NCDVAC

Evaluation of new vaccines and development of appropriate vaccination schedules for Newcastle disease

9th Animal Health Symposium – 26/03/24

Evaluation of the current serological status of hobby birds

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Recruitment of participants

29 hobby flocks sampled:

- 11 sampled on-site
- 18 sampled at slaughterhouse

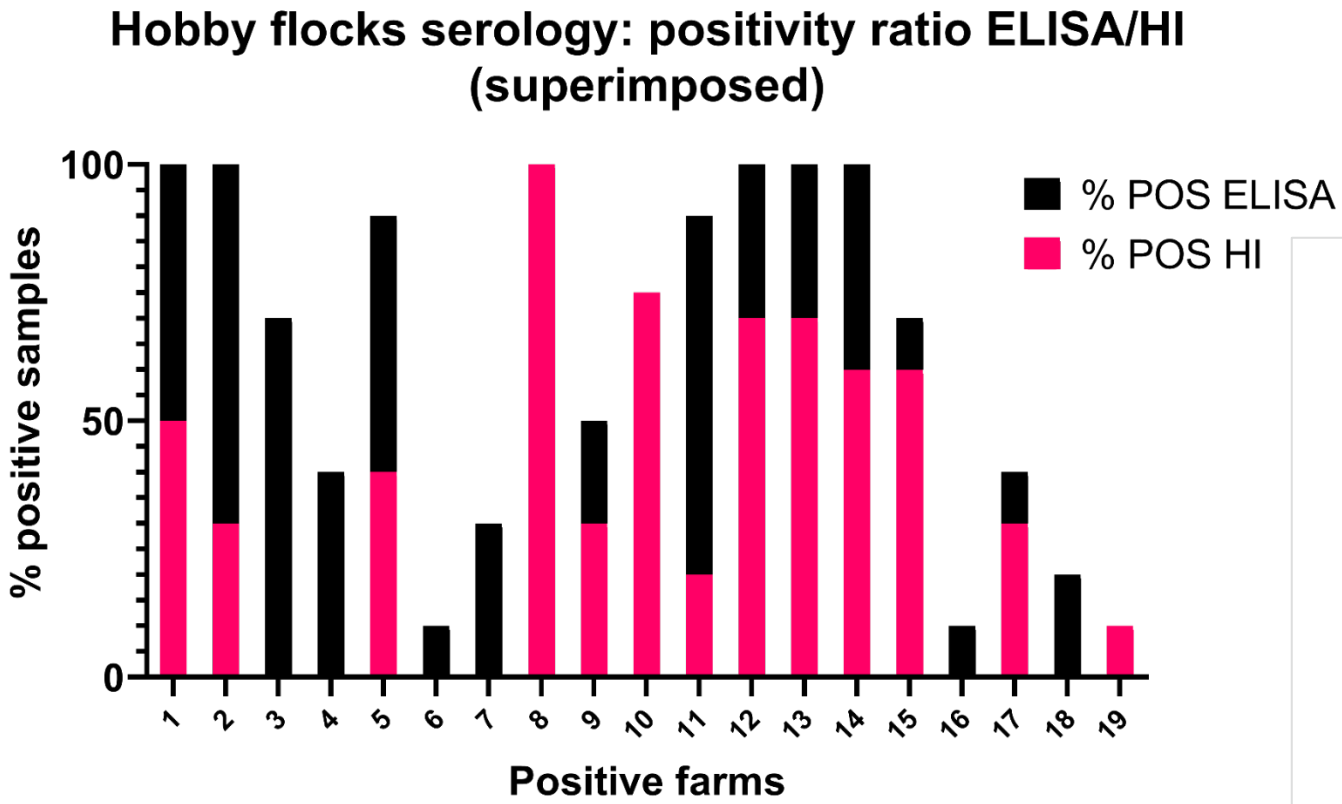
Province	Number of flocks (owner, n=11)	Number of flocks (slaughterhouse, n=18)
Hainaut	2	0
Liège	2	0
Luxembourg	2	16
Namur	4	1

