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Risk factors for *Neospora caninum* infection in dairy cattle and their possible cause-effect relation for disease

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ABSTRACT

Neospora caninum causes reproductive problems in cattle such as abortion, premature birth, retention of fetal membranes, and metritis. Therefore, this study aimed to verify possible risk factors for *N. caninum* infection in dairy cattle and their cause-effect relation to neosporosis. Serum samples of 1518 dairy cows from the West of Santa Catarina State, Southern Brazil were analyzed by indirect immunofluorescence assay (IFA) for *N. caninum*, where 466 were found to be positives (30.69%-$CI_{95\%}$; 28.3–33.0). In addition, an epidemiological survey was conducted in order to verify possible risk factors for neosporosis and their relation to the disease. The presence of dogs in the farm was strongly associated with IFA positive results for *N. caninum*, and lack of history for neosporosis in the farm increased the chances of positivity in 66%. It was found a significant cause-effect relation between the occurrence of reproductive problems and the presence of antibodies against *N. caninum* ($p = 0.05$). It is possible to conclude that *N. caninum* is widely distributed in dairy farms of the Western part of Santa Catarina state, Brazil, and that the occurrence of reproductive problems is directly related to the disease with the presence of dogs as a risk factor for *N. caninum* infection.

1. Introduction

Neospora caninum is an obligate intracellular protozoan of the Apicomplex phylum that infects domestic and wild animals [1]. It was discovered in 1984 parasitizing canids, well known definitive hosts of this parasite [2,3]. Until 1988, *N. caninum* used to be confused with a closely related parasite *Toxoplasma gondii* [4]. In subsequent research, some differences were identified distinguishing the two parasites regarding their intermediate hosts, virulence factors, and pathogenesis [5]. However, in 1988 researchers were able to describe *N. caninum* as a new parasitic species [4]. *Neospora caninum* causes clinical disease in canids [6], and reproductive problems in dairy and beef cattle such as abortion, causing economic losses in many countries of South America [7]. A study conducted by López-Gatius [8] has indicated that cows *N. caninum* seropositives may have 12 to 19 times more chances of abortion compared to seronegative animals with an average of approximately 30–44% of abortion.

A study in dairy cattle demonstrated a relation between *N. caninum* infection and abortion [9]. Basso et al. [10] have shown in their study that *N. caninum* is the main cause of reproductive disorders in cows worldwide, including abortion, estrus repetitions, and temporary anestrus [11]. There is a great association between cattle infection and reproductive losses due to *N. caninum* seropositivity [10]. The presence of dogs in the farm is a determinant factor for the *N. caninum* infection in bovines [12–14]. In a comparative study of farms where dogs were present, it was evidenced a high seroprevalence for *N. caninum* in cows compared to farms where dogs were absent [14]. Animal age was observed by

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Guimarães-Junior [15] as a risk factor for *N. caninum* infection, where older animals showed greater seroprevalence, indicating that the horizontal transmission has great influence on the herds. In addition, a study in South America demonstrated that neoporosis in dairy cattle has many more risk factors related to the infection [16]. These factors are increasing age of cows (between 2 and 6 years old), as well as the intensive management of dairy cattle in the farm, indicating high rates of horizontal transmission in the herds [16]. Therefore, the aim of this study was to evaluate the risk factors for *N. caninum* infection, and possible cause-effect relation to the disease in dairy cattle.

2. Materials and methods

2.1. Animal selection and blood sampling

This study was conducted in 72 dairy farms of the Western region of Santa Catarina state, Brazil (Fig. 1). The farms were randomly selected and only lactating cows were studied. Blood samples of 1518 cows of different stages of lactation were collected from approximately 30 to 60% of each herd from the caudal vein, stored in tubes without anticoagulant, and transported under refrigeration to the laboratory. Then, all blood samples were centrifuged at 3500 rpm for 10 min. Obtained sera were stored at −20 °C until serological analyzes by indirect immunofluorescence antibodies test (IFA), as previously described [7,17].

