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## RESEARCH ARTICLE

### Molecular Detection of *Toxoplasma gondii* in Human and Chicken by Real-Time PCR Technique

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#### Abstract

The *Toxoplasma gondii* is one of the most common zoonotic infectious pathogenic parasites and can be infected the human and animals. Regarding to transmission of disease by feline, the chicken can be a risk factors for *Toxoplasma* infection by transmission the oocyst. Current diagnosis of toxoplasmosis dependent on serological detection it may fail to detect specific anti-*Toxoplasma* IgG or IgM during the active phase of *T. gondii* infection, because these antibodies may not be produced until after several weeks of parasitemia. Therefore, in this study we used highly specific molecular as Real-Time PCR based TaqMan probe and primers to amplify the *T. gondii* B1 gene for detection of *Toxoplasma gondii*. Our results recorded the detection of *Toxoplasma gondii* in positive blood samples by LAT test collected from aborts woman and local breed chicken at (16%) and (24%) respectively. We conclude that real-time PCR a rapid, sensitive molecular technique specific for detection of *T. gondii* in human, animals and the chicken may be play important role in transmission of disease. Using the Real-Time PCR technique as detection tools of *toxoplasma gondii* in human and chicken was reported at first time in Iraq

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#### Introduction

Toxoplasmosis is a common parasitic disease caused by the protozoan parasite *Toxoplasma gondii*. Toxoplasmosis is a zoonosis of worldwide distribution caused by *Toxoplasma gondii*, an obligate intracellular coccidian parasite that infects most warm-blooded animals including birds, humans, domestic and wild animals (7). Birds can be considered important reservoirs of *T. gondii* as they are often hunted by felids; they proliferate out of control as they are not selective about food, eating food waste that may be contaminated with *T. gondii*. In addition, as they fly long distances and can feed on the ground, they can be potential hosts of this coccidian (11).

The diagnosis of *T. gondii* infection by direct detection of parasite-specific DNA in biological samples using PCR-based molecular methods has gained popularity. The molecular diagnosis is more sensitive and cost-effective than the conventional methods (4). Molecular methods rely on PCR for the specific detection or analysis of *T. gondii* DNA. These methods have proved to be simple, sensitive, reproducible and cost-effective, and have been applied to a variety of clinical samples from animals and humans (2, 5, 3, and 1). Real-time PCR has been used to amplify and quantify DNA from the *T. gondii* B1 gene (6, 8). This quantification of parasite DNA can be used to determine the number of parasites in tissues and fluids, such as the amniotic fluid of patients suspected of being congenitally infected with *T. gondii*. The real-time PCR is a highly sensitive and specific method, however it is expensive and requires specialized detection systems and therefore may only be cost-effective in laboratories where analysis of large numbers of samples is carried out (9). Real-time PCR results from peripheral blood samples originating from patients suspected of acute toxoplasmosis according to the serological criteria for acute infection, i.e. avidity of specific IgG antibodies and the finding of specific IgM antibodies. (10).

## Materials and Methods

**Samples collection:** blood samples from aborts woman were collected from Al-Mothana hospital laboratory and blood samples from local breed chickens were collected from different farms in Iraq, two blood samples from each individual human and chicken. The collected blood samples from each bird were kept in clean and sterilized test tubes without anticoagulant for serum collection and with anticoagulant for DNA extraction and transported to the laboratory. Clotted blood samples were kept in a refrