RESEARCH PAPER

Detection of *Toxoplasma gondii* among Healthy Populations by Different Techniques in Erbil Province

Ahmed Akil Khudhair Al-Daoody, Tara Srood Suad, Hiba Rizgar Hashim, Omer Dler Babasheikh, Helen Yousif Akram, Sarab Khairadin Ali

Department of Medical Microbiology, College of Health Sciences, Hawler Medical University, Erbil, Kurdistan Region, Iraq.

**ABSTRACT:**

*Toxoplasma gondii* causes the foremost widespread protozoan infection with a broad variety of host range. Toxoplasmosis in Immunocompetent person is usually asymptomatic but severe complications might occur in immunocompromised persons and life threatening congenital infections can develop during pregnancy. This study was conducted to investigate the prevalence and risk factors of *T. gondii* among healthy populations in Erbil City. A total of 167 healthy participants were examined for the detection of *T. gondii* in Erbil City from November 2017 to January 2018 by using Latex agglutination test and ELFA-IgM and IgG. For collecting full information about the participants, a special questionnaire sheet was prepared and data were analyzed using SPSS software version 21. Out of 167 samples examined 41(24.6%) were positive by LAT, 14(8.4%) were positive for IgG by Mini-Vidas and 26(15.6%) were positive for IgM by Mini-Vidas. The prevalence rate of toxoplasmosis among females was (25.6%) which was higher than that seen among males (23.5%) but statistically insignificant. High seropositivity (28.2%) was observed in age group 11-20. Those who had contact with cats showed high percentage (25.7%) of infection, also in rural residents seropositivity was higher (30.8%) than urban residents (22.7%). No significant differences were observed between those who consumed and non-consumed fast food. Our study concluded that to reduce risk of toxoplasma infection in our community, it should avoidance direct contact with cat and soil, or consumes fast food, poultry or ordinary farm meat without sufficient cooking.

**KEY WORDS:** Detection; Toxoplasma gondii; Healthy; Latex; ELFA; Erbil.

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**1. INTRODUCTION:**

Toxoplasmosis is a zoonotic parasitic infection of humans and animals produced by *Toxoplasma gondii* (Al-Mossawe et al., 2016). It belongs to coccidian parasites, which having an alternating two-generation life cycle (Koyee and Faraj, 2015; Lorenzi et al., 2016). *T. gondii* can infecting any mammalian or avian cells and replicating within these nucleated cells, has two part of life cycle; divided to sexual replication in feline host and asexual replication in nonfeline host (Abd Al-Hussien et al., 2016).

Toxoplasmosis causes a lot of disease syndromes in women, ranging from headache-like symptoms in healthy adults, severe symptoms in immuno-deficiency individuals, to birth damage in fetus when females are exposed during pregnancy (Rahi and Jasim, 2011). In normal individuals, extracellular Tachyozites in acute phase of infection are rapidly destroyed and controlled with the immunity, whereas intracellular Bradyzoites multiplication is hindered, and formed tissue cysts, which are commonly found in the skeletal muscle, heart, retina and brain, generally cause little or no tissue lesion (Champoux et al., 2004). Chronic phase of toxoplasma infection might cause myocarditis, developing to permanent heart defect and pneumonia (Bogitsh et al., 2013).
Oocysts shed only in feces of feline family especially cats, in intermediate host species, the ingestion of mature oocysts from contaminated water, soil or contact with cat feces cause infection in exposed host (Esch and Petersen, 2013). Humans also become infected by eating tissue cysts in raw or inadequate cooked meat (Hill and Dubey, 2002; Al-Daoody, 2012).

In human and mammals hosts, *T. gondii* is so much related with congenital infection and abortion; this parasite can be transmitted by cross the hemato-placental transmission of the rapidly growing tachyzoite form mother to fetus during pregnancy (Halonen and Weiss, 2009).

In addition, in several hosts tachyzoites may also be transmitted in the milk from the mother to the baby (Dubey, 2010). Transmission of *T. gondii* can also occur through blood transfusion if the donor has recently acquired toxoplasmosis and is parasitemic at the time of blood sampling, transmission can also occur during organ transplantation (Hill and Dubey, 2002).

