

# Seroprevalence of *Toxoplasma gondii* in Immunocompromised cancer patients in Basrah Province, Southern Iraq

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## A B S T R A C T

The current study was conducted in Basrah province during the period from Dec. 2020 to Oct. 2021. The purpose of the study was to determine the seroprevalence of IgG and IgM antibodies of toxoplasmosis in cancer patients in Basrah province, southern Iraq, using the enzyme-linked immunosorbent assay (ELISA). This study was conducted on 173 people, including 123 people with cancer who were taking chemotherapy and 25 healthy people as a first control group and 25 people with cancer who were not taking chemotherapy were considered as a second control group. The results showed that the incidence of chronic IgG toxoplasmosis was 31 and acute (IgM) toxoplasmosis was 0.8%.

## 1. Introduction

*Toxoplasma gondii* is an obligatory intracellular parasite distributed through the world and it can infect all warm-blooded animals including humans [1]. The life cycle of this parasite is complex which include a sexual cycle in epithelial cells of felines intestine and asexual cycle in birds, Mammals and humans. It is include three phases: Oocyst, Tachyzoite, and Bradyzoite [2]. Infection with this parasite occurs through ingestion of food and drink water contaminated with oocysts posed by the final host of this parasite (Felidae family of cats) or by eating undercooked meat containing tissue cysts [3] and there are other modes of transmission such as transmission of infection from mother to foetus via placenta (congenital transmission) and also through blood transfusion and organ transfusion [4].

The infection is usually asymptomatic in immunocompetent individuals, but it is life threatening for immunocompromised patients, including cancer patients, especially those taking chemotherapy [5]. There are many researchers studied the effect of *T.gondii* on people within Iraq especially Basrah Province. The Seroprevalence toxoplasmosis were relatively high (41% - 52%) in rural and city centre areas [6].

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Sero – epidemiological study carried out for detection of toxoplasmosis between woman in two different area (rural and urban) at Basrah Province the prevalence of toxoplasmosis were ranged between (40-48%) in two areas and the study shows that toxoplasmosis is still make a high pathogenic risk factor in Basrah[7].

Another study was done in AL-Muthanna province (2015) studied the prevalence of *T. gondii* antibodies in hemodialysis patients with chronic renal disappointment and patients with urinary tract inflammation by using ELISA.[8]

Cancer is the main cause of death in economically developed countries and the second cause of death in developing countries [9]. In recent years, a clear increase in the incidence of breast cancer was found in Iraq including a study conducted in Basrah Governorate in 2015. The results showed an increase in cancer cases especially in woman and the highest rate was recorded for breast cancer followed by lung cancer [10][11]. A significant increase in antibodies to the *T. gondii* parasite was observed, which is attributed to the weak immune system in cancer patients and as a result of their use of chemotherapy [12]. In most cases of breast cancer, patients do not show symptoms [13]. Diagnosing toxoplasmosis infection in cancer patients is important to reduce the burden on the immune system when both diseases are present. In view of the lack of serological studies of *T. gondii* in immunosuppressed patients, especially those with cancer, this study aimed to determine the seroprevalence of *T. gondii* in patients with breast, lung, colon and lymphoma cancers in Basrah province, southern Iraq.

## 2. Materials and Methods

The study samples included cancer patients attending the Oncology Center in the Teaching Hospital in Basrah Governorate, especially breast cancer patients, in the period from Dec. 2020 to Oct. 2021. It included 123 blood samples for patients attending the Oncology Center taking chemotherapy, from women and men, and 25 samples considered as a first control group. (healthy people without cancer). 25 samples were considered a second control group (people who had cancer but had not yet taken chemotherapy).

### Blood Collection

Blood samples were collected by drawing 5 ml of venous blood from all subjects using medical syringes, and each sample was divided into two tubes. Then 2 ml of blood was added. After that, blood samples from the first group were taken to the laboratory for separating the serum centrifuged at 3000 rpm for 10 minutes. The blood serum tubes were kept in -20°C .

Note: A questionnaire was used for each patient that included the name, age, gender, area of residence and whether or not they took chemotherapy.

### Serological diagnosis method

#### ELISA test for diagnosing toxoplasmosis

An ELISA kit from the company examined all collected sera. (Calbiotech , United States) for the purpose of detecting IgG and IgM antibodies. Work was done according to the manufacturer's information. The results were read and the cut-off was determined (the result of the highest cut-off was considered positive and the lowest of the cut-off was considered negative).

### Statistical analysis

The data were statistically analysed using the Chi-square ( $X^2$ ) test and the percentage of infection in the current study to test the relationship between toxoplasmosis infection, types of cancer, gender, age of patients and area of residence using the probability level  $P \leq 0.05$ .

