Could vaccination reduce *Coxiella burnetii* infection and shedding prevalence in red deer (*Cervus elaphus*)?

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Introduction

*Coxiella burnetii* is a gram-negative zoonotic bacterium that uses several animal species as hosts including wildlife¹. The red deer (*Cervus elaphus*) may be among the most relevant wild reservoirs of *C. burnetii* in Europe because of its increasing demographic and geographic trends, its high appreciation as game species, its gregariousness and its ability to replicate and shed *C. burnetii* to the environment²-⁴. Thus, it is of paramount relevance to design accurate control measures of *C. burnetii* in red deer to control inter-species transmission and prevent wildlife-related Q fever outbreaks in domestic and humans.

Vaccination is one of the most effective *C. burnetii* control measures in domestic ruminants⁵-⁶. To test the efficiency of vaccination, we selected a *C. burnetii* endemic semi-extensively bred red deer population and a commercial *C. burnetii* vaccine (Coxevac, Ceva; Fig. 1). The 74% (n=517) of females within the study population (N=699) from 3 cohorts (≤2010, 2011 & 2012) were vaccinated/re-vaccinated along 3 years whereas the 26% of them (n=182) remained as control group. Vaccine efficiency was evaluated in terms of seroconversion (ELISA¹) and reduction of *C. burnetii* shedding prevalence and burden (PCR¹) in vaginal secretions, milk and faeces along the study period.

Results & Discussion

Vaccination induced high seroconversion rates and long-lasting antibody levels (Fig 2). There was no reduction in *C. burnetii* shedding prevalence and burden in vaginal secretions and milk in any of the groups (Fig 3). Nonetheless, the prevalence of *C. burnetii* shedders in faeces significantly decreased in vaccinated animals and coexisting non-vaccinated mates along the study period (Fig 3, C). The reduction in faecal shedding along the vaccination experiment coincided with a reduction in the annual incidence of infection by *C. burnetii* in coexisting non-vaccinated yearling females⁷. Since faeces may be the main source for environmental pollution with *C. burnetii* and the bacterium is transmitted predominantly by infected aerosols⁸, long-time vaccination may be a promising tool to reduce the risk of *C. burnetii* transmission from red deer in scenarios of interaction with domestic and humans.

Figure 1. Vaccination and sample collection schedule

![Vaccination and sample collection schedule](image1)

Figure 2. Evolution of seroprevalence (%) and average antibody levels (SP) in vaccinated (black line) and unvaccinated (grey line) deer groups along the implementation of the vaccination experiment. Error bars represent 95% confidence interval of the mean for average antibody levels. Red dots depict the dates at which animals were vaccinated.

![Evolution of seroprevalence and antibody levels](image2)

* Statistically significant differences (p<0.05) between vaccinated and unvaccinated groups.

Figure 3. Shedding prevalence in vaginal secretions, milk and faeces in vaccinated (black diamonds) and unvaccinated (grey diamonds) deer groups with time from vaccination according to deer cohort.

![Shedding prevalence in vaginal secretions, milk and faeces](image3)

* Statistically significant differences (p<0.05) between vaccinated and unvaccinated groups.

References