Seroprevalence of *Toxoplasma Gondii* Infection in Indoor Pigs, from Center and North-Western of Romania

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**Abstract.** *Toxoplasma gondii* causes one of the most common zoonoses worldwide. Pigs infected with *T. gondii* are considered an important source of infection for humans in several countries. The aim of the study was to determine the seroprevalence of *T. gondii* infection in indoor pigs. Between November 2007 and May 2009, 285 sows and 282 fattening pigs sera samples were collected in the slaughterhouse, from five indoor farms. Samples were tested in the direction of detecting antibodies anti-*T. gondii*, IgG type by ELISA method, using a commercial kit (Toxoplasmosis Indirect Multi-Species, ID VET Innovative Diagnostics, France). The prevalence of anti-*T. gondii* antibodies in sows from Cluj county was 49.4% (42/85), while in sows from Satu-Mare county was 0.5% (1/200) and in fattening pigs was 0.4% (1/282).

**Key words:** *Toxoplasma gondii*, sows, fattening pigs, indoor farms.

**INTRODUCTION**

*Toxoplasma gondii* is an intracellular parasite that infects a variety of cell types from a wide range of mammals and birds throughout the world, including humans. Usually, *T. gondii* does not produce clinic signs, but the primary infection during pregnancy in women and a few animal species may result in abortion, fetal abnormalities or perinatal death (Gilbert *et al.*, 2000). Humans become infected postnatally by ingesting tissue cysts from undercooked meat, consuming food or drink contaminated with oocysts, or by accidentally ingesting oocysts from the environment. The proportion of the human population that acquires infection by ingestion of oocysts in the environment or by eating contaminated meat is not known and there are currently no tests available that can determine the infection source. However, seroepidemiologic data suggest that ingesting improperly cooked meat containing *T. gondii* cysts is a major source of infection for humans in the USA (Dubey and Jones, 2008).

Pigs are important to the economy of many countries because they are a source of food for humans. Infected pig meat is a source of *T. gondii* infection for humans and animals in many countries. This parasite also causes mortality in pigs, especially neonatal pigs. Most pigs acquire *T. gondii* infection postnatally by ingestion of oocysts from contaminated environment or ingestion of infected tissues of animals. Few pigs become infected prenatally by transplacental transmission of the parasite. Raising pigs indoors in confinement has greatly reduced *T. gondii* infection in pigs but the recent trend of organic farming is likely to increase *T. gondii* infection in pigs (Dubey, 2009).
MATERIALS AND METHODS

**Sera samples.** There have been checked 285 sows and 282 fattening pigs reared in the intensive system, from five indoor farms, from Centre and North-Western Romania (Cluj, Sibiu, Arad, Satu-Mare and Maramureș counties). The pigs were slaughtered in 3 slaughterhouses. We were divided the pigs in two groups: group one – 1 to 3 year old sows (85 from Cluj and 200 from Satu-Mare,); groupe two – 6-7 months old fattening pigs (47 from Satu-Mare, 47 from Arad, 94 from Sibiu and 94 from Maramureș counties). Blood was harvested from the jugulare vein, at the time of slaughtering, and sera were transferred in eppendorf tubes and were kept in a freezer at -20 °C until use.

**ELISA.** The samples were processed through ELISA technique, in the direction of detecting anti-\textit{T. gondii} antibodies IgG type, using a commercial kit (Toxoplasmosis Indirect Multi-Species, made by ID. VET Innovative Diagnostics, France). The sera were diluted 1:10. The sera were considered positive if the S/P value was \(\geq 50\%\), while the value of S/P between 40 and 50% were considered doubtful.

**Statistical analysis.** The results were statistically analysed to calculate the statistical significance of the prevalence of \textit{T. gondii} infection in pigs (fattening pigs and sows) by Chi-square test using EpiInfo program. It was considered significantly statistically values of \(p \leq 0.05\).

RESULTS AND DISCUSSIONS

In the case of fattening pigs there were obtained positive results only in Arad farm with a prevalence of 2.1\% (1/94), without statistical significance between farms \((p = 0.1705)\) (Tab. 1). In Satu-Mare county antibodies against \textit{T. gondii} were detected in 1/200 (0.5\%) sows and in 42/85 (49.4\%) sows from Cluj county. It is possible that the difference among provinces may be due to the type of management practices in the farms where the sows originated. Comparing the results of the ELISA test there was noticed a statistical significance between the sow farms \((p = 0.0001)\) (Tab. 2).