2.2. Epidemiological survey

An epidemiological survey was applied to farmers in order to investigate the risk factors for *N. caninum* infection, as well as to verify possible causes and effects related to neosporosis. The variables studied were: age (years), breed (Holstein-Friesian, Jersey, or mixed), number of pregnancies, diet, type of feedstock (closed or open), water source (natural, river, lake or potable water), years of farming (up to 5 years, 6–10 years or >10 years), feed source,

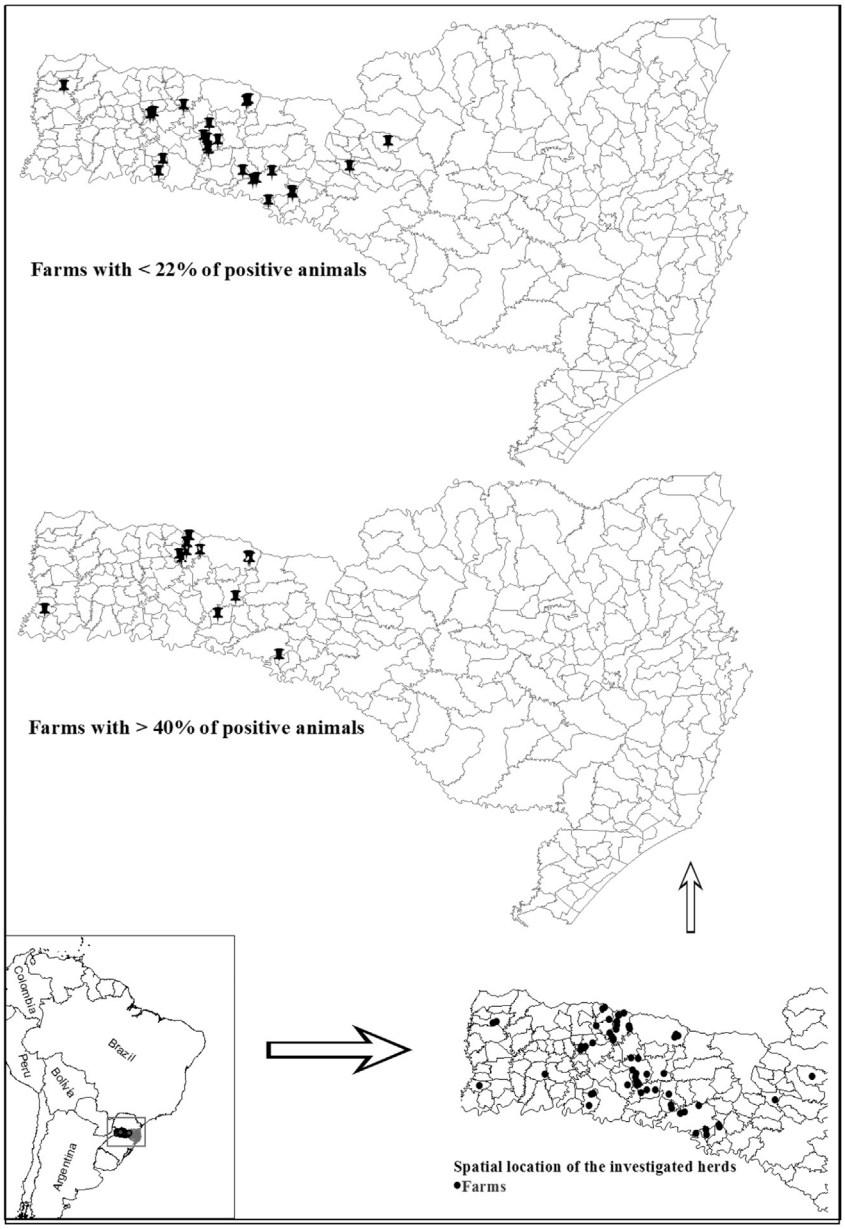

Fig. 1. Representative map of *Neospora caninum* seroprevalence in the Western part of Santa Catarina state, South of Brazil.