### 3. Results.

#### Toxoplasmosis infection rate by type of examination

123 serum samples were taken from people with cancer and addicted to chemotherapy who attended the Oncology Center in Basrah Governorate using the ELISA test during the period from 2020 to 2021.

The results showed that 39 (31%) were positive for the IgG ELISA and 1 (0.8%) were positive for the IgM ELISA for patients with cancer taking chemotherapy, Table 1.

**Table 1.** Positive Examination and Percentage of Toxoplasmosis in Cancer Patients Using ELISA Test

Samples	Total count	IgM		IgG	
		(Negative) (%)	(Positive) (%)	(Negative) (%)	(Positive) (%)
Cancer Patients	123	122 (99%)	1 (0.8%)	84 (68%)	39 (31%)
Control 1	25	25 (100%)	0	23 (92%)	2 (8%)
Control 2	25	25 (100%)	0	22 (88%)	3 (12%)
Total	173	164	1	121	44

#### Prevalence of toxoplasmosis according to type of cancer

The results of the current study showed significant differences between infection with *T. gondii* parasite and the type of cancer. The highest percentage of chronic infection was 35% for breast cancer patients, and the lowest percentage for chronic infection was for lymphoma 13%.

For acute infection, the highest percentage of lymphoma was 13%, while the rest of the cancers did not record any acute infection, Table 2.

**Table 2.** Prevalence of toxoplasmosis according to type of cancer

Cancer Type	Number of Subjects	IgG positive, No (%)	IgM positive, No (%)
Breast	98	34 (35)	0 (0.0)
Lung	12	3 (25.0)	0 (0.0)
Lymphoma	8	1 (13)	1 (13)
Colon	5	1 (20)	0 (0.0)
Total	123	39 (31)	1 (0.8)
Control (Healthy)	25	2 (8.0)	0 (0.0)
Control 2	25	3 (12)	0 (0.0)

$X^2=19.487$  ,df=3 , p value = 0.00

### Prevalence of *T. gondii* according to gender

The results of the current study showed that there were no significant differences between infection with the *T.gondii* parasite and the gender of patients with cancer. The highest rate of infection in females was 50% in colon and 36% in breast cancer. The lowest incidence in females was in lymphoma, at a rate of 17%, Table 3.

**Table 3.** Prevalence of *T. gondii* infections according to the gender of cancer patients.

Cancer Type	Number Tested		Number Positive		Positivity%	
	Femal e	Male	Female +	Male+	Female	Mal e
Breast	90	8	32	2	36	25
Colon	2	3	1	0	50.0	0.0
Lung	7	5	2	1	29	20.0
Lymphoma	6	2	1	0	17	0.0
Control 1	15	10	1	1	7	10
Control 2	18	7	3	0	17	0.0

$$X^2=7.107, df = 5, P \text{ value} = 0.21$$

### Prevalence of *T. gondii* according to age

The current study showed significant differences between infection with the parasite and the ages of people with cancer in breast, colon and lymphoma, except for lung cancer. The highest incidence rate was recorded in the age group 56-76 in people with breast cancer.

As for colon cancer and lymphoma, the highest percentage was (28%) in the age groups 36-56, Table 4.

**Table 4.** Distribution of infections to *T. gondii* parasites according to age groups.

Age group	Breast cancer			Lung		
	Number tested	Number Positive	(%)	Number tested	Number Positive	(%)
15-35	8	2	25	1	0	0
36-56	71	24	34	7	2	28
57-76	19	8	42	4	1	25

  

Age group	Colon	Lymphoma
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	Number tested	Number Positive	(%)	Number tested	Number Positive	(%)
15-35	1	0	0	1	0	0
36-56	2	1	50	4	2	50
56-76	2	0	0	3	0	0
Age group	Control 1			Control 2		
	Number tested	Number Positive	(%)	Number tested	Number Positive	(%)
15-35	13	1	8	8	1	13
36-56	8	1	13	11	2	18
56-76	5	0	0	6	0	0

P value :Breast cancer = 0.00 Lung =0.083 Colon =0.00 Lymphoma =0.00

#### Prevalence of toxoplasmosis according to the area of residence.

The results of the current study showed that there were significant differences between parasite infection and the patient's residential area, where the highest rate of infection was in Al-Hartha 64%, while the lowest infection rate was in the city centre at a rate of 17%, Table 5.

**Table 5.** Percentages of infection with toxoplasmosis, distributed by area of residence.

Region	Number tested	Positive samples	percentage%
Al-Zubair	14	3	21%
Shatt Alarab	5	3	60%
Al-Hartha	11	7	64%
Abu Alkhasib	17	7	41%
Qurna	5	2	40%
City center	35	6	17%

#### 4. Discussion

A healthy immune system plays a critical role in fighting any parasitic infection [14]. In many cases, immunocompromised individuals, including cancer patients, may develop opportunistic infections such as toxoplasmosis [15].

