Proportion of Abortions due to Neosporosis among Dairy Cattle in Japan

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ABSTRACT. A retrospective cohort study was conducted to clarify the association between seropositive reactions to Neospora caninum and subsequent reproductive disorders among dairy cattle in Japan. A statistically significant association between Neospora seropositive reactions and abortions was observed (P=0.016), and seropositive cattle were 6.1 times more likely to abort compared to seronegative cows. No significant differences were observed between seropositive reactions and other reproductive disorders such as conception failure, perinatal death and calf mortality. As indicated by estimation of the attributable fraction, 83.6% of abortions in Neospora seropositive animals may be attributed to N. caninum. Considering seroprevalence of N. caninum in the cattle which aborted in Japan, 21.8% of abortions were estimated to be caused by neosporosis in Japan.

KEY WORDS: abortion, dairy cattle, Neospora caninum.

Neospora caninum infection is an important cause of abortion in dairy cattle in many countries [1, 3, 4]. In Japan, nationwide seroprevalence of N. caninum among clinically healthy dairy cattle was estimated as 5.7% [7]; however, the association between N. caninum serostatus and subsequent reproductive disorders is still poorly understood. Therefore, Neospora seropositive and seronegative animals were followed for their subsequent reproductive performances during a 1-year period in collaboration with prefectural administrations.

A previous survey revealed that 139 out of 2,420 cattle, which were randomly drawn from 18 prefectures in 1997, were seropositive to N. caninum using an indirect fluorescent antibody test (IFAT) [7]. Presence of antibodies to N. caninum at a dilution of ≥1:200 was considered positive [3, 4]. The animals were assigned to two cohorts based on their serological reactions. Cohort 1 consisted of Neospora seropositive (IFAT, titer ≥1:200), and cohort 2 consisted of randomly selected seronegative animals with twice the number of seropositive animals. Data were available from 56 of 139 (40.3%) Neospora seropositive cows; therefore, for cohort 2, a total of 112 seronegative cows were randomly selected from the same farms where the seropositive animals were reared. Information on their reproductive performances in 1998 was retrospectively followed by prefectural veterinary officers.

Reproductive disorders were classified into the following four groups. Conception failure was defined as unsuccessful pregnancy after serial inseminations. Abortion was defined as the birth of a dead fetus more than 10 days before the expected date of birth [13]. Perinatal death was defined as calf death between 10 days before expected date of birth and 24 hr after birth [6]. Calf mortality was defined as calf death between 24 hr after birth and weaning age [15]. Normal calving was defined as a birth without clinical signs of these reproductive disorders.

Incidence rate for each of the reproductive disorders was calculated as the number of reproductive disorders divided by the number of cow-months at risk. Statistical differences in proportions were compared using the Fisher’s exact test [5]. Strength of the association between Neospora serostatus and reproductive disorders was measured by the relative risk (RR) with a 95% confidence interval (CI) using the method described by Thrusfield [12]. The RR with a lower 95% CI greater than 1 was considered to be a significant association at the 5% level [12]. The attributable fraction (AF), proportion of reproductive disorders attributable to N. caninum in seropositive cows, was estimated as (RR-1)/RR [12].

Reproductive performances of 56 Neospora seropositive and 112 seronegative cows in 1998 are shown in Table 1. Of the 56 seropositive cows enrolled for 627 cow-months at risk of follow-up, six cows aborted. Of the 112 seronegative cows followed for 1,321 cow-months, two cows aborted. Incidence rates of abortion in Neospora seropositive and seronegative cows were 11.5/100 and 1.8/100 cows/year, respectively. The corresponding estimated RR of a seropositive cow aborting compared to a seronegative cow was 6.1 (Table 1). A statistically significant association between seropositive reactions and abortions was observed, as indicated by a low P-value and the exclusion of 1 in the 95% CI of the RR (Table 1). The AF of abortion was estimated as 0.836 ((6.1–1)/6.1). No significant differences were observed between seropositive reactions and other reproductive disorders such as conception failure or perinatal death. No calf mortality was observed.
A statistical association between Neospora serostatus and abortion found in this study is consistent with findings in many previous reports [1, 4, 13]. The present study shows that Neospora seropositive cows were 6.1 times more likely to abort compared to seronegative cows; the result may not differ from those in previous reports [2, 6, 8, 10, 11, 14], given the wide range of 95% CI of the RR due to the limited sample size in this study. In contrast, seropositive reactions for N. caninum did not show a significant association with the risk of conception failure or perinatal death. Additionally, no calf mortality was observed in either Neospora seropositive and seronegative cows in this study. These results are in accordance with previous reports, in which fertility, perinatal death or calf mortality was not significantly influenced by serostatus of N. caninum [6, 8, 9]. The figures obtained in this study are useful in estimating economic losses due to neosporosis in the Japanese dairy cattle industry, as described previously [13, 16].

The point estimate of the AF in this study indicated that 83.6% of abortions in seropositive cows may be attributable to N. caninum in Japan. Considering that 26.1% of the Japanese dairy cattle which aborted were seropositive to N. caninum, classified by a cut-off titer of 1:200 [8], 21.8% (83.6% × 26.1%) of abortions were estimated to be caused by N. caninum infection in Japan, as shown in Fig. 1. This corresponds to the report, in which approximately 20% of all aborted bovine fetuses submitted to diagnostic laboratories were diagnosed with N. caninum infection [1]. On the contrary, two epidemiological studies showed that 12.5% of all bovine abortions in England and Wales [2], and 38.7% in northern Spain [10] were due to neosporosis in dairy cattle. The proportions of abortions due to neosporosis may be influenced by the existence of other abortifacients such as arthropod-borne virus and differ among countries or regions. The finding reported here indicates that valuable benefit may be expected if the number of N. caninum infections can be reduced in Japan.

In conclusion, N. caninum is a major cause of bovine abortion in Japan, and devising strategies, such as selective culling of Neospora seropositive animals, are needed to prevent its spread.
reduce the infection among dairy cattle.

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REFERENCES