Reduction of *Coxiella burnetii* shedding by vaccination

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Introduction

Human Q fever cases in the Netherlands increased dramatically between 2007 and 2009. In response to this increase, dairy goats and dairy sheep in the high incidence area were vaccinated with Coxevac®. Despite vaccination, all pregnant dairy goats and dairy sheep in herds positive for Q fever were culled early 2010, thereby precluding any field analysis of vaccine efficacy. However, there was an opportunity to sample animals shortly after they were humanely killed.

Goal

The purpose of this study was to quantify the effect of vaccination on bacterial load in excreta of pregnant goats and sheep.

Materials & Methods

On the day of culling, samples of uterine fluid, vaginal mucus, and milk were obtained from 957 dead pregnant animals of 13 herds. Per herd, ~50 pregnant and lactating animals (old animals), and ~50 nulliparous animals (young animals) were sampled. Quantitative real-time PCR was performed for all samples. Results for the 3 sample types were cycle threshold (C_t) values, in which a lower value indicates a higher bacterial load. All samples with C_t <40 were considered as positive. A negative result indicated that no specific signal was detected in a maximum of 40 cycles.

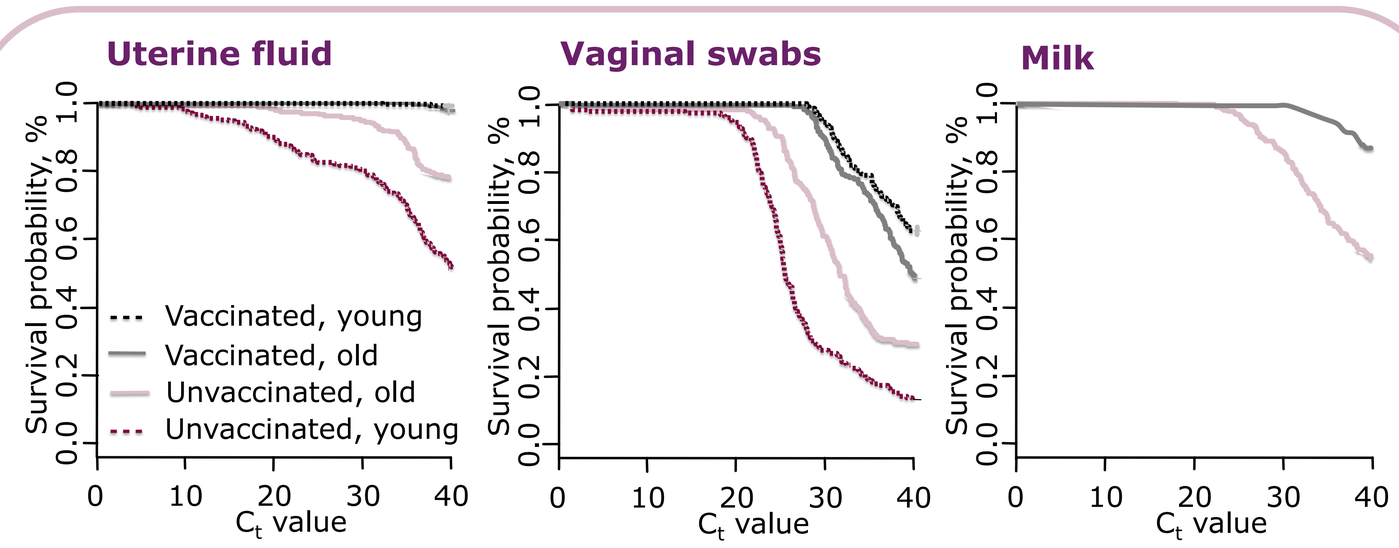
Results

Prevalence and bacterial load were reduced in animals from vaccinated herds compared with animals from unvaccinated herds. This effect was most pronounced in animals during their first pregnancy.

The bacterial loads (C_t values) in uterine fluid, vaginal swabs and milk are presented in the figure below. Vaccinated animals hardly have any positive tests results in uterine fluid. In vaginal swabs and milk, vaccinated animals are less likely to test positive than unvaccinated animals, and when they do, they have higher C_t values (~ lower bacterial loads).

In the tables below, the results of multivariate logistic regression and univariate survival analysis are presented for uterine fluid. In uterine fluid, vaccinated animals had a very low odds ratio (OR) for testing positive and had a hazard ratio (HR) that was half that of unvaccinated animals, which indicated that unvaccinated *C. burnetii*–positive animals had higher relative amounts of bacteria on the basis of Ct value. These effects were similar for vaginal mucus and milk.

Quantitative PCR results



Kaplan-Meier curves for cycle threshold (Ct) values for C. burnetii, for all samples.

Prevalence

Group	OR (95% CI)
Unvaccinated, young	1
Unvaccinated, old	0.44 (0.25–0.78)
Vaccinated, young	0.005 (0.0002–0.12)
Vaccinated, old	0.03 (0.002–0.58)

Multivariate logistic regression of prevalence of Coxiella burnetii in uterine fluid. A random herd effect was included.

Bacterial load

Group	HR (95% CI)
Unvaccinated	1
Vaccinated	0.49 (0.39 – 0.70)

Univariate survival analysis of PCR C_t values for Coxiella burnetii in positive uterine fluid samples ($C_t \leq 40$)

Conclusions

This observational study showed reduced prevalence and bacterial load in uterine fluid, vaginal swabs and milk from vaccinated animals, in comparison to unvaccinated animals. These effects were most pronounced in animals during their first pregnancy. Results indicate that vaccination may reduce bacterial load in the environment and human exposure to *C. burnetii*.

L. Hogerwerf , R. van den Brom, H.I.J. Roest, A. Bouma, P. Vellema, M. Pieterse, D.Dercksen, and M. Nielen (2011). "Reduction of *Coxiella burnetii* prevalence by vaccination of goats and sheep, the Netherlands". Emerg Infect Dis 17(3), 379-386.

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