RESEARCH REPORT
PORK SAFETY

Title: Determination of *Toxoplasma gondii* Antibody Prevalence in Midwest Market Swine – **NPB #02-147**

Investigator: James D. McKean

Institution: Iowa State University

Date Received: April 28, 2003

Abstract: This project was designed to determine the current prevalence of *Toxoplasma gondii* antibodies in the Midwestern market swine population. *Toxoplasma gondii*, an intracellular protozoan of cats, is increasingly being recognized as an important public health concern. Human infection may occur by one of two routes: 1). direct contact with cat feces, soils or foods contaminated with cat feces; or 2). consumption of undercooked meat from an animal infected with *Toxoplasma gondii*. Pork has been identified as one of the food source(s) for this parasite. As Trichinosis concerns are further reduced, consumers may recognize Toxoplasma as a potential food safety issue for pork.

The prevalence of Toxoplasma in swine has been reduced as confinement management practices have become more commonly employed. This study was designed to demonstrate the current infection rate in Midwestern swine. A total of 15, 014 samples were collected at harvest by obtaining a meat sample from the carcass. Samples were frozen, and then thawed to obtain intra- and intercellular fluids containing antibodies. All samples were tested with a commercial ELISA kit to detect Toxoplasma antibodies. The detected prevalence was 0.75%. A higher prevalence was found in lots of 20-40 animals compared to 150-190 head. These observations are consistent with prior studies indicating management practices and facilities during finishing influences Toxoplasma infections. Additional on-farm evaluations of exposure risk factors are required to clarify these relationships.

Introduction: *Toxoplasma gondii* infection in rodents, swine, sheep, cattle and perhaps poultry results from exposure to infected cats feces or environments exposed to these feces. The infectious stage (bradyzoites) may survive in muscle and brain tissues for the life of the animal. Consumption of infected bradyzoites from undercooked meats will infect humans. Human toxoplasma infections may come in several forms. An acute phase with swollen lymph nodes, similar to mononucleosis, is less frequently seen than is an asymptomatic condition. After an asymptomatic infection the cysts may remain viable for many years, becoming reactivated if the immune system is compromised. Inflammation of the eye, heart and lungs are commonly found after reactivation. Growth of cysts in the brain is a frequent component of AIDS infections. A primary infection during pregnancy may lead to fetal death, brain damage and retardation, or delayed infections of the eye or reactivation infections after birth. As a result human, toxoplasma infections have risen in public health interest.

Management practices in pork production may influence the rate of infections. Infected cats shed large numbers of oocysts in feces for approximately 10-20 days during the Toxoplasma life cycle. Few oocysts are required for infection of swine, and they can survive in the environment for extended periods of time. Removal of direct contact with cats, and cat feces or infected environment minimizes transmission. Keeping cats from contact with feed or soils outside of buildings will also minimize exposures. It is possible that soil transferred from outside on boots may be sufficient for infection. Rodents (mice) may be a source of infection for cats and for swine. Prior prevalence studies have indicated infection levels of 20 – 43% in breeding animals and 0.14 - 5% in finishers depending on the sample populations, locations of operations and sampling period (Gamble, personal communication). In many cases outside production and exposures to cats were identified as risk factors. As pork production has become more confined a question has been raised about the prevalence of Toxoplasma infections. The 2000 NAHMS survey indicated that the prevalence of Toxoplasma antibodies was about 0.8% in their sample population.

Objectives: To evaluate the presence of Toxoplasma antibodies as measured by a meat juice-based ELISA detection procedure in Midwestern market swine.

Materials and Methods: Meat samples were selected from a population collected for the PRV market swine surveillance project. This market surveillance was designed to collect four (4) meat samples from each lot of swine at eight (8) high volume Iowa abattoirs. Approximately 600 lots were collected daily and submitted to the Iowa State University meat juice processing laboratory of processing and PRV antibody analysis. Each sample is maintained with a unique identifier that enables trace back to the submitting producer.

Samples for Toxoplasma antibody detection were selected randomly from the daily submissions for PRV analysis during the spring of 2002. A total of 250 samples were drawn each day for 12 consecutive weeks (60 sample days) – total of 15,014 samples. As part of the random sampling algorithm only one sample from a producer was selected each day, even if multiple lots were submitted to single or multiple plants from that producer. Producer identification and lots size submitted were recorded. The presence of antibodies was determined using the ELISA test kits supplied by Safepath Laboratories. Samples were diluted 1:10, according to manufacturer's recommendations for meat juice prior to testing. Results were reported as positive with > 0.20 O.D. breakpoint.

Data analysis was based on the presence/absence of detected antibodies, lot size and origin of these swine. The distribution of lot sizes in the sample population was identified. Comparisons of antibody detected and lot sizes were made.

Results: A total of 15,014 samples were collected from 3,690 producers from 16 Midwestern states. Mean lot size was 92 head, but a clear bi-modal distribution for lot size existed. Approximately 60% of the lots were from 20-50 head/lot and 30% from 160 -200 head/lot. The remainder was arrayed between these values. A total of 113 samples were positive for a prevalence of 0.75%. Eighty-eight (88) producers were identified with a single positive sample. Sixteen (16) producers, including four identified as order buyers/buying stations, were assigned two (2) or more positive head. Comparisons of the lot size/positive values interaction indicated that 86/113 positives were found in lot sizes < 50 head. Only 11/113 were identified in lots > 100 head. All of the duplicate sample values were from the smaller lots.

Discussion: This survey confirms the 2000 NAHMS report for the prevalence of Toxoplasma antibodies in market swine. The level of 0.75% is consistent with a continued prevalence reduction from earlier studies. The concentration of positive samples in the smaller lot sizes may indicate a higher risk associated with more extensive production. These results are consistent with earlier evaluations of risk factors at the production level. These issues require further examination as Toxoplasma control programs are developed.

Lay interpretation: This study demonstrates the continued reduction in Toxoplasma antibodies in the Midwestern commercial market swine herd from earlier surveys. The prevalence of 0.75% is consistent with the National Animal Health Monitoring System (NAHMS) 2000 survey of finishing swine. Further it provides an indication that the risk factors associated with antibody presence may be related to on-farm management practices. These findings are consistent with the known concerns about contact with cats and cat feces as a major exposure risk factor. Efforts to limit access of swine to infective material will continue to reduce prevalence of Toxoplasma antibodies in market swine.