases where birds were still protected by the MDA (in regard to vaccinal MDA break-through; 16-17th day of life) and in 97.79% of the cases in general (13-17th day of life). On the other hand in 30.89% of the analyzed cases, vaccination on the 16th day of life is later than the estimated date of vaccination (10-15th day of life) which generates a threat of production loss due to early infection with field IBDV.

Since reports concerning the application of Deventer formula in the field are scare our goal was to investigate the possible impact of different factors (hatchery practices, transport and accommodation period) on MDA decline, and therefore the optimal day for vaccination of broilers against IBD. The layout of estimated optimal days for vaccination of broiler chickens against IBD in regard to the sampling age is summarized in table 2. In the light of the results of Block et al. (2007), our findings indicate that the 16th day vaccination routine would result in satisfactory vaccine-induced immunity in 79.01 and 54.71% of the analyzed cases where birds were still protected by the MDA (in regard to vaccinal MDA break-through; 16-17th day of life) and in 98.76 and 100% of the cases in general (13-17th day of life) if blood samples were collected 0-3 or 4-7 days after hatch respectively. The above data indicate that the accommodation period and other factors interfering with yolk sac resorption influence the outcome of chicken anti – IBD serum MDA level, which may affect vaccination schedule and efficiency.

No differences have been observed in the distribution of optimal days for vaccination of broilers against IBD in regard to the hatcheries and the distance between the hatchery and the broiler house (data not shown) after implementation of sampling age-related differences.

Table 2. Layout of estimated days of vaccination of broiler chickens against IBD (based on „Deventer formula" protocol) within analyzed cases.

Bird age at estimated time of vaccination	Number of cases	Percentage of cases
10	2	1.47
11	0	0
12	0	0
13	2	1.47
14	11	8.10
15	27	19.84
16	54	39.71
17	39	28.67
18	1	0.74
Total	136	

Table 3. Layout of estimated days of vaccination of broiler chickens against IBD within analyzed cases, in regard to bird age at time of blood sampling.

Birds age at blood sampling (number of cases)	Percentage (number) of cases of vaccination against IBD at different age of birds – days of life[a]					
	13	14	15	16	17	18
0-3 (81)	0	1.23 (1)	18.52 (15)	44.44 (36)	34.57 (28)	1.23 (1)
4-7 (53)	3.77 (2)	18.87 (10)	22.64 (12)	33.96 (18)	20.75 (11)	0

[a] Two cases in which vaccination was estimated on the 10th day of life were not included (blood samples in those cases were collected on the 4th and 7th day of bird life).

In conclusion, Deventer formula is a powerful tool which enables precise estimation of the day of vaccination of chicken flocks against IBD. Despite the fact that this formula enables blood sampling between 1-10 days after hatch, our results suggest that collection of blood samples from birds older than 3 days is more accurate and reliable for estimating the optimal date of IBD vaccination.

References

Block H, Meyer-Block K, Rebeski DE, Scharr H, de Wit S, Rohn K, Rautenschlein S (**2007**) A field study on the significance of vaccination against infectious bursal disease virus (IBDV) at the optimal time point in broiler flocks with maternally derived IBDV antibodies. Avian Pathol 36: 401-409.

de Wit S (**2001**) Gumboro Disease: estimation of optimal time of vaccination by the deventer formula. Annual Report and Proceedings of COST Action 839: Immunosuppressive Viral Diseases in Poultry, pp 170-178.

Müller H, Mundt E, Eterradossi N, Islam MR (**2012**) Current status of vaccines against infectious bursal disease. Avian Pathol 41: 133-139.

Müller H, Islam MR, Raue R (**2003**) Research on infectious bursal disease – the past, the present and the future. Vet Microbiol 97: 153-165.

Withers DR, Young JR, Davison TF (**2005**) Infectious bursal disease virus – induced immunosupression in the chick is associated with the presence of undifferentiated follicles in the recovering bursa. Viral Immunol 18: 127-137.