Short Communication

Seroepidemiology of *Toxoplasma gondii* Infection in Child Bearing Age Women in Dir Khyberpakhtunkhawa, Pakistan

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**ABSTRACT**

Toxoplasmosis is the most prevalent parasitic zoonotic disease caused by *Toxoplasma gondii* that infects a wide range of warm-blooded animals including humans. Congenital infection with *T. gondii* during pregnancy can result in severe abnormalities in infants such as hydrocephalus and mental retardation. The present study was conducted to estimate seroprevalence and potential risk factors in acquiring *T. gondii* infection by child-bearing age women in Dir Khyber Pakhtunkhwa, Pakistan. A cross sectional study was conducted and data regarding risk factors were recorded through questionnaire. A total of 405 women of child bearing age were serologically tested for *T. gondii* antibodies through immuno-chromatographic technique using strips (CTK, USA) and Indirect Enzyme Linked Immunossorbant Assay (i-ELISA). The study revealed that overall 57.28% sero-prevalence was recorded in women of child bearing age. Highest (56.46%) seroprevalence was recorded in pregnant women as compared to non-pregnant women (43.53%). Highest (57.3%) sero-prevalence was recorded in women having 21-30 years age. Notably, the highest (25%) prevalence was reported in second trimester of pregnancy. Higher (52.6%) incidence of *T. gondii* infection was observed in illiterate women. The study demonstrates that age, low level of education, pregnancy, contact with cat and soil are the major risk factor of *T. gondii* infection.

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Toxoplasmosis is one of the most prevalent zoonotic disease infecting wide range of warm-blooded animals including humans (Petersen et al., 2010; Torgerson and Macpherson, 2011). Approximately 6 billion people worldwide are infected with *Toxoplasma gondii* (Furtado et al., 2011). The causative agent of toxoplasmosis is an obligate intracellular protozoan parasite having cat as the definitive host and warm blooded animal including human are intermediate host (Dubey, 2010). The presence of *Toxoplasma* has been reported in every country and its prevalence ranges from 30% to 60% in both developed and developing countries (Flegr et al., 2003).

The seroprevalence of toxoplasmosis greatly varies among different geographic regions of the country and among different age group within the same area.

*Toxoplasma* infection during pregnancy can result in spontaneous abortion, stillbirth, or a child that is seriously handicapped mentally and physically (Montoya and Rosso, 2005; Dubey, 2010). Toxoplasmosis is possibly a risk factor for personality shifts and reduced intelligence or schizophrenia (Dogruman et al., 2009). Screening of toxoplasma is very important in child bearing age women. It helps in identification of women at risk and contracting the infection and approach for the control of innate toxoplasmosis (Montoya and Liesenfeld, 2004).

Seroprevalence rate of *T. gondii* varies among different parts of the world (Tenter et al., 2000). The seroprevalence of toxoplasma has reported 70% in Indonesia, 81% in Ethiopia, 52% in Brazil, 10.8% in the U.S., 13.2% in Korea, 25% in Africa and 75% in Burkina Faso (Torgerson and Macpherson, 2011).

In Pakistan, toxoplasmosis is one of the neglected diseases and its prevalence is unknown among child bearing age women. Few studies are carried out in Pakistan.
to assess the prevalence among general population (Aleem et al., 2018). To prevent life threatening consequences of congenital Toxoplasmosis, it is important to study the epidemiology and potential risk factors of Toxoplasma infection in child bearing age women. Therefore, the present study was designed to investigate the overall sero-prevalence and potential risk factors in acquiring T. gondii infection in child bearing age women in Dir Khyber Pakhtunkhawa Pakistan.

Materials and methods
A cross sectional study was conducted from May 2016 to October 2016. District Dir (L) is situated in north western part of KhyberPakhtunkhawa, Pakistan. Women population of child bearing age (14-55) was selected and blood samples were collected. Data regarding risk factors were recorded through questionnaire (age, qualification, marital status, pregnancy duration, raw meat, vegetable and milk consumption, hand washing after raw vegetable and meat consumption, residential place, house floor type, contact with soil, drinking water source, cat at home , contact with cat, livestock at home, contact with livestock, awareness about Toxoplasma). Sample size was calculated according to Thrusfield (1995). Blood samples (405) were collected and centrifuged at 3000 rpm for 10 min. The obtained serum was tested for T. gondii with the help of immuno-chromatographic technique using strips (CTK, USA). All samples were repeated through Indirect Enzyme Linked Immunosorbant Assay (i-ELISA) for T. gondii antibodies.

The data were statistical analyzed using (SPSS) and Microsoft Excel. To determine the association between seropositivity and potential risk factors Chi-square test was used.

Results and discussion
The overall sero-prevalence of T. gondii infection in women of childbearing age was recorded as 57.28%, while among pregnant women seroprevalence was recorded 56.46% and 43.53% were recorded among non-pregnant. The results of the present study are in line with the findings of earlier researchers (Mostafavi et al., 2012). They reported 57.60% and 47.50 % sero-prevalence among child bearing age women in Timis, Isfahan and Iran respectively. Higher seroprevalence 65.71% was recorded in women of child bearing age in Malakand agency Khyber Pakhtunkhawa, Pakistan (Khan et al., 2014). Seroprevalence (60-75%) was reported in northern part of Iran (Youssefi et al., 2007; Sharif et al., 2006). Discrepancy in the results might be due to climatic condition, eating habits, possessing cat, life style, enrolled subjects and different sampling and analysis methods among different areas and studies.