**Aims of the study**

1. Detection of toxoplasmosis among healthy individuals in Erbil City.
2. Assess the risk factors of toxoplasmosis such as (contact with cat, contact with soil, type of meat consumed and residency) within the same investigated group.

**2.MATERIALS AND METHODS**

**2.1 Study Population**

The samples were collected from (November 2017 to January 2018) at Rizgari Hospital and Hawler Teaching Hospital. The study was conducted on 167 people (the age ranged from 3.5 to 35 years old) and various information about the participants was collected through a special questionnaire sheet.

**2.3 Samples Collection**

This study was carried out on 167 samples (81 Males and 86 Females). Blood samples were collected from all participants, and then transported to each of Rizgari and Hawler Teaching Hospital microbiology labs. The collected blood were centrifuged at 3000 rpm for 10 minutes to separate the sera which were then divided to 2 parts and placed into Eppendorf tubes labeled with names and numbers then stored at -20 c° in the freezer to be tested later.

**2.3 Serological techniques**

Three serological tests were performed on the samples to detect *T. gondii* infection, which were LAT (Latex Agglutination Test) was provided from PLASMATEC (UK) and ELFA (Enzyme Linked Fluorescence Assay)-IgG/IgM provided from (bioMerieux SA) (France) (L21-TOX.V1) (2010-07).

**Statistical Analysis**

The results obtained from the serological techniques and the questionnaire data submitted to statistical analysis by using statistical package social system (SPSS v: 21).

**RESULTS**

**3.1 Frequency of anti-Toxoplasma antibodies in the sera by Latex agglutination test, IgG test by mini-vidas device and IgM test by mini-vidas device:**

A total of 167 participants were tested for *Toxoplasma gondii* antibodies in the present study by LAT test technique then by ELFA-IgG and ELFA-IgM antibodies by mini-vidas device. The overall percentage of infection were 41(24.6%) by LAT, 14(8.4%) by Mini Vidas – IgG and 26(15.6%) by Mini Vidas – IgM as seen in (Table 1).
Table 1: Frequency of anti-Toxoplasma antibodies in the sera by three techniques.

| Techniques                  | Participants | Total |
|-----------------------------|--------------|-------|
|                             | No. +ve (%)  | No. -ve (%) |   |
| Latex agglutination test    | 41(24.6)     | 126(75.4) | 167 |
| ELFA - IgG                  | 14(8.4)      | 153(91.6) | 167 |
| ELFA - IgM                  | 26(15.6)     | 141(84.4) | 167 |

3.2 Sero-prevalence of anti-Toxoplasma antibodies in relation to gender by LAT:
As shown in (Table 2), in 167 samples (81) samples were taken from males and (86) from females. A higher sero-positivity was observed among females (25.6%) than males (23.5%), but the difference was statistically insignificant (P.value = 0.752).

Table 2: Sero prevalence of anti-Toxoplasma antibodies in relation to gender by LAT.

| Gender  | Latex agglutination test | Total | P.value |
|---------|--------------------------|-------|---------|
|         | No. +ve (%) | No. -ve (%) |               |         |
| Male    | 19(23.5)     | 62(76.5)   | 81(48.5)    | 0.752   |
| Female  | 22(25.6)     | 64(74.4)   | 86(51.5)    |         |
| Total   | 41(24.6)     | 126(75.4)  | 167(100)    |         |

3.3 Distribution of anti-Toxoplasma antibodies among the surveyed population according to different age groups by LAT:
Seropositivity for anti-Toxoplasma antibodies appeared to be highest among the ages ranging from 11-20 years that had a seropositive result of 28.2% and close to that was among the ages of ≤10 years which had a result of 25% followed by those among the age range 21-30 years which had a seropositivity of 22.5% and lowest results were among the age group of ≥ 31 years that had a seropositivity of 10%. The differences were not statistically significant (P.value=0.602) as shown in (Figure 1).
3.4 Seropositivity of *Toxoplasma gondii* antibodies according to contact with cats by LAT:

In a total of 167 sample participants who had contact with cats had seropositivity of 9/35 (25.7%) while those who had no contact with cats had a seropositivity of 32/132 (24.2%). As presented in **Table 3** and have shown no statistical significance (P.value = 0.857).

