

## Serological Diagnosis of *Toxoplasma gondii* Parasite among Al-Qadisiyah University Students

**Bushra Hakim Hassoon, Khalid Thamer Moter**

Department of Biology, College of Education, University of Al- Qadisiyah, Al-Qadisiyah, Iraq.

Email: bushrahakim320@gmail.com

khaled.alshaebani@qu.edu.iq

### **Abstract :**

*Toxoplasma gondii* is a parasitic microorganism restricted to living within its host cells and is responsible for developing toxoplasmosis, a prevalent ailment affecting both humans and animals. The present investigation encompassed an assessment of the incidence of the *Toxoplasma* parasite among students enrolled in a university setting. A total of 290 individuals, comprising 103 males and 187 females, aged between 18 and 43 years, were selected from diverse faculties at Al-Qadisiyah University. Venous blood samples were obtained from these participants during the period spanning from September 2022 to February 2023. An ELISA assay was used to investigate *T. gondii* IgG and IgM antibodies. The result showed that 66 students carried antibodies to the parasite at a rate of 22.75%. Sixty cases were positive for the IgG antibody at a rate of 20.68%, and 6 cases were positive for the IgM antibody at a rate of 2.06%. The study showed that age, sex, and place of residence statistically correlate with the seroprevalence of toxoplasmosis.

**Keywords:** *Toxoplasma gondii*, University students, ELISA.

## Introduction

*Toxoplasma gondii*, a parasitic organism, is recognized as one of the most extensively distributed parasites afflicting the human population. According to Shapiro *et al.* (2019, around 33% of the global population is afflicted with *T. gondii* infection. The prevalence of *T. gondii* seropositivity exhibits notable variations across different countries, with infection rates ranging from 10% to 80% (Fernández Escobar, 2021). Among both humans and animals, toxoplasmosis is the most prevalent disease. Disparities in disease transmission modalities have emerged across different countries globally, as posited by Robert-Gangneux & Dardé (2012). The *T. gondii* parasite can be transmitted by consuming unpasteurized milk contaminated with Tachyzoite and through direct exposure to soil contaminated with cat feces. It is important to note that cats are the sole definitive host for this parasite. Furthermore, the transmission may transpire through direct contact with the tissue sacs found in the meat and tissues of the susceptible intermediate hosts (Mohamed, 2020) or the consumption of contaminated eggs expelled by felines. The study conducted by Nogareda *et al.* in 2014 is referenced here.

According to Elhence *et al.* (2010), the transmission of the *T. gondii* parasite can occur through inhaling dust contaminated with egg sacs—multiple diagnostic procedures allowed for its detection. The parasite's DNA is identified by employing molecular techniques, such as the PCR method. The diagnosis of toxoplasmosis is established through direct methods, such as microscopic examination of the parasite, or indirect methods, which involve the detection of specific antibodies to *T. gondii* IgG, IgM, IgE, and IgA in serum, particularly for inhalation purposes (Fernández Escobar, 2021). Various research investigations have documented the seroprevalence of *T. gondii* among students in universities and schools, as Vicente *et al.* (2014) reported.

## Materials and Methods

Two hundred ninety blood samples were collected from AI-Qadisiyah University students (males and females) in the morning and evening studies, whose ages ranged from 18 to 43 years, from September 2022 until the end of February 2023. Information was recorded for each student based on a detailed information form that had previously been prepared.

### Collection of Blood samples

5 ml of venous blood was collected, placed in a gel and clot activator tube, and left for 30 minutes. Then, it was centrifuged at 3000 rpm for 10 minutes to separate the serum. After that, the serum was withdrawn by a micropipette and divided into two plastic tubes that did not contain an anticoagulant substance, and the serum was kept frozen at -20 degrees Celsius. This test was performed using the antibody diagnostic kit produced by the German company DRG for IgG and IgM antibodies to *T. gondii*. An ELISA reader read the results.

**Statistical analysis:** The results of the current study were subjected to statistical analysis. For this purpose, the statistical program, Known as the statistical package for human sciences SPSS version 31, was used. A total square test was applied to compare the percentages of the study variables. Significant differences were identified at the level of probability of 5% (AL- Qassas, 2014 ).

## Results

### Infection percentage according to the antibody type

Table 1 shows the ELISA test for 290 serum samples to detect infection with the *T. gondii* Parasite according to the type of antibodies. The highest infection rate with the IgG antibody reached the *T. gondii* parasite at

20.68%, and for the IgM antibody at 2.06%, there was a significant difference at the level of  $P < 0.05$ .

**Table 1.** Percentages of parasite infection by antibody type.

The total examined samples	Samples positive for the ELISA test		The total positive samples
	IgM	IgG	
٢٩٠	6(2.06)	60(20.68)	66(22.75)
X2	88.36		
The calculated p-value	*		

### Percentage of parasite infection by sex

The results of the current study showed that there was a significant difference ( $p < 0.05$ ). The highest percentage of infection with the *Toxoplasma gondii* parasite was found in females, which amounted to 50 samples, at a rate of 26.73%. In contrast, the male infection was 15.53% for 16 positive samples, as shown in Table 2.

**Table 2.** Percentage of parasite infection by sex.

	Total number	Positive samples for the ELISA test	
		Samples number	Percentage
Males	103	16	15.53
Female	187	50	26.73
The total number	290	66	٢٢.٧٥
X2	4.74		
The calculated p-value	0.029*		

### The percentage of infection with the parasite according to the place of residence

Table 3 shows the distribution of the infection according to the place of residence, where the number of the rural population while the number of positive cases was 51, at a rate of 28.49%, in the city, and the results showed that there were significant differences at the level of  $P < 0.05$ .

