Proceedings of the
21st International Pig Veterinary Society Congress
IPVS
Jul. 18 – 21, 2010
Vancouver, Canada

Next congress:

22nd International Pig Veterinary Society Congress
June 10-13, 2012 – Jeju, Korea

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O.144

Use of workshops and face-to-face interviews to teach smallholder pig farmers about how to prevent disease due to Taenia solium

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Introduction

Neurocysticercosis is the major preventable cause of adult-onset epilepsy in developing countries. Epilepsy is caused by the neurocysticercosis form of Taenia solium. The life cycle includes the pig as an intermediate host having larval cysts (Cysticercus cellulosae) and the human as the definitive host, having adult tapeworms (taeniasis). Humans also act as intermediate hosts if they consume T. solium eggs.

The purpose was to describe changes in and retention of knowledge and changes in behaviours of pig farmers after providing workshops using the training of the trainers model followed by one-on-one farmer training.

Materials and Methods

A random sample of 282 pig farmers in the Busia and Kakamega Districts of Western Kenya were included in the study beginning in 2006. Each farm was visited 3 times at 4-7 month intervals. Data was collected from farmers in face-to-face interviews at each farm visit. The authors presented a one-day workshop about pig management, feeding, housing, and the lifecycle of Taenia solium and its association with epilepsy to government livestock, veterinary and public health officers (staff). Then, the staff taught this material during one-day farmer workshops. Three farms visits that were 5 months apart enabled researchers to conduct one-on-one training. Farmers were asked what management changes they made as a result of the research and workshops during 2008 &2009 workshops.

Proportions of correct answers to questions regarding the life-cycle and prevention of disease due to T solium in people and pigs were compared amongst three groups of farmers based on training; those who attended workshops and those who were given one-on-one training. Acquisition of knowledge was compared within respondent from the 2nd to the 3rd farm visit using a McNemar’s chi-square test.

Results

Many farmers (51%) have seen tape worm segments in their own stool. Most farmers (89%) knew that if they saw these segments, they should seek medical treatment. However, few farmers knew how people became infected with the tapeworm. Male farmers were 9 times more likely to have seen a pig with cysts than female farmers.

Farmers were 3.7 times more likely to know how people become infected by T solium after the one-on-one training (60%) than before this training (50%). Farmers with at least a grade 8 education were more likely to understand the life cycle than farmers with less education. Farmers were more likely to tether their pigs 100% of the time after the workshop (51%) than before the workshop (34%) and still more likely after the one-on-one training (63%) (P<0.02). At the end of the study, 79% of farmers were keeping their pigs tethered 75% of the time. More than half (59%) of the farmers knew how to make the pork safe to eat if it was infected with cysts. This proportion was higher (66%) for those farmers who received the one-on-one training.

Discussion

Education is the primary method of reducing the prevalence of diseases due to Taenia solium in developing countries. Workshops and one-on-one training increased the level of knowledge and changed the behavior regarding confining pigs. The life cycle of T solium is difficult to understand. Farmers with a grade 8 education and those with individual training were most likely to understand the cycle and therefore know how to prevent the disease. Individual training is expensive but may be necessary to reduce the prevalence of epilepsy due to this disease.
Toxoplasma gondii Seroprevalence on U.S. swine operations in 2000 and 2006 and factors associated with changes in prevalence in 2006

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Introduction.
Toxoplasma gondii is a protozoan parasite capable of infecting most warm blooded animals, potentially resulting in the disease toxoplasmosis. It is estimated that 60 million people in the U.S. are infected, although few demonstrate symptoms.¹ Cats can serve as the host and shed oocysts in the feces for approximately 1-2 weeks. These oocysts then sporulate in 1-5 days following deposition.² Swine, can be infected by ingesting material contaminated with the oocysts. It has been estimated that up to 25% of apparently healthy pigs in the United States have positive antibody titers.³ While few pigs display clinical signs, the parasite can persist in the edible tissues of pigs.

Our first objective was to compare sample and farm level prevalence of exposure to Toxoplasma (as measured by antibodies) in 2000 and 2006 from the National Animal Health Monitoring System’s (NAHMS) swine studies and associated herd factors. The second objective was to present factors associated with the number of positive Toxoplasma test results within farms sampled in the 2006 study.