**Table 3**: Prevalence of anti-*Toxoplasma* antibodies according to the contact with cats by LAT.

| Contact with cats | Latex agglutination test | Total | P.value |
|-------------------|--------------------------|-------|---------|
|                   | No. +ve (%) | No. -ve (%) |       |         |
| Yes               | 9(25.7)      | 26(74.3)    | 35(21.0)| 0.857   |
| No                | 32(24.2)     | 100(75.8)   | 132(79.0)|         |
| Total             | 41(24.6)     | 126(75.4)   | 167(100)|         |

3.5 Prevalence of *Toxoplasma gondii* antibodies according to residency by LAT:

Statistically no significant differences (P.value=0.303) were recorded in infection according to residency, after exam a total of 167 samples (**Figure 2**). Although higher seropositive results were recorded among rural residents 12/39(30.8%), while lower results were among urban residents 29/128 (22.7%).
Figure 2: Prevalence of anti-Toxoplasma antibodies in a healthy population according to the residence area by LAT.

3.6 Seroprevalence of *Toxoplasma gondii* antibodies according to Fast-Food consumption by LAT:
As shown in (Figure 3) highest seropositivity was among those who consumed fast food, which was (25.4 %) while it was (22.0%) among those that didn’t consume fast food but the difference was not statistically significant (P.value=0.656).

Figure 3: Prevalence of anti-Toxoplasma antibodies according to Fast-Food consumption by LAT.

3.7 Seropositivity of *Toxoplasma gondii* antibodies according to contact with soil by LAT:
As shown in (Table 4). The high rate of seropositivity was observed among those who had contact with soil (25.8%), while it was (23.8%)
among those who had no contact with soil, although this difference statistically was not significant (P.value=0.77).

**Table 4:** Seroprevalence of anti-*Toxoplasma* according to contact with soil by LAT.

| Contact with soil | Latex agglutination test | Total | P. value |
|-------------------|--------------------------|-------|----------|
|                   | No. +ve (%) | No. -ve (%) |       |
| Yes               | 17(25.8)    | 49(74.2)    | 66(39.5) |
| No                | 24(23.8)    | 77(76.2)    | 101(60.5) |
| Total             | 41(24.6)    | 126(75.4)   | 167(100) |

3.8 **Distribution of Toxoplasma gondii antibodies according to Type of meat consumed by LAT:**

In a total of 167 samples highest seropositivity was among those who ate ordinary farm meat (27.5%) followed by those who ate both ordinary farm meat and poultry meat (23.7%) While lowest seropositivity was observed among those who ate only poultry meat (23.5%) as seen in (Figure 4), but the difference was not statistically significant (P.value=0.884).

![Figure 4: Prevalence of anti-Toxoplasma antibodies in relation to the type of meat consumed by the participants by LAT](image)

4. **DISCUSSION**

The present study evaluates the prevalence of toxoplasmosis in healthy participants in Erbil city. The overall prevalence of anti-*Toxoplasma* antibody (Table 1) was (24.6%) by Latex agglutination test, this result is similar to other studies, which were done in Thi-qar (21.94%) by (Al-Mosawi *et al*., 2005), in Kirkuk (21.5%) by (Obaid, 2017), and in Kerbala (25.6%) by (Hasan, 2017).
2011). While disagree with (Shin et al., 2009) in Korea who recoded (6.6%), and in Mexico (4.6%) by (Galván-Ramírez et al., 2010). Whereas higher results were recorded in Erbil (45.2%) by (Al-Daoody and Khoshnaw, 2012), in Baghdad (38%) by (Al-Mossawe et al., 2016). These differences in results might be due to differences in the environment, climate factors socio-demographic and habit differences in these populations, or could be due to used different methods to diagnose toxoplasma infection. Certain characteristics of the Korean population might contribute to the low prevalence. For example, in Korea, the range of meats that are eaten undercooked or raw is narrow; the frequency of raising a cat is low (Shin et al., 2009). In our study no significant difference was observed between males and females although a higher seropositivity was observed among females (25.6%) than males (23.5%) (Table 2). Similar results were obtained by (Marques et al., 2008) in Brazil. While other studies like that of Thi-qar by (Al-Mosawi et al., 2005) and Kirkuk by (Obaid, 2017), have shown a significant difference between male and female positive rates for anti-Toxoplasma antibodies. Higher seropositivity among females might be due to the fact that females spend more time in the kitchen cooking handling meat and taste uncooked meat. The highest occurrence of T.gondii antibody (28.2%) was among the age group (11-20) (Figure 1) this result was consistent to a study done in Mexico by (Galván-Ramírez et al., 2010). The high prevalence among these age groups might be due to the possibility that most of them are students, which increases their contact with risk factors such as contact with soil or outdoor eating, and disagree with other studies in Erbil by (Al-Daoody, 2012) and in Kerbala by (Hasan, 2011), Which they stated that seroprevalence of toxoplasmosis increases with age. Our results showed no significant difference among age groups, which is in agreement with results reported by (Obaid, 2017) in Kirkuk and (Sero-Prevalence of TORCH, 2017) in Erbil, but disagree with results reported by a study done in Kerbala by (Hasan, 2011).

