

# Seroprevalence of Anti-*Toxoplasma* IgG in Canadian Swine

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## ABSTRACT

In 1990, 1443 sera randomly selected by computer generated random numbers from a bank of >15,000 sera collected earlier from sows at slaughter in various geographic regions of Canada were tested for anti-*Toxoplasma* immunoglobulin G (IgG) by the modified direct agglutination test. One hundred and thirty-six (9.4%) samples were positive for anti-*Toxoplasma* IgG while 36 (2.5%) of the sera gave borderline reactions. The highest prevalence of anti-*Toxoplasma* IgG was in swine originating in the Atlantic provinces and Ontario while the lowest was in swine from Manitoba and Saskatchewan.

## RÉSUMÉ

En 1990, à travers différentes régions du Canada, une banque de plus de 15 000 sérums provenant de truies au moment de l'abattage a été réalisée. De ces sérums, 1443 ont été aléatoirement choisis afin d'y déterminer la présence d'immunoglobulines G anti-toxoplasme par la technique modifiée d'agglutination directe. Des sérums analysés, 136 (9,4 %) étaient positifs et 36 (2,5 %) étaient douteux. La plus haute prévalence d'animaux positifs a été retrouvée en Ontario et dans les provinces de l'Atlantique tandis que la Saskatchewan et le Manitoba en dénombraient le moins. (Traduit par D<sup>r</sup> Pascal Dubreuil)

Toxoplasmosis is a protozoan disease in which cats and other felines are definitive hosts (1). A wide variety of mammals, including humans, and birds may serve as intermediate hosts. Toxoplasmosis may be transmitted in three ways, i.e. by the consumption of

meat containing tachyzoites (the form of the organism that develops during the acute phase of the infection) or bradyzoites (detected in cysts that form subsequent to the acute phase); by ingestion of oocysts that occur only in the feces of definitive hosts; and by congenital transmission that takes place when a pregnant female becomes infected (2).

Toxoplasmosis is a zoonosis of considerable importance largely because of the risk in pregnant women of transmitting the organism to the fetus *in utero*. In the United States, it is estimated that the number of infected infants could be as high as 4000 per year (2). In Canada, considering the difference in population, the number would be proportionately less.

In the United States, adults are most exposed because of the postadolescent cultural habit of eating undercooked or raw meat (1). Infected pork is believed to cause half to three quarters of the cases (3). Undercooked pork sausage is thought to be an important source of infection for humans (4). The prevalence of toxoplasmosis is reported to be particularly high in American swine (2). Zimmerman *et al* (5) estimated the prevalence as 5.4% among finishing swine and 11.4% among sows and gilts. In the United States, sows are the largest source of meat for sausage (4). Regional differences in prevalence have been noted in the United States which may be related to climate and to survival of cysts in the environment (5).

In 1990, a study was undertaken to determine the prevalence of toxoplasmosis in Canadian swine by testing of sera from sows for anti-*Toxoplasma* antibodies.

A bank of >15,000 sera was collected in 1990 from randomly selected sows at slaughter from all regions of Canada. Using computer-generated

random numbers, 1443 sera from the bank were selected and used in this study. The sera were examined for the presence of anti-*Toxoplasma* immunoglobulin G (IgG) using a direct agglutination test (Toxo Screen DA) kit (NCS Diagnostics Inc., Mississauga, Ontario). The principle of this technique is the agglutination of formalin-treated *Toxoplasma* in the presence of diluted serum containing specific IgG. Non-specific agglutination is suppressed by using a dilution buffer containing 2 mercaptoethanol. Sera were examined at two dilutions, i.e. 1:40 and 1:4000 giving positive specific IgG titers that may be expressed as 4 and 400 IU/mL, respectively.

Seventy-six (5.3%) of the 1443 sera tested were positive at both 1:40 and 1:4000 dilutions while 60 (4.2%) were positive only at the 1:40 dilution. Thirty-six sera gave borderline reactions. A prozone phenomenon indicated by a positive reaction at the 1:4000 dilution and a negative or borderline reaction at the 1:40 dilution was observed in four sera.

The geographic origin and prevalence of anti-*Toxoplasma* IgG in the sera tested are shown in Table I. The highest prevalence of anti-*Toxoplasma* IgG was found in swine originating in the Atlantic provinces and Ontario while the lowest was in swine from Manitoba and Saskatchewan.

The findings of this limited study of Canadian sows are comparable to those reported for sows and gilts in the United States (5). The considerable variation in the seroprevalence of toxoplasmosis in swine in various regions of the country perhaps should not be unexpected. In the United States seroprevalence of *T. gondii* in pigs in various locations ranged up to 69% (6). Many factors may be involved in the transmission of the disease. Zimmerman *et al* (5) observed that

**TABLE I. Geographic origin and prevalence of *Toxoplasma* IgG in Canadian porcine sera**

	Atlantic provinces	Quebec	Ontario	Manitoba	Saskatchewan	British Columbia
Number tested	76	443	585	98	161	80
Number positive at 1/40 and 1/4000	10 (13.1%)	11 (2.5%)	46 (7.9%)	1 (1.0%)	4 (2.5%)	4 (5.0%)
Number positive at 1/40 only	4 (5.3%)	18 (4.1%)	28 (4.8%)	1 (1.0%)	6 (3.7%)	3 (3.7%)
Number borderline reactions	3 (3.9%)	8 (1.8%)	21 (3.6%)	1 (1.0%)	1 (0.6%)	2 (2.5%)
Total reactors	17 (22.4%)	37 (8.4%)	95 (16.2%)	3 (3.0%)	11 (6.8%)	9 (11.2%)

herds with < 100 breeding swine were more likely to be infected than herds with  $\geq 100$  breeding swine. Conditions under which swine are raised may be important in the transmission of the disease to swine (4). The presence of cats with contamination of unprotected feed, cannibalism and tail chewing are known sources of infection for swine (4,6).

The seroprevalence of toxoplasmosis detected in Canadian swine points out that the potential for transmission of the organism via pork products to humans exists. The disease in humans has been characterized by statements to the effect that although infection is common, disease is rare (2). This is undoubtedly an oversimplification. Illness from toxoplasmosis develops generally in young immunologically immature animals or in old animals with impaired immune responses (1). Even an asymptomatic or mild first infection in a pregnant woman may be transmitted to her fetus *in utero* (1). Recrudescence of chronic *Toxoplasma* infections in immunologically compromised persons who have been

treated with immunosuppressive agents or who have acquired an immunosuppressive disease such as acquired immunodeficiency syndrome adds significantly to the importance of this zoonosis (1,3).

Results of the modified direct agglutination test as used in this study correlate well with those from the methylene blue dye test developed in 1948 by Sabin and Feldman, and the test by which all other tests are judged (7). The direct agglutination test is also simple to perform, is not species specific and can be used to test both human and animal sera.

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