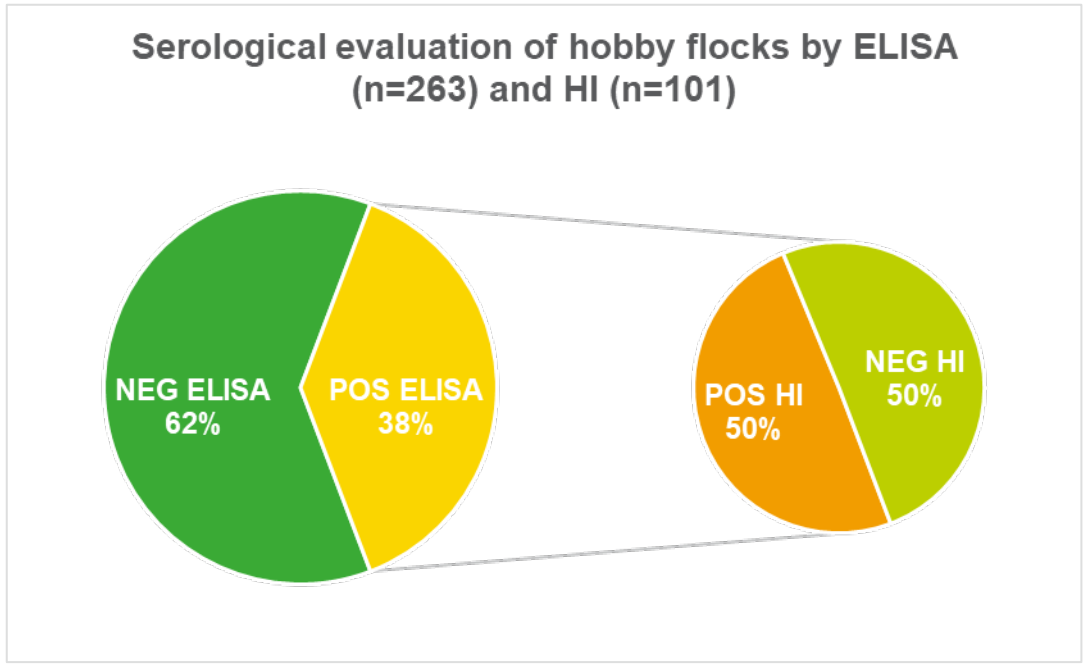
All flocks sampled on-site:

- **Had an outside access**
- **Were not re-vaccinated (anterior vaccinal status unknown)**
- Type of chicken is unknown

Serological evaluation

19 flocks (9 from slaughterhouse) with at least 1 positive case (ELISA)





- Discrepancies between ELISA and HI results

Key messages

38% of birds with ND antibodies → **Half were older than 1 year**

- **Potential residual antibodies elicited by anterior vaccination**
- **Possible contact with wild birds**

Perspectives

- Better understanding of observed immunity levels
- Potential role of wild birds: assessment of the circulation of NDV

Development of alternative vaccination approaches in layer and broiler chickens

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Vaccinal protection of Belgian poultry – Snapshot evaluation

SPF/FOD funded research

- Long living birds
  - ❖ General detection of humoral IR (3x vaccinated)
  - ❖ No morbidity / mortality
  - ❖ Excretion – Transmission to sentinels

Clinical protection - Risk of silent circulation

~ Antigenic mismatch of vaccine

- Short living birds
  - ❖ Poor humoral IR (2x vaccinated live)
  - ❖ Minimal clinical protection

    Mortality + systemic infection
  - ❖ Excretion – Transmission to sentinels

Poor efficacy - Ineffective vaccinal output

~ MDA-interference

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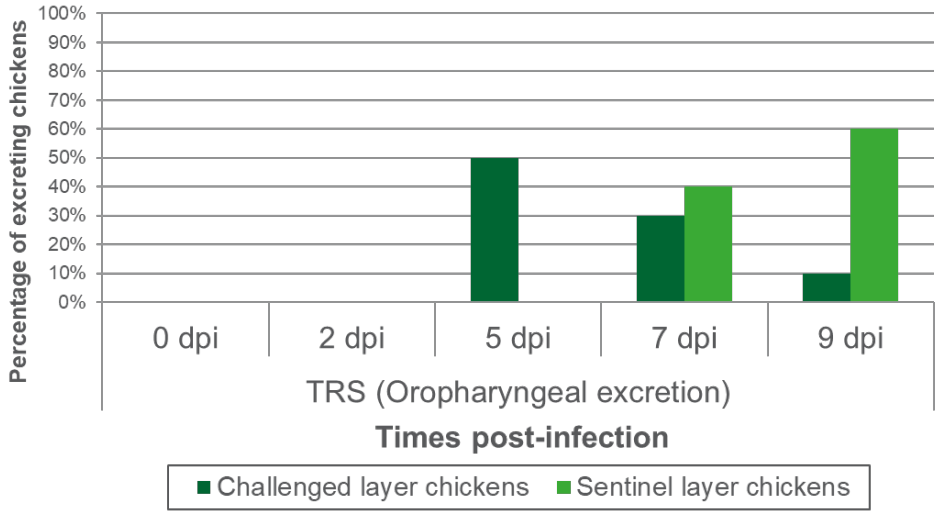
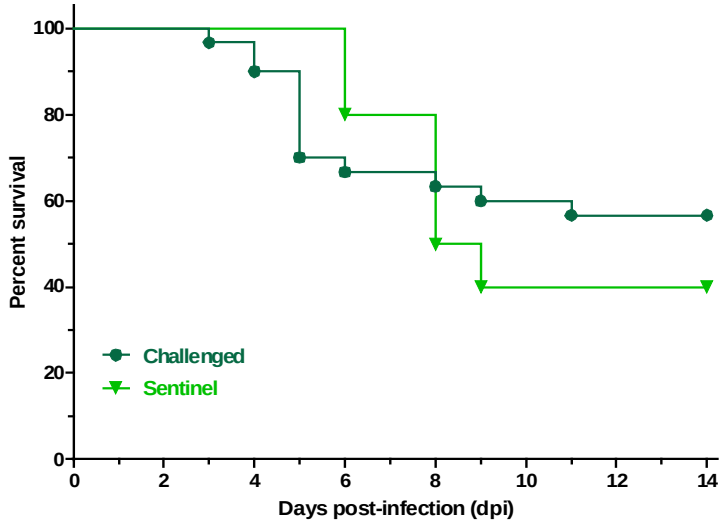
Commercial layer chickens challenge: viral excretion