The overall prevalence of \textit{T. gondii} infection in fattening pigs was 0.4\% (1/282) and in sows 15.1\% (43/285). The seroprevalence of infection with \textit{T. gondii} increases as they grow, being significantly higher in reproduction pigs (Tab. 3, Fig. 1).

<table>
<thead>
<tr>
<th>Positive n (%)</th>
<th>Satu-Mare</th>
<th>Arad</th>
<th>Sibiu</th>
<th>Maramureș</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI 95%</td>
<td>0 (0)</td>
<td>1 (2.1)</td>
<td>0</td>
<td>0</td>
<td>0.1705</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Negative n (%)</th>
<th>Arad</th>
<th>Sibiu</th>
<th>Maramureș</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI 95%</td>
<td>46 (97.9)</td>
<td>94 (100)</td>
<td>94 (100)</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Legend: CI – confidence interval

<table>
<thead>
<tr>
<th>Positive n (%)</th>
<th>Cluj</th>
<th>Satu-Mare</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI 95%</td>
<td>38.4-60.5</td>
<td>0-2.8</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Legend: CI – confidence interval
In the present study, we used a ELISA test as a method for serodiagnosis of *T. gondii* infection in pigs. This study wanted to bring in evidence, primarily seroprevalence of *T. gondii* infection in pigs slaughtered for human consumption and the existence of risk for human contamination through the consumption of raw meat.

Our study reflect that the prevalence of *T. gondii* in pigs (0.4% in fattening pigs and 15.1% in sows) from Center and North-Western Romania is smaller than in other European and American countries.

In Romania, the similar studies on indoor sows from Cluj county, was obtained a very hight prevalence (33-46,5%). Inadequate rodent control is considered to play a role in *T. gondii* infection of pigs. This prevalence is due to very poor management conditions (Iovu et al., 2008). In another study, from the South of Romania, 265 samples of indoor pigs were tested with a Romanian homologated ELISA kits. The results obtained revealed 62,26% positive sample in pigs. These results were confirmed by indirect imunofluorescence (Militaru et al., 2008).

To determine the seroprevalence of *T. gondii* infection in pigs raised and slaughtered in Sicily, Southern Italy were used a commercial Enzyme-Linked Immunosorbent Assay (Institut Pourquier, France). Antibodies against *T. gondii* were found in 16.3% of Sicilian pig.
pigs. The lowest seroprevalence, 7%, was found in the age group 5–7 months (fattening pig) and the highest, 19%, in the age group >24 months (Villari et al., 2009).

In Argentina were tested 280 serum samples from slaughter sows. Antibodies to *T. gondii* were detected in 87 (37.8%) of 230 sows sera. They were obtained a 4.5% serum samples positive to *T. gondii* in indoor fattening pigs (Venturini et al., 2004).

A total of 2041 plasma samples of sows from 94 randomly selected farms were examined in southern Hesse, Germany. Antibodies to *T. gondii* were detected by ELISA in 19% of the sows. The within-herd seroprevalence was significantly higher in farms with reproductive disorders than in those without such problems. The seroprevalence increased significantly with the age of sows (Damriyasa et al., 2004).

The prevalence obtained in our study (0.4% in fattening pigs and 15.1% in sows) reflect the existence of a real risk of human contamination through the consumption of row meat. Our results show that it should be possible to eradicate or reduce infections with *T. gondii* in modern intensive farming system. The main risk factors identified are representative of large contact with the outside world with very many of them easily controllable.

Toxoplasmosis prevalence to human populations is associated with exposure to risk factors. A high incidence of toxoplasmosis has been detected in people coming in contact with the ground, which consume raw meat or unwashed vegetables/fruits, to persons who have poor body hygiene or food is cooked in poor conditions (Tenter et al., 2000). An increased prevalence of *T. gondii* infection was observed in women older than 40 years, which consume raw meat, vegetable or fruit improperly washed (Studenicova et al., 2006).

**CONCLUSIONS**

In the intensive farm pigs, in good management, the seroprevalence of *T.gondii* infection is very low (fattening pigs 0.4% and sows 0.5%). In reproduction pig farm of Cluj county, the increased prevalence of *T. gondii* infection is due to very poor management conditions (49.4%). The prevalence of anti-*T. gondii* antibodies was positively correlated with the age of sows.

**ACKNOWLEDGEMENTS**

This work was supported by the Ministry of Education, Research and Inovation of the Romania – National Authority for Scientific Research (grants PNII PC 51-013/2007).

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