The current study showed the presence of IgG and IgM antibodies to *T. gondii* at a higher rate in cancer patients (31%, 0.8%) compared to the control group (healthy) (8%, 0%) and the control group who did not take chemotherapy (12%, 0%).

The appearance of large quantities of IgG antibody in blood of patients is resulting to weakened immune system in cancer patients that leads to reactivation of chronic infection or acquisition of new infection, allowing reactivation of previous *T.gondii* or increasing the risk of potential infection to acquire a new infection.

Several studies agree with the results of the current study, as IgG antibodies to toxoplasmosis appeared in 60% of cancer patients taking chemotherapy in Turkey, compared to 27% of healthy

controls [16]. In a study conducted in Korea, the proportion of IgG antibodies to cat disease was higher in cancer patients than it was in the control group [17].

This study also agrees with a study conducted in Egypt, where the results showed significant differences between the history of cancer and toxoplasmosis with a percentage of 66.7% for patients compared to healthy people with a percentage of 33.3% [18]. The current study agrees with another study conducted in Egypt, [19]. IgG antibodies appeared by 22% compared to the healthy control group by 8%, while the acute infection was 4%, 2% for patients and healthy controls, respectively.

The current study showed that the number of females infected with toxoplasmosis is more than males with no significant differences. This result may be attributed to the increased exposure of females to indoor activities that deal with raw or undercooked meat, unwashed fruits and vegetables, and their proximity to cats and other animals during daily activities.

The highest incidence of IgG antibodies was in patients aged between 56-76 compared to other groups, this may be due to weak immune system and exposure to infection with age. This is consistent with the study of [20] and [21] in contrast, did not agree with a study of [22], which indicated in her study the presence of antibodies in a higher percentage at young ages than (18-24) in Basrah.

The highest percentage of the emergence of antibodies according to the study areas was in the patients of Al-Hartha District, Shatt Al-Arab District and Abu Al-Khasib, respectively, with significant differences. This is due to the daily habits of contacting with soil, since most of these areas' residents work in agriculture and keep cats indoors.

The weakening of immune system due to cancer and the use of chemotherapy, which lead to the reactivation of the chronic infection or a new infection may occur so, for that reasons the present study was recommended the implication of ELISA test for toxoplasmosis in cancer patients for screening awareness, avoid contracting the infection and reduce its fatality rates.

## 5. Conclusions

The current study showed a high rate of the infection of toxoplasmosis among cancer patients in Basrah governorate, using the ELISA test, compared with the control group (8% & 12%). The results of the ELISA IgG test recorded a high rate of 35% of the infection compared with ELISA IgM test (1%), meaning chronic infections more than acute one, indicative of the presence of previous infections. The highest incidence was in the 56-76 age group. The results showed that the highest incidence of infection was 34% in the breast cancer group and a high prevalence of infection in the areas of Al-Hartha and Shatt Al-Arab district compared to other areas. The result also showed the effect of chemotherapy on infection with *T. gondii* parasite.

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## دراسة مصلية لطفي المقوسة الكونيدية في مرضى السرطان المثبتين مناعيا في محافظة البصرة جنوب العراق

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معلومات البحث	الملخص
الاستلام القبول النشر	<p><b>الملخص.</b> أجريت الدراسة الحالية في محافظة البصرة في الفترة من كانون الأول 2020 الى تشرين الأول 2021. الغرض منها تحديد الانتشار المصلي للأجسام المضادة , IgG , IgM لداء المقوسات في مرضى السرطان خصوصا مرضى سرطان الثدي في محافظة البصرة جنوب العراق باستخدام اختبار ارتباط الانزيم للأدمصاص المناعي ELISA أجريت هذه الدراسة على 173 شخص منهم 123 مصابين بمرض السرطان ومتعاطين للعلاج الكيميائي و25 من الأشخاص أصحاء اعتمدوا كمجموعة سيطرة أولى و25 من الأشخاص مرضى مصابين بمرض السرطان غير متعاطين للعلاج الكيميائي اعتبروا كمجموعة سيطرة ثانية. اظهرت النتائج ان معدل الإصابة بداء المقوسات المزمن ( IgG ) لمرضى السرطان كانت 31% ولداء المقوسات الحاد (IgM) كانت 0.8%.</p>
<b>الكلمات المفتاحية</b>	
المقوسة الكونيدية، دراسة مصلية، مرضى السرطان، اليزا ، البصرة.	
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