Commercial broiler chickens challenge: survival rate



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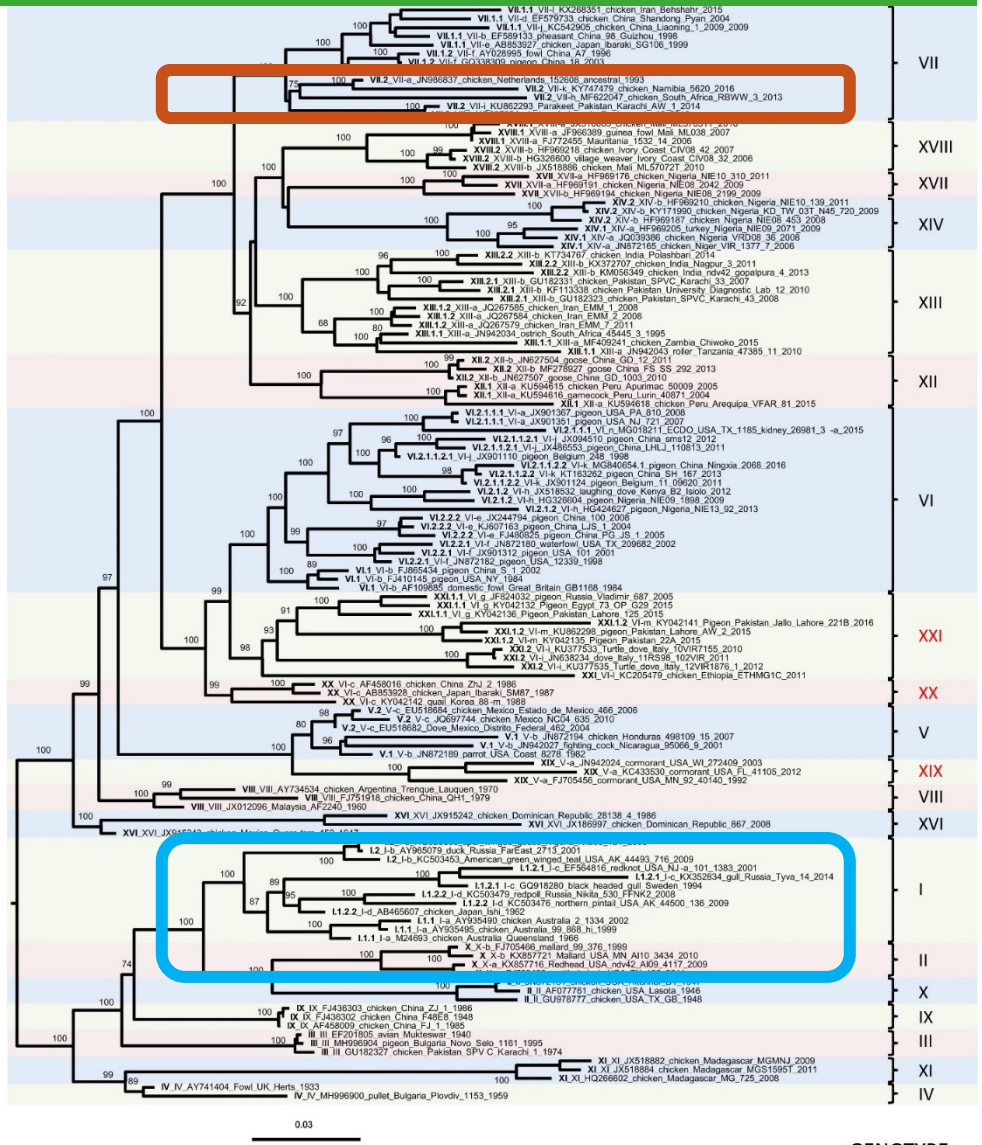
The genetic gap between vaccinal and wild strains