Materials and Methods
Questionnaire data and blood samples were collected as part of the NAHMS Swine 2000 and 2006 studies. Producers participating in the NAHMS Swine 2000 and 2006 studies were able to submit up to 15 and 35 blood samples, respectively from finisher pigs to be tested for antibodies to Toxoplasma. In 2000, 5,718 samples were collected from 394 swine sites and tested using a modified agglutination test (MAT) test. In 2006, 6,238 samples were collected from 185 sites and tested using an enzyme linked immunosorbant assay (ELISA).

Results
Overall, 0.9% of grower/finisher pigs sampled were positive for Toxoplasma antibodies in 2000 and 2.7% in 2006. Smaller herds (<2K head) appeared to have more positive samples than medium (2-4.9 K head) and larger herds (5 K head plus) in both years. The number of finisher pigs housed in total confinement comprised a lower percentage of positives in 2000 compared with 2006.

The average within herd prevalence in positive (had at least one positive sample) and negative herds in 2000 was 1.8% of finishers overall and in positive herds was 23.5%. In 2006 the corresponding average within herd prevalence was 4.6% and 17.4%, respectively. Overall, 7.5% of sites were positive for Toxoplasma antibodies in 2000 and 26.8% of sites were positive in 2006. Similar to the sample level results, smaller herds appear to be affected more often in both years but the prevalence in confinement vs. not confined herds seemed to be different only in 2000.

For the 2006 samples we used a method of modeling called zero inflation to detect herd level practices associated with counts of positive samples.⁴ For farms that buried dead weaned pigs off site, the count of Toxoplasma positives was 7.2 times higher than when they were not buried off site. When a farm composted dead preweaned pigs on site the incidence rate of Toxoplasma positives went up 83 percent, while the use of traps, bait, poison, exterminator or some other method besides cats or dogs for rodent control on the farm reduced the prevalence of Toxoplasma by 63 percent.

Discussion
It is likely that since there was less sampling of finisher pigs in 2000, the incidence has not gone up so much as there wasn’t sufficient sampling in 2000 to find a difference. However, for 2000 and 2006 it would be possible to get estimates of true herd prevalence based on published test accuracies for the MAT and ELISA tests. The results of modeling suggest there is an unmeasured effect since one would expect that burying pigs off-site would decrease positive counts.

References
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Prevalence, detection and isolation of *Toxoplasma gondii* in swine tissue samples from a slaughterhouse in Bogota-Colombia

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**Introduction**

Toxoplasmosis is a zoonotic disease caused by infection with the protozoan *Toxoplasma gondii*. Infections by this parasite are widely prevalent in humans and other warm-blooded animals in all continents. In humans, infection occurs either by consumption of uncooked meat containing cysts or ingesting or drinking contaminated food with sporulated oocysts. Studies have demonstrated that toxoplasmosis in pregnant women is generally related with uncooked meat consumption (Kapperud et al., 1996; Baril et al., 1999; Cook et al., 2000). It is important to study the prevalence of this protozoan in pork as it is a major source of infection. The seroprevalence in pigs was reported to be 29% worldwide. (Kim & Weiss . 2008)

To guarantee the destruction of the parasite, the meat must be properly cooked until it reaches a temperature of 67°C or must be frozen at freezing temperature lower than -10°C for a period of 48 hours. (Kijlstra & Jongert, 2008)

**Materials and Methods**

80 pig samples of tongue, heart and blood were collected in a slaughterhouse in Bogota- Colombia.

DNA extraction of tissues samples of heart and tongue was performed by the method of salting out. The amplification of a 532 bp fragment of B1 gene was performed by nested PCR to evaluate the presence of the parasite (Boothroyd & Grigg 2001). For the isolation of native strains, subcutaneous inoculation of the processed material in CFW and Swiss mice was performed. Infection was assessed by analyses of mice sera by Western-blot technique using an anti-mouse IgG secondary antibody labeled with peroxidase.

Seroprevalence in pigs was assessed. The presence of antibodies against *T. gondii* and *Trichinella* in blood samples of pigs were analyzed using an ELISA kit (ID Screen toxoplasmosis indirect multi-species, and ID Screen Trichinella indirect), produced by ID VET innovative diagnosis (Montpellier- FRANCE).

