Seroprevalence of *Toxoplasma gondii* Infection Among Pregnant Women in Shandong Province, China

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Abstract: The seroprevalence of *Toxoplasma gondii* infection in pregnant women was investigated in Shandong Province, China between August 2010 and September 2013. A total of 7956 serum samples collected from 15 representative administrative regions in Shandong Province, China were evaluated by Enzyme-Linked Immunosorbent Assay (ELISA) for the detection of specific antibodies. Overall, 13.33% (1218/9139, 95% CI: 12.63-14.02) of the samples was positive for specific IgG against *T. gondii*. The highest seroprevalence was found in low educational standards (15.77%; 533/3379, 95% CI: 14.55-17) and followed by secondary educational standards (12.15%; 454/3736, 95% CI: 11.1-13.2) and high educational standards (11.41%; 231/2024, 95% CI: 10.03-12.8). Furthermore, the seroprevalence of *T. gondii* was the highest in less more 8 weeks (time of pregnancy) (14.12%; 431/3053, 95% CI: 12.88-15.35), followed by 8-12 weeks (13.08%; 508/3900, 95% CI: 11.97-14.08) and >12 weeks (12.76%; 279/2186, 95% CI: 11.36-14.16). The present resulted indicated infection with *T. gondii* is prevalence in pregnant women in Shandong Province, China which provides relevant “base-line” data for conducting control strategies and measures against toxoplasmosis in this region and elsewhere in China. This is the first report of the comprehensive survey of *T. gondii* seroprevalence in pregnant women in Shandong Province, China.

Key words: *Toxoplasma gondii*, seroprevalence, pregnant women, Shandong Province, China

INTRODUCTION

Toxoplasmosis caused by *Toxoplasma gondii* is one of the more common parasitic zooneses world-wide. It has been found worldwide in nearly one-third of the human population (Zhou et al., 2011). Almost infected adults are usually asymptomatic but can cause mortality in the very young and the immune-compromised disease like AIDS patients occasionally (Elmore et al., 2010). Importantly, *T. gondii* infection in pregnant women may cause poor obstetric outcomes such as hydatidiform mole, spontaneous abortion, teras, still-born and sterility (Gao et al., 2012).

The seroprevalence of *T. gondii* infection in pregnant women is 6.1% in Mexico (Alvarado-Esquivel et al., 2006), 43.8% in France (Berger et al., 2009), 35% in Austria (Edelhofer and Prossinger, 2010), 53% in Brazil (Vaz et al., 2010), 10.3% in Japan (Sakikawa et al., 2012), 34.4% in Iran (Babaie et al., 2013), 30.9% in Tanzania (Mwambe et al., 2013). *T. gondii* infection in pregnant women has been reported in many provinces of China ranging from 0.5% (Cheng et al., 2006) to 25.5% (Zhong and Xue, 2006) in China. However, these literatures were published in the Chinese language in local journals and are not readily accessible to international readers. Moreover, little information is available about the seroprevalence of *T. gondii* infection in pregnant women living in Shandong Province, China (He et al., 1999; Liu and Li, 2001). Therefore, the objective of the present investigation was to examine the *Toxoplasma gondii* seroprevalence in pregnant women in Shandong Province, China. The results should provide base-line data for recommendations with regards to prevention and control of toxoplasmosis in this region and elsewhere in China.

MATERIALS AND METHODS

A total of 7956 blood samples were collected from pregnant women in hospital which are distributed in 15 representative administrative regions in Shandong Province city between August 2010 and September 2013 (Table 1). The pregnant women were 21-38 years old.

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Table 1: Seroprevalence of *Toxoplasma gondii* infection in pregnant women in Shandong Province, China

<table>
<thead>
<tr>
<th>Regions</th>
<th>No. of tested</th>
<th>No. of positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zibo</td>
<td>478</td>
<td>66</td>
<td>13.81</td>
</tr>
<tr>
<td>Zaozhuang</td>
<td>579</td>
<td>62</td>
<td>10.71</td>
</tr>
<tr>
<td>Dongying</td>
<td>662</td>
<td>78</td>
<td>11.78</td>
</tr>
<tr>
<td>Jining</td>
<td>572</td>
<td>76</td>
<td>13.29</td>
</tr>
<tr>
<td>Tai’an</td>
<td>361</td>
<td>59</td>
<td>16.34</td>
</tr>
<tr>
<td>Weihai</td>
<td>367</td>
<td>56</td>
<td>15.26</td>
</tr>
<tr>
<td>Rizhao</td>
<td>258</td>
<td>65</td>
<td>21.80</td>
</tr>
<tr>
<td>Binzhou</td>
<td>419</td>
<td>98</td>
<td>23.39</td>
</tr>
<tr>
<td>Dezhou</td>
<td>678</td>
<td>88</td>
<td>12.98</td>
</tr>
<tr>
<td>Liaocheng</td>
<td>778</td>
<td>54</td>
<td>6.94</td>
</tr>
<tr>
<td>Heze</td>
<td>559</td>
<td>69</td>
<td>12.34</td>
</tr>
<tr>
<td>Laiwu</td>
<td>789</td>
<td>101</td>
<td>12.80</td>
</tr>
<tr>
<td>Lingzi</td>
<td>899</td>
<td>99</td>
<td>11.12</td>
</tr>
<tr>
<td>Jinan</td>
<td>830</td>
<td>102</td>
<td>12.29</td>
</tr>
<tr>
<td>Qingshao</td>
<td>879</td>
<td>145</td>
<td>16.50</td>
</tr>
<tr>
<td>Total</td>
<td>9139</td>
<td>1218</td>
<td>13.33</td>
</tr>
</tbody>
</table>

Blood samples were then centrifuged at 1,000 g for 10 min and serum was obtained, frozen and stored at -20°C until use.