- Genetic gap:
  - 2018 BE field strain: genotype VII.2
  - Vaccinal strains: genotypes I or II
- ➢ Antigenic mismatch

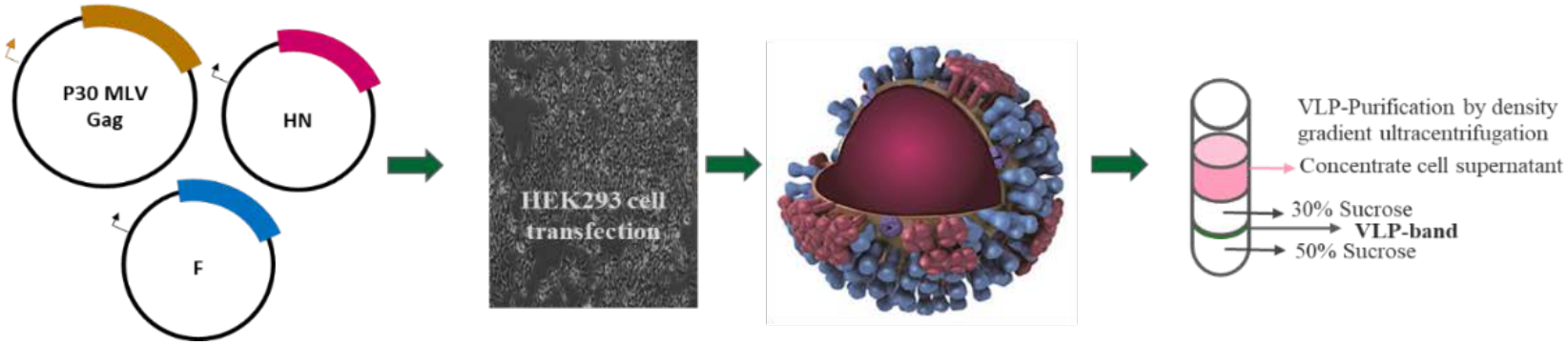
	Genotype (number of analyzed sequences)	No. of base substitutions per site (SE)[3]							
		I	II	III	IV	V	VI	VII	VIII
CLASS II	I (n=136)								
	II (n=154)	0.129							
	III (n=8)	0.115	0.144						
	IV (n=4)	0.102	0.131	0.082					
	V (n=87)	0.192	0.211	0.181	0.147				
	VI (n=222)	0.189	0.210	0.184	0.140	0.165			
	VII (n=460)	0.187	0.218	0.179	0.143	0.164	0.139		
	VIII (n=5)	0.145	0.169	0.136	0.097	0.131	0.124	0.129	
	IX (n=25)	0.107	0.132	0.094	0.078	0.173	0.177	0.173	0.127

Dimitrov et al.



Aims of the study

- Easily editable, matched emergency vaccine for long-living birds
  - VLP-based vaccine: safe and adaptable



➢ Production and characterisation of 3 vAOAV-1 VLPs: VLP-F, VLP-HN, VLP-F-HN

- Alternative vaccination protocols for short-living birds
  How to overcome passive immunity?
  - Delayed vaccination
  - Combined vaccination

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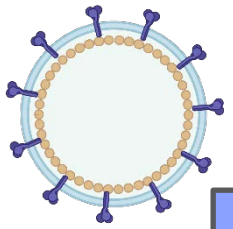
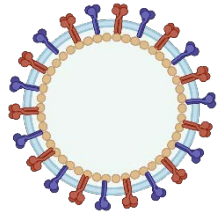
VLPs as matched emergency vaccines

- Evaluation as boost vaccines in commercial vaccinated layers (26-week-old)
  - Live vaccine at 2+7 weeks, inactivated at 12 weeks

G1 Non-boosted	G2 Conventional boost	G3 Matched VLP 1 boost	G4 Matched VLP 2 boost
Mock vaccine Saline Water-in-oil (W/O)	In-house inactivated La Sota  W/O	VLP-HN vAOAV-1  W/O	VLP-F-HN vAOAV-1  W/O

Pre-boost sampling → Boost vaccination → Challenge vAOAV-1 → 2-14DPI: Monitoring & Swabbing → 14DPI: Sacrifice & sampling

