

Vaccination of chickens against *S. enteritidis* with the *S. gallinarum* 9R strain

Maarten Witvliet, Tanja Mols-Vorstermans, Luc Wijnhoven
Intervet International, Boxmeer, The Netherlands

Introduction

The *S. gallinarum* 9R live vaccine strain, which has been developed by Williams Smith, has been used safely and effectively for the prevention of fowl typhoid for many years. Previous work has shown that vaccination with the 9R strain will induce cross-protection against *S. enteritidis* under laboratory conditions (Barrow et al. (1991) Avian Path. 20, 681-692). This finding was confirmed in a large field study in 80 commercial layer flocks with a high risk for *S. enteritidis* infection in The Netherlands (Feberwee et al. (2001) Avian Dis. 45, 83-91). In the same study, safety and spread of the vaccine strain were evaluated (Feberwee et al. (2001) Avian Dis. 45, 1024-1029). The flocks had been vaccinated subcutaneously (s.c.) at the rearing farm at 6 and 14-16 weeks of age. A significant reduction in *S. enteritidis* positive flocks was observed and no spread of the vaccine strain or shedding into eggs was detected. In the present work, the effect of vaccination with the 9R strain on egg contamination with *S. enteritidis* was tested. In addition, the efficacy of several vaccination schemes was assessed.

Protection against egg contamination

Chickens were vaccinated s.c. with Nobilis SG 9R at 6 and 18 weeks of age. The vaccine was used at the minimal dose level, which is 2×10^7 CFU. Twenty-eight vaccinated laying hens and 30 unvaccinated controls were housed individually in cages and infected orally with a *S. enteritidis* PT4 field strain (6.8×10^8 CFU) at 23 weeks of age. All eggs laid in the 3-week period following challenge were cultured for the challenge strain. Cloaca swabs were taken weekly and the animals were necropsied at 26 weeks of age. At that time spleen, liver and cecum were cultured.

Figure 1. Reisolation of the challenge strain from eggs after oral challenge at 23 weeks of age. Vaccinates received two s.c. injections with Nobilis SG 9R at 6 and 18 weeks of age.