Although cats are the definitive hosts that shed oocysts, statistically no significant difference was detected between persons who had contact with cats and those who had no contact with cats, in spite of high rate of infection was seen in persons that had contact with cats (25.7%) than those who had no contact with cats (24.2%) (Table 3), which might be due to the presence of many stray cats around the neighborhoods, this result is similar to studies done in Kirkuk by (Obaid, 2017), in Brazil by (Marques et al., 2008) and in Ethiopia by (Gelaye et al., 2015). In disagreement with our results was a study done by (Alrashada et al., 2016) in Saudi Arabia that detected a lower seropositivity in those who had contact with cats, and studies done by (Galván-Ramírez et al., 2010) in Mexico and by (Rahi and Jasim, 2011) in Kut city, that showed there was a relationship between the prevalence of the disease and contact with cats. These differences might be due to the fact that pets are more common in Mexico than in Erbil or Kirkuk and also differences in basic personal hygiene among the surveyed populations of Kut and Erbil city.

In spite of no significant difference was observed between participants of urban and rural, but higher seropositivity was observed among rural residences (30.8%) (Figure 2). Similar results were obtained by a study in Iran by (Fallah et al., 2014). In contrast to our result another study was done in Erbil by (Al-Daoody, 2012) that showed higher results among urban residences. Other studies like that of Kerbala by (Hasan, 2011) reported a significant statistical difference. The high infection rate in rural areas can be explained by the differences in life style, type of feeding, overcrowding, contact with animals and water source (Koyee and Faraj, 2015). In addition to the fact that urban residences might be have a general awareness about the disease and less contact with soil and animals, than rural residences, and water service facilities are well established in cities.

Our study showed no statistical significant difference between seropositivity and fast food consumption although the highest seropositivity was among those who consumed fast food, which was (25.4 %) while it was (22.0%) among those that didn’t consume fast food (Figure 3). This might be due to the possibility of eating undercooked or uncooked meat containing T. gondii tissue cysts in restaurants and fast food facilities.

The prevalence of anti-Toxoplasma antibodies in our study according to the contact with soil was (25.8%) and (23.8%) in those who had no contact
with soil (Table 4), but the differences were statistically insignificant. Other studies like that of Kerbala by (Hasan, 2011) had similar results.

The prevalence of anti-Toxoplasma antibodies was highest among those that ate ordinary farm meat (27.5%) followed by those who ate both ordinary farm meat and poultry meat (23.7 %) While lowest seropositivity was observed among those who ate only poultry meat (23.5%) but the differences were statistically insignificant (Figure 4). Similar results were reported by (Marques et al., 2008) in Brazil that showed no significant difference between seropositivity and type of meat consumed. Ingesting tissue cyst containing uncooked or undercooked meat can infect humans (Al-Daoody and Khoshnaw, 2012).

5. CONCLUSIONS

In our research we concluded that. The rate of infected females was higher than the rate of infected males, there was no significant effect of contact of individual with cat or soil on prevalence of toxoplasmosis, and the people who consume fast food, poultry or ordinary farm meat are more likely to have toxoplasmosis, Finally in order to reduce the infection, we should avoidance contact with cat and soil, or eating these types of food without sufficient cooking.

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