10^6 EID_{50}/100µl Occulonasal

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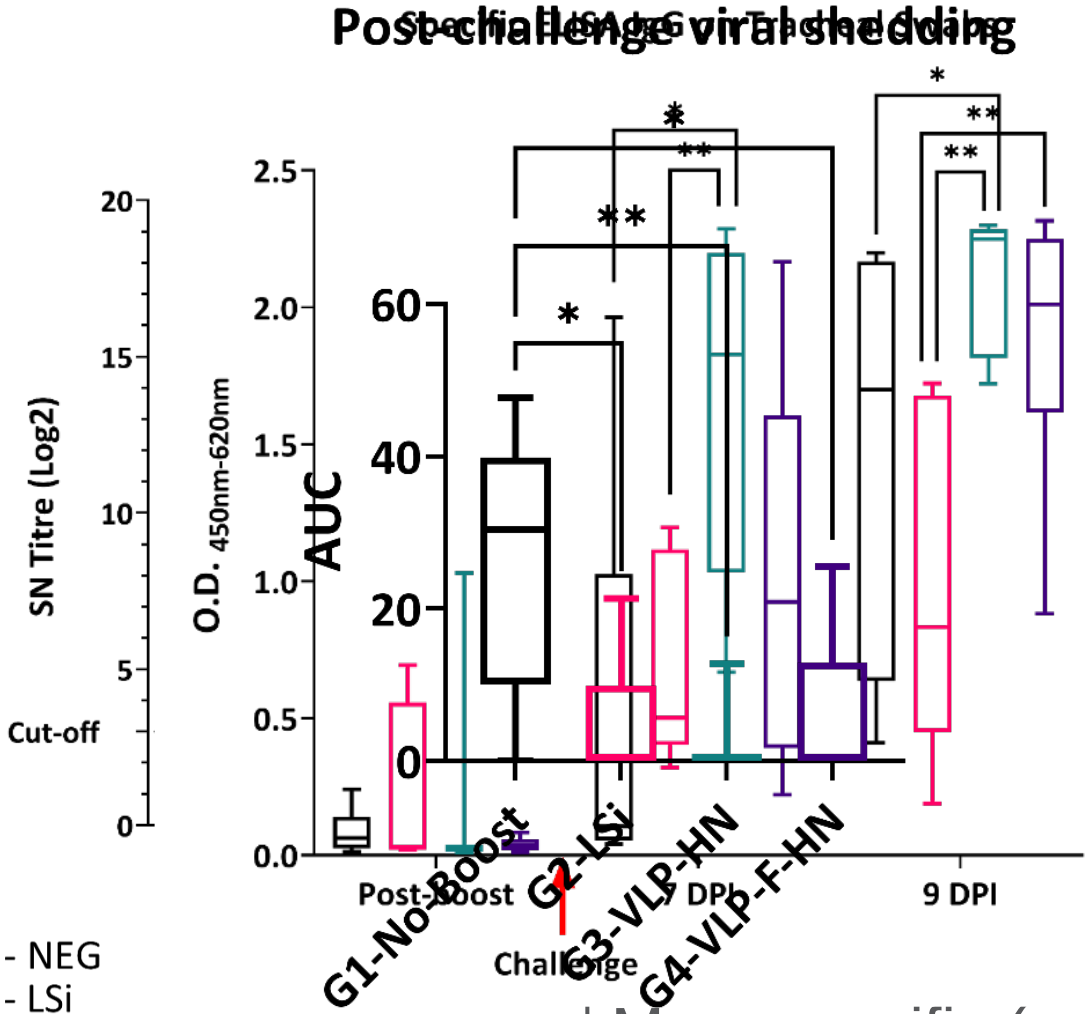
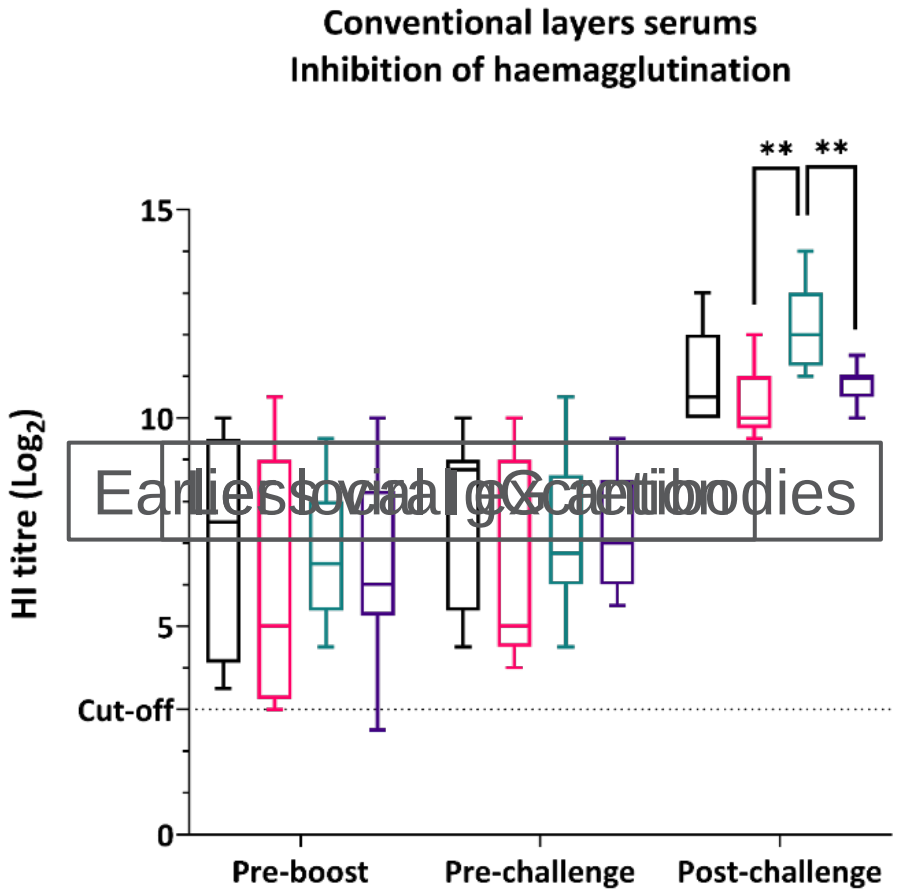
VLP-HN shows better boost efficacy