**Table 3.** Infection percentage with the parasite according to the residence place.

		Positive samples for the ELISA test	
Address	Total number	The number	Percentage
Rural	111	15	13.51
Urban	179	51	28.49
The total number	290	66	22.75
X2	٨.٧٤		
The calculated p-value	0.003*		

### Parasite infection percentage by age

The current study showed significant differences ( $P < 0.05$ ) in the samples of the ELISA test. The highest infection rate was in the age group of 38-43 years, at a rate of 48.64%. The lowest infection rate was recorded in the age group 23-27 years, at a rate of 8.19%, as shown in Table 4.

**Table 4.** Parasite infection percentage by age.

		Positive samples for the ELISA test	
Age categories	The total number	The number	Percentage%
18-22	77	7	9.09
23-27	61	5	8.19
28-32	63	14	22.22
33-37	52	22	42.3
38-43	37	18	48.64
The total number	290	66	22.75
X2	40.96		
The calculated p-value	0*		

## Discussion

The results of the current study indicated that the number of positive cases of toxoplasmosis among students was 66 out of 290, with a total rate of 22.75% to examine ELISA. This result came close to what Al-Musawi (2015) reached at Dih-Qar University when using the ELISA examination and the results of Ahmed *et al.* (2018) for Kirkuk University students, with an infection rate of 21.94% and 21%, respectively. The percentage of positive cases was higher than what Al-Sadoon *et al.* (2018) reported for students of the faculty of medicine at the University of Basra using the ELISA test and what Yang *et al.* (2017) reported for undergraduate students using the MAT examination in Shenyang, China, with 13.03% and 9.4%, respectively.

However, this number of positive cases was less than the percentages recorded by Dardona *et al.* (2020) in Gaza in Palestine for university students using the ELISA test (AL-Musawi, 2016) in Baghdad for unmarried female university students using a LAT examination and (Obaidat *et al.*, 2015) in Jordan for university students, using the ELISA test with a percentage of 38%, 67% 50.8% respectively.

The different incidence rates in the world may be due to different social and cultural habits, environmental factors, transition methods, geographical factors (nature of the land), and other factors such as gender, age, and the presence of cats, as the seroprevalence of the disease increases in warmer and wetter regions and decreases in cold regions. (Flegr *et al.*, 2014)

The prevalence of chronic infections ascertained through the employment of the ELISA IgG enzyme-linked immunosorbent assay was 20.68%. This percentage agrees with the findings of Al-Moussawi (2016) in Baghdad, who employed the ELISA test and reported a percentage of 29%. The recorded rate exceeded that of Al-Sadoon *et al.* (2018) at the University of Basra, who utilized the ELISA test and reported a rate of 11.3%. Regarding acute toxoplasmosis infection among students, the ELISA IgM test yielded

six positive cases, indicating an infection rate of 2.06%. This percentage is consistent with the findings reported by Al-Moussawi (2016) in their study conducted at the University of Baghdad, which indicated a convergence rate of 1.5%.

The findings of the present investigation indicated statistically significant variations between infections and gender. The data indicate that the prevalence of infection was greater among females, with a percentage of 26.73%, compared to males, with a prevalence of 15.53%. The present study's outcomes were consistent with the discoveries of Obaid (2017) at Kirkuk University and Al-Mosawi (2015) at Dhi-Qar University.

The higher prevalence of toxoplasmosis in females compared to males may be attributed to various factors such as exposure to cats, handling of raw meat without protective gloves, consumption of undercooked meat, inadequate knowledge of preventive measures for toxoplasmosis, and greater involvement in gardening activities at home (de la Luz Galvan-Ramirez, 2010).

The present investigation yielded noteworthy dissimilarities between the various age cohorts using the enzyme-linked immunosorbent assay (ELISA). The age group of 38–43 years exhibited the highest incidence of infection, with a rate of 48.64%. This finding aligns with the observations made by Al-Tai (2015) in Dhi Qar. The concentration of higher rates of infection within a particular age group may be attributed to prolonged exposure to risk factors associated with the parasite, as posited by Al-Zaheb and Al-Amer (2017). According to Obaid's (2017) findings, the age group of 23–27 years exhibited the lowest infection rate at the University of Kirkuk, with a recorded percentage of 8.19%. Notably, the injury was observed within the age range of 23–25 years.

The present investigation documented notable differences in residential location between rural and urban areas and in the incidence rates determined by the ELISA test. The urban regions exhibited a higher ratio of

28.49%, while the rural areas demonstrated a lower percentage of 13.51%. The findings of our present investigation are consistent with those of Fallah et al. (2014), and Stopic et al. (2022), as the prevalence of infection in urban areas is greater than in rural regions. The findings of our current investigation are incongruent with those documented in Dardona's (2020) research, as the prevalence of infection in rural regions surpasses that of urban areas.

The elevated incidence of infection observed in urban areas may be attributed to dietary patterns, population density, and heightened levels of environmental contaminants relative to their rural counterparts. The expansive rural regions are instrumental in mitigating infection rates due to the extensive dispersion of oocytes across these areas. In contrast to their urban counterparts, felines tend to defecate in specific areas within the confines of their household's garden or its immediate vicinity. The egg sacs of parasites exhibit elevated concentrations, augmenting the likelihood of infection (Diaz-Suarez & Estevez, 2009).

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