Neospora caninum and Milk Production – a Theory Based on a Comparison of the Effect in Two Populations of Ontario Dairy Herds

T. Duffield[1a]; J. Hobson[1a]; D. Kelton[1a]; A. Peregrine[1b]; B. McEwen[1c]; S. Hietala[2]; K. Lissemore[1a]; K. Leslie[1a]; G. Cramer[1a]

[1]Department of Population Medicine[a], Department of Pathobiology[b], and Animal Health Laboratory[c], University of Guelph, Guelph, Ontario, Canada

[2]California Animal Health & Food Safety Laboratory System, University of California, Davis, CA

Introduction

Recent research on *Neospora caninum* infection in dairy cattle and its effect on milk production has yielded conflicting results, ranging from positive to negative effects. These differences may be related to experimental factors such as study design, sample selection criteria, statistical techniques, or an as-yet undetermined biological effect. While analysing *N. caninum* serology and milk production data from two distinct samples of Ontario Holstein dairy cows, a different production effect was identified in each sample. The objective of the work reported here was to compare this effect and propose a potential theory explaining the effect of *N. caninum* serostatus on milk production in these two populations of Ontario cows.

Materials and Methods

The first sample (Group A) consisted of cows from the 28 case herds of a large epidemiological investigation into *N. caninum* in Ontario Holstein dairy herds conducted in 1999. The herds were considered to have experienced abortion problems due to *N. caninum* on the basis of fetal histopathology in 1998-99. Sera from these cows were collected in summer 1999. The individual cow 305-day completed milk production records were obtained from Ontario Dairy Herd Improvement (DHI) records for the lactation corresponding to the time of serum collection. The second sample (Group B) was obtained from cows sampled in the 1998 Ontario Sentinel Herd Project, which was from 48 herds that demonstrated serological evidence of *N. caninum* infection but experienced only normal herd abortion rates. Cow level 305-day milk production records just prior to serum collection, and projected 305-day records at the time of culling, were also obtained from DHI for this group. For both samples, individual cow serostatus was determined using a kinetic enzyme-linked immunosorbent assay (ELISA) for anti-*Neospora* antibodies, using a sample-to-positive ratio ≥ 0.45 as the cutoff for defining a seropositive animal. Data were analysed using a linear regression model with the GENMOD procedure of (SAS) (ver. 8) controlling for parity, days in milk at test date and the random effect of herd clustering.

Results and Conclusions

In the Group A cows, a seropositive cow produced 276 kg (607.2 lb) of milk less than a seronegative cow (n=1196, $p<0.05$) in a 305-day lactation. In the Group B cows, a seropositive cow produced 302 kg (664.4 lb) of milk more prior to sera collection (n=2987, $p<0.01$), and 422 kg (972.4 lb) more (projected 305 kg [671 lb]) at the time of culling (n=1546, $p<0.05$) compared to seronegative cows in a 305-day lactation. Therefore, if *N. caninum* was causing abortion problems in a herd, milk production was negatively affected in seropositive cows. In contrast, when *N. caninum* was not causing an abortion problem, milk production was enhanced in seropositive cows.

The authors theorize that active, clinically apparent *N. caninum* infection, due to either a new infection or reactivation of an existing infection, imposes an immune-system related energy drain in seropositive cows resulting in reduced milk production. Conversely, in the latent form of infection the immune system is not under challenge by active *N. caninum* infection, and the cow is able to allocate more energy to milk production.