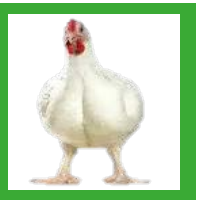




Earlier local & systemic antibodies

More specific (neutralising) Abs

Alternative vaccination protocols for broilers

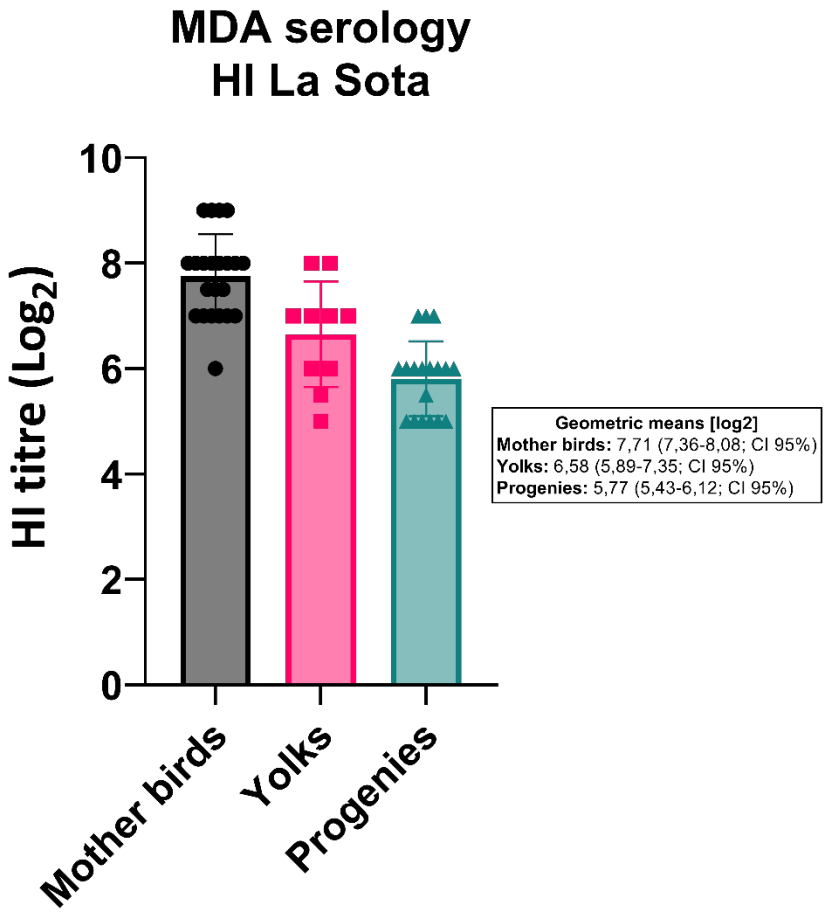


Early gap immunity, primo-vaccination neutralised by MDAs

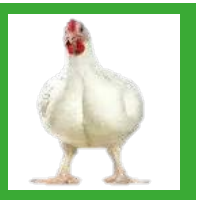
- Delayed vaccination
- Combined vaccination