**Results**

Analysis of the samples obtained by B1 gene amplification showed a 40% prevalence of *T. gondii* in pig tissue in 66 samples analyzed. Seroprevalence analysis showed 37% presence of antibodies against *T. gondii* in 80 swine serum samples, where 22 samples were positive by ELISA and PCR. Serum analysis for *Trichinella* gave negative in all cases.

The sera of mice infected with PCR positive swine samples were tested using Western blot to evaluate the possibility of infection. After 6 months only one mouse was Western blot positive, showing the presence of a native avirulent strain. This mouse serum showed reactivity to tachyzoite proteins of RH strain. The presence of cysts in brain were also detected in this mouse using PCR.

**Conclusions**

Using amplification of gene B1 it was possible to detect the presence of the parasite in 27 of the 66 samples from a slaughterhouse of Bogota, Colombia. This represents a 40% prevalence of *T. gondii* in swine tissue.

In the 80 samples analysed by the ELISA technique, the seroprevalence was 37%, coinciding with previous reported studies. The tecnification of the production plants has allowed better control of some diseases transmitted by swine. Nevertheless the present Colombian legislation for the proper handling of swine is still too lax to control infection by certain mechanisms of control of *T. gondii*, for example the presence of cats in the production area.

According to the FAOSTAT Studies done in Colombia in 2005, the total consumption of pork and its derivatives corresponds to 10% of the total meat consumption. This, together with the high prevalence of *T. gondii* in the country, shows the urgent need for better methods of control.

**References**


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Isolation of immunogenic glycopeptidolipids of *Mycobacterium avium* subsp. *hominissuis*

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Introduction

*Mycobacterium avium* (MA) is an important pathogen in both animals and humans which belongs to the *M. avium* complex (MAC). Diagnosis of MA-infections in pigs is traditionally based on the detection of granulomatous lesions in lymph nodes seen by eye at slaughter. Since sensitivity and specificity of this approach is questioned (Komijn et al., 2007) we developed as an alternative a serodiagnostic ELISA assay on the basis of a polar lipid fraction from MA (Wisselink et al., 2009). We isolated glycopeptidolipids (GPLs) from *M. avium* subsp. *hominissuis* (MAH) and analyzed them for their suitability for serodiagnosis of MA infections in pigs.

Materials and Methods

MAH serotype 4 strain 17404 was grown at 37°C in Dorset Henry medium. Glycolipid antigens were extracted, analyzed by one and two dimensional thin layer chromatography (TLC) and further purified (Nishiuchi et al., 2004; Papa et al., 1993; Kitada et al., 2002). As reference, GPLs from a MAH serotype 4 strain were used (Kindly supplied by Y. Nishiuchi, Osaka, Japan). The immunogenicity of the GPLs was evaluated in ELISA tests using reference serum samples obtained from pigs held under experimental and field conditions.

Results

The TLC-pattern of GPLs from MAH strain 17404 and the reference GPL (Nishiuchi et al., 2004) showed both a Retention Factor (RF) value of 0.42 (Fig. 1)

To evaluate the GPLs for their immunogenicity the cut-off value for negative and positive test results was calculated (Wisselink et al., 2009) which appeared to be 24.5 percentage positivity (PP). In all eight sera of pigs, experimentally infected with MA, high anti-GPL antibody titers were found. On the two infected farms 10.6 % (11/104) of the pigs tested serologically positive and on the five farms, free for an MA infection 3.3% (3/92) pigs (Fig. 2).

Fig. 2. Results of ELISA tests with 1 ug GPLs per well from MAH using serum samples from pigs experimentally infected with MA (A; n=8), from two farms with pigs known to be infected with MA (B; n=104)) and pigs from five farms free for an MA infection (C; n=92).

Discussion

Earlier we developed an ELISA test on the basis of polar lipids for serodiagnosis of MA infections in pigs. Here we show that purified GPLs can also be used as antigen in a serodiagnostic test because of its clear recognition by serum antibodies in experimentally infected pigs. For use under field conditions, the results of the GPL-ELISA indicate that MA-infected farms can be discriminated from MA-negative farms. Further work is needed to optimize and evaluate the GPL-ELISA for use in the field.

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