Among positive cases of child bearing age women 7.80% were in age group 14-20 years, 57.30% were in age group 21-30 years, 26.30% were in age group of 31-40 years, 8.60% were in age group of 41-50 years. These results are in line with early findings (Khan et al. 2014). Prevalence in age group of 21-30 years from Khartoum State, Sudan was reported by were observed by Mohamed et al. (2013). Among positive cases of child bearing age women 7.80% were in age group of 14-20 years , 26.30% were in age group of 31-40 years, 8.60% were in age group of 41-50 years while no positive cases were recorded having age above 50 years. These results are in line with the findings Mohamed et al. (2013). Several studies have indicated an increase in seroprevalence with age (Techalew et al. 2009; Sroka et al. 2010) which might be due to accumulated opportunities for contact. These differences in results may be due to target group which were in age of 14-45 years which is considered as reproductive age.

Seroprevalence of T. gondii among pregnant women during different stages of pregnancy is presented in Figure 1. Different stages of pregnancy showed different percentage of seroprevalence among women. Higher seroprevalence25.00 %was recorded at second trimester (4-6 months), 15.90 % was recorded at first trimester (1-3months), followed by (15.00 %) at third trimester (6-9 months).

The effect of different level of education on seroprevalence of T. gondii was presented in Figure 2. Education level showed a significant effect on seroprevalence of T. gondii. Those women having high education, the seroprevalence of T. gondii was minimum. Higher seroprevalence (52.6%) was recorded in illiterate women, followed by women having primary level of education (17.2 %). Similar findings were also reported by Gebremedhin et al. (2013) and Malarvizhi et al. (2012). Higher seroprevalence was recorded in illiterate women, followed by women having primary level of education. The results of the present study are an agreement with
the findings of previous researchers Doni et al. (2015), Jones et al. (2001) and Daryani et al. (2014) reported that T. gondii seroprevalence reduced with the increase in education level. With higher education level knowledge about awareness, prevention and controlling of disease as a source of infection increases which decrease chance of infection.

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**Fig. 2.** Seroprevalence of Toxoplasma gondii infection in child bearing age women having different levels of education.

The comparison of different risk factors for Toxoplasma seropositivity is shown in Table I. Consumption of raw vegetables and raw milk was reported in 26.70 % and 27.70 %, respectively. Among the positive cases, 84.10 % women have contact with cat. Higher (74.60 %) seroprevalence was recorded in women living in rural areas as compared to urban areas (25.40 %). Prevalence in women living in house having soil floor was 56.90 %, consuming spring water was 35.30 %, and contact with soil was 66.4%. High (65.90 %) seroprevalence was recorded in women who had contact with livestock.

The current results consonant with the early findings of Njunda et al. (2011) and Liu et al. (2009) who reported that Toxoplasma infection as associated with raw vegetable consumption. Comparatively higher seroprevalence was recorded in women who have contact with cat. Similar findings were reported by Acha and Szyfres (2003) and Negash et al. (2008). The high seroprevalence in presence of cat in the household may be due to contamination of the environment with cat shaded oocysts which become infective for a long time in water or soil (Dubey, 2010). Higher prevalence was reported in rural areas as compared to urban areas. The current results are in consistent with the findings Ertug et al. (2005). The present study revealed that women living in rural areas, contact with soil and livestock, illiterate or primary education, low socioeconomic conditions are sensitive to T. gondii infection. The results of the present study are an agreement with the findings of some previous studies of Tammam et al. (2013), Senthamarai et al. (2013) and Siddiqui et al. (2014). Life style of the residents in the areas, there socioeconomic condition, contact with livestock and other related activities and favorable climatic condition may contribute for T. gondii oocysts sporulation and increase rate of infection (Liu et al., 2009).

**Table I.- Association of risk factors and seropositivity among child bearing age women.**

| Factors                  | Category | Number of positive samples | Prevalence (%) |
|--------------------------|----------|---------------------------|----------------|
| Raw vegetable consumption| +        | 62.00                     | 26.70          |
| Raw milk consumption     | -        | 170.00                    | 73.30          |
| Raw meat consumption     | +        | 64.00                     | 27.60          |
| Hand washing after handling raw meat | -   | 168.00                    | 72.40          |
| Hand washing after handling raw vegetable | - | 232.00                    | 100.00         |
| Cat at home              | +        | 20.00                     | 84.10          |
| Contact with cat         | +        | 202.00                    | 87.10          |
| Contact with livestock   | -        | 30.00                     | 12.90          |
| Exposure to soil         | +        | 150.00                    | 66.70          |
| Livestock at home        | +        | 82.00                     | 35.30          |
| Making dong cakes        | -        | 154.00                    | 66.40          |
| Making dong cakes        | +        | 220.00                    | 88.40          |
| Making dong cakes        | -        | 37.00                     | 15.10          |
| Making dong cakes        | +        | 146.00                    | 64.60          |
| Making dong cakes        | -        | 78.00                     | 33.60          |
| Making dong cakes        | +        | 146.00                    | 66.40          |
| Making dong cakes        | -        | 86.00                     | 37.10          |
| Making dong cakes        | +        | 153.00                    | 65.90          |
| Making dong cakes        | -        | 79.00                     | 34.10          |
| Making dong cakes        | +        | 119.00                    | 51.30          |
| Making dong cakes        | -        | 113.00                    | 48.70          |
| Awareness about toxoplasmosis | +   | 48.00                     | 20.70          |
| Awareness about toxoplasmosis | - | 184.00                    | 79.30          |

+ and -” denote Yes and No, respectively.

**Conclusion**

In present study potential risk factors to acquire T. gondii infection in child bearing age women was identified. The high seroprevalence of T. gondii infection was recorded in pregnant women, and those who have low level of education. Women living in rural areas are at high risk. The results of the present study help to alert the government and private sector to take initiative to control the overwhelming outcome of these zoonotic diseases.

**Statement of conflict of interest**

The authors state that there is no conflict of interest in publishing this work.
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