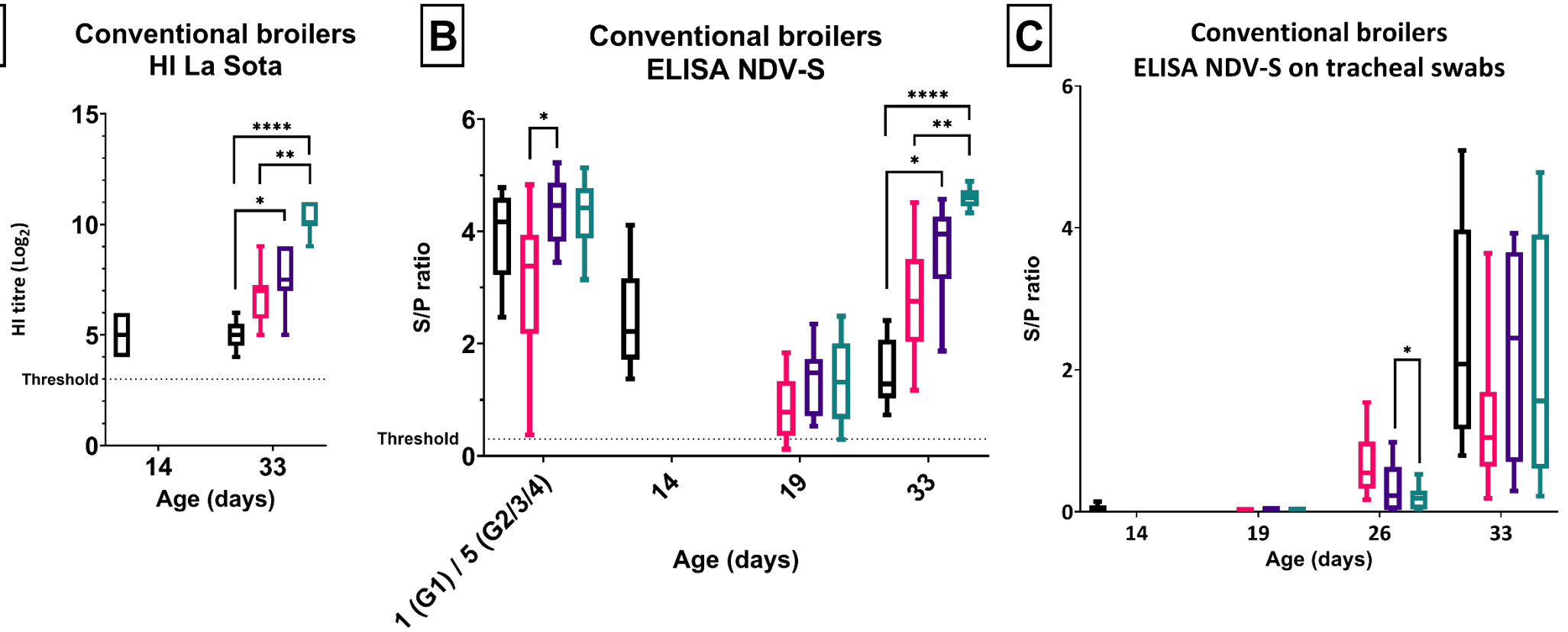
- Optimal vaccination time based on Deventer formula
  - Vaccination age = 19-day-old
- Yolks or blood samples from dams could be used as replacement (with correction factor)

Experimental groups	Vaccination time points		
	D1	D14	D19
G1 – Classic « field » vaccination (control)	Live	Live	/
G2 – Delayed vaccination	/	/	Live
G3 - Delayed + inactivated vaccination	/	/	Live + inactivated
G4 – Delayed + VLP vaccination	/	/	Live + VLP-HN



VLP-HN improves vaccination efficacy





Average HI titre of the flock at hatch
(Based on 18 animals)

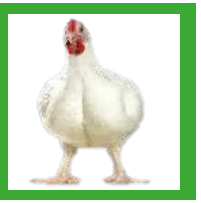
5,77 log2

- Group 1 - Control
- Group 2 - Delay
- Group 3 - Delay + Inac.
- Group 4 - Delay + VLP-HN

Group 1: Live -- 1D + 14D
Group 2: Live -- 19D
Group 3: Live + inactivated -- 19D
Group 4: Live + VLP-HN -- 19D