ELISA was used for determination of *T. gondii* IgG antibodies. The ELISA kits were provided by Beijing Modern Golden Biotechnology Co., Ltd. Beijing, China. The procedure was performed according to the manufacturer’s instructions.

The data were analyzed statistically using the PASW Statistics 18 (IBM Corporation, Somers, NY, USA). 95% Confidence Intervals (CI) are given. The value of *p* < 0.05 differences between levels within factors and interactions were considered to be statistically significant.

**RESULTS**

Antibodies against *T. gondii* were detected in 13.33% (1218/9139; 95% CI: 12.63-14.02) pregnant women. The *T. gondii* seroprevalence in pregnant women from different regions ranged from 6.94 (95% CI: 5.16-8.73) to 23.39% (95% CI: 19.34-27.44) (Table 1), having not statistically significant differences (*p* > 0.05). The seroprevalence of *T. gondii* in pregnant women from 6 of the 15 representative administrative regions in Shandong Province city was >13.33% (95% CI: 12.63-14.02) (average value) and the highest seroprevalence (23.39%) (95% CI: 19.34-27.44) was in Binzhou city (Table 1). The highest seroprevalence was found in low educational standards (15.77%; 533/3379; 95% CI: 14.55-17) and followed by secondary educational standards (12.15%; 454/3736; 95% CI: 11.1-13.2) and high educational standards (11.41%; 231/2024; 95% CI: 10.03-12.83). Furthermore, the seroprevalence of *T. gondii* was the highest in less more 8 weeks (time of pregnancy) (14.12%; 431/3053; 95% CI: 12.88-15.35), followed by 8-12 weeks (13.03%; 508/3500; 95% CI: 11.97-14.08) and >12 weeks (12.76%; 279/2186; 95% CI: 11.36-14.16).

**DISCUSSION**

*T. gondii* is a parasite widely distributed around the world, infecting humans and all warm-blooded animals. Although, it is considered as major pathogens of abortion, there is no information about the seroprevalence of *T. gondii* infection in pregnant women living in Shandong Province, China.

Seroprevalence of *T. gondii* in pregnant women in the present study was 13.33% (95% CI: 12.63-14.02) which is significantly higher than that in Anhui (8.97%) (Tang et al., 1994), Gansu (7.28%) (Zhang et al., 1999), Guangxi (5.93%) (Guo et al., 1998), Guizhou (10.3%) (Zheng, 2007), Hainan (9.6%) (Zhang et al., 2006), Henan (7.5%) (Liu and Guo, 2009), Hunan (6.03%) (Lin et al., 2001) and Zhejiang (6.51%) (Zuo et al., 2009) provinces of China but was lower than those in Hubei (22.8%) (Liu and Jun, 2009), Liaoning (21.5%) (Li et al., 2004) provinces of China. This is most likely due to difference in welfare, climates and lifestyle. Another reason for the different seroprevalence may be due to use different investigational methods.

The highest seroprevalence was found in low educational standards (15.77%; 95% CI: 14.55-17) which was consistent with that of earlier study (Liu et al., 2009). The earlier and present studies indicated that health education has been proved a cost-effective intervention. The peaks of *T. gondii* seroprevalence in less more 8 weeks suggested that it is more important to control and prevent toxoplasmosis in this stage.

The ingestion of food or water that is contaminated with oocysts shed by cats is considered an important source of *T. gondii* infection in humans (Zhou et al., 2011). In present study, researchers observe that people of this region have the habit of eating raw vegetables or undercooked meat. More importantly, we noted that many pregnant women have contact with cats. So, these results indicate that *T. gondii* may exist in their environment which may also pose the risk for human infection.

Toxoplasmosis can lead to abortion, stillborn, mummification in pregnant women (Elmore et al., 2010). However, the present dataset could not determine whether or not *T. gondii* infection can significantly increase the risk of abortion in the pregnant women. Therefore, further studies are necessary to elucidate a potential effect of *T. gondii* on reproduction of pregnant women.

**CONCLUSION**

The present results indicated the high seroprevalence of *T. gondii* infection in pregnant women in Shandong
Province, China, however, this severe situation received little attention in the past. Therefore, effective measures should be taken to prevent and control toxoplasmosis in pregnant women in this region and elsewhere, China. This is the first report of the comprehensive survey of *Toxoplasma* seroprevalence in pregnant women in Shandong Province, China.

**REFERENCES**