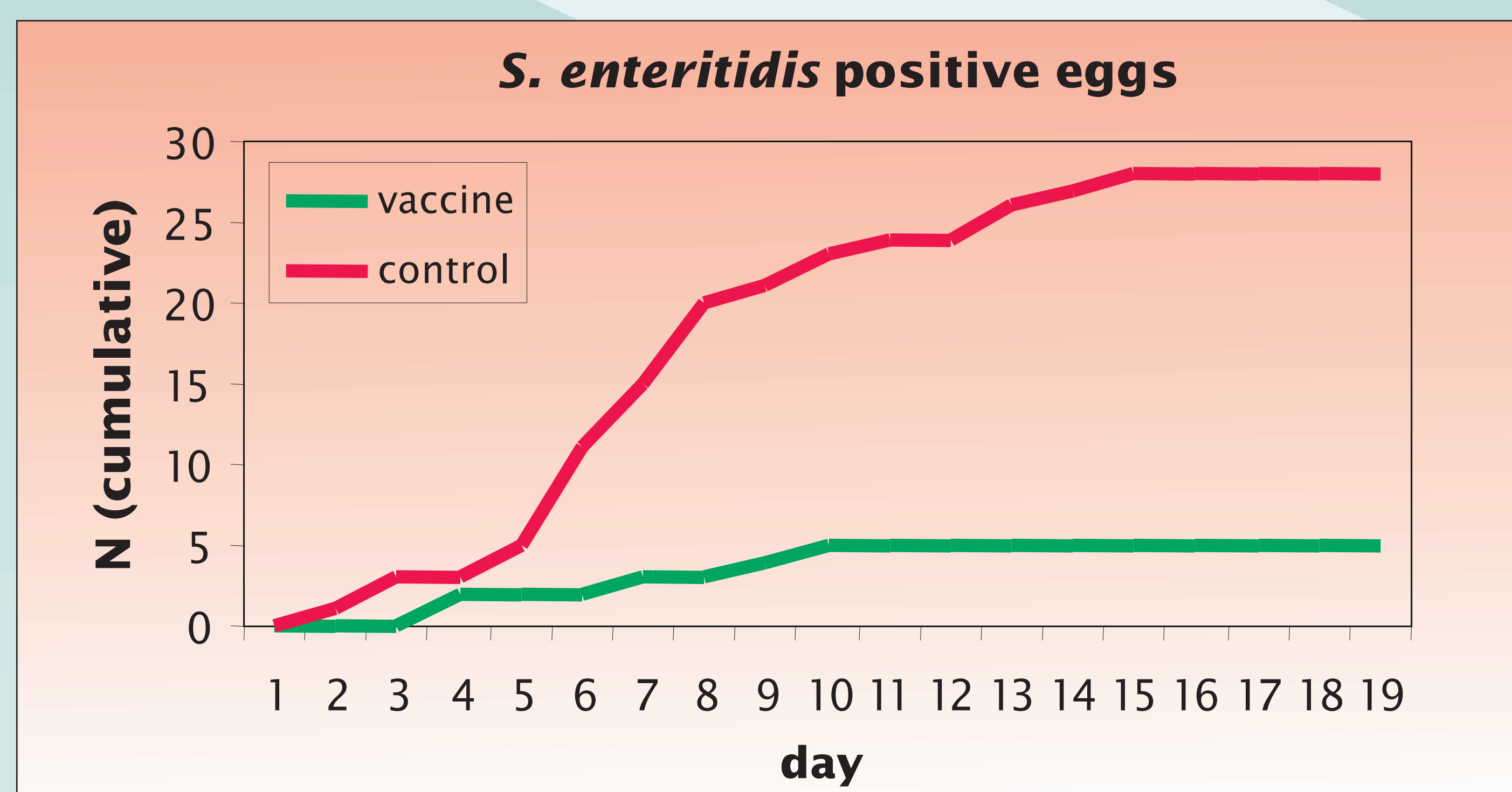


Table 1. Reisolation rates of the challenge strain after oral challenge at 23 weeks of age.

	<i>S. enteritidis</i> positive			
	Vaccine		Control	
Cloaca (1 wk)	4/28*	14%	12/30	40%
Cloaca (2 wk)	0/28	0%	0/30	0%
Cecum (3 wk)	3/28	11%	4/30	13%
Liver (3 wk)	3/28*	11%	21/30	70%
Spleen (3 wk)	2/28*	7%	24/30	80%
Chickens	10/28*	36%	28/30	93%
Eggs	5/479*	1%	28/503	6%

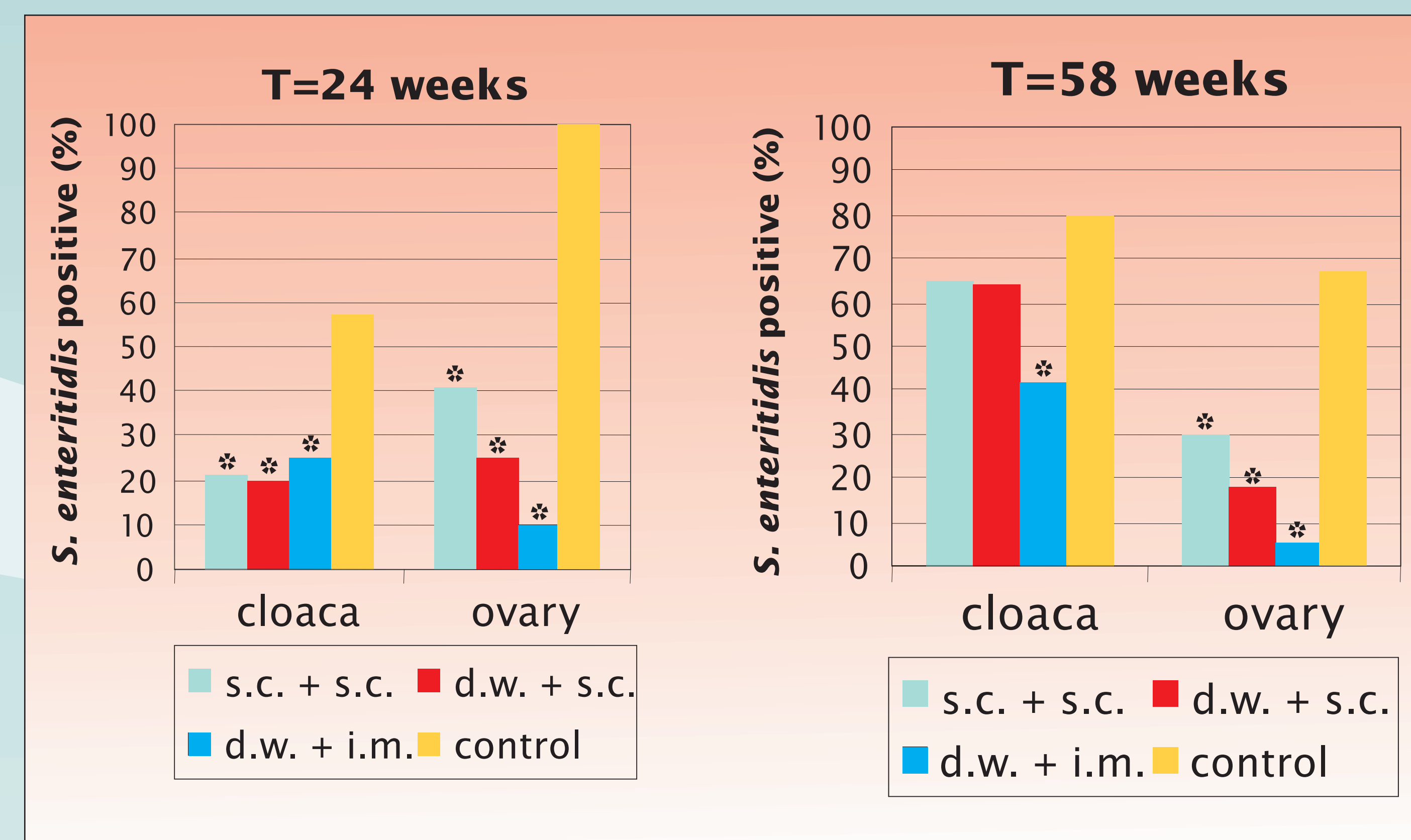
*: significantly different from control ($p < 0.05$)

Oral challenge with a *S. enteritidis* PT 4 strain resulted in detectable shedding of the challenge strain in the feces for 1 week and the production of a number of *S. enteritidis* positive eggs (Figure 1, Table 1). Almost all positive eggs were laid within 14 days after challenge infection. The percentage positive eggs in the vaccinated group (1.0%) was significantly lower than that in the control group (5.6%). At necropsy three weeks after oral infection, the challenge strain could still be isolated from the internal organs of 86.7% of the controls and 25.0% of the vaccinates. In total, 35.7% of the vaccinates and 93.3% of the controls were positive for the *S. enteritidis* challenge strain in one or more samples taken during the study.

Efficacy of alternative vaccination schedules

Three groups of 40 laying hens housed on litter were vaccinated with Nobilis SG 9R strain either by drinking water (d.w.) or s.c. at 6 weeks, followed by an s.c. or i.m. booster vaccination at 18 weeks. At 23 or 57 weeks of age, 20 vaccinated animals and 20 unvaccinated controls were challenged with *S. enteritidis* PT4 (simultaneously orally and i.m., $\pm 5 \times 10^8$ CFU), followed by necropsy 1 week later.

Figure 3. *S. enteritidis* colonization one week post oral and i.m. challenge at 23 or 57 weeks of age. Chickens had received Nobilis SG 9R at 6 and 18 weeks of age by the indicated vaccination schedule.



*: significantly different from control ($p < 0.05$)

After oral and i.m. *S. enteritidis* challenge at 23 weeks of age, the challenge strain was isolated from the ovaries of all the control animals and from cloacas of the majority of them (Figure 3). All vaccination schedules induced a significant reduction in ovary infection and fecal shedding. There were no statistically significant differences between the tested vaccination schedules. After challenge at 57 weeks of age, protection against ovary infection was still significant for all groups.

Conclusions

It was shown that vaccination of laying hens with Nobilis SG 9R during the rearing period will result in a reduction in contaminated eggs after *S. enteritidis* infection. Protection can be induced by various vaccination schedules. As the *S. gallinarum* 9R strain is non-flagellated, serological monitoring based on antibodies to the *S. enteritidis* flagellin is still possible.