Commercial ELISA NDV-S: Full NDV + F antigen

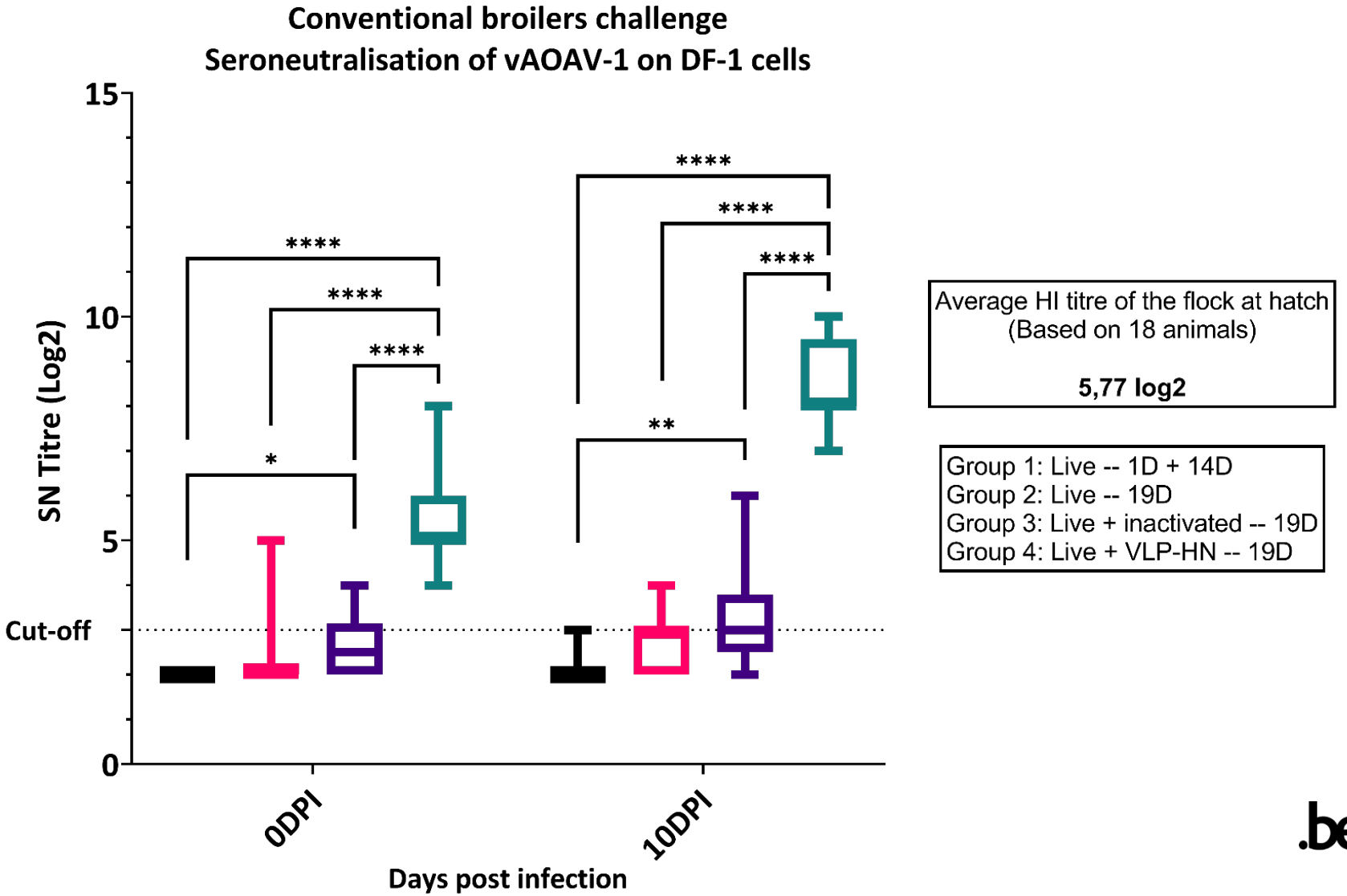
VLP-HN might provide better clinical protection



VLP-HN (G4)

- Better *in vivo* protection potential

➢ To be tested in challenge experiment



Key messages

VLPs as a safe and easily adaptable vaccination tool

Layer experiment

- Added value of matched vaccines as emergency boost for long and short living birds
- Co-expression of F & HN on VLPs impacts the boost efficacy
- Proof of concept: matched vaccines can be used in case of other velogenic incursions

Broiler experiment

- Single delayed and classical vaccination: similar levels of immunity
- Combined matched-VLP vaccination: best humoral IR and levels of neutralising Abs
- Deventer formula can be used in the scope of ND vaccination

Perspectives

- Is the clinical protection improved by a matched vaccine in broilers?
- Preparedness: larger scale production (baculovirus system)
- Evaluation of the relevance of a primo-vaccination at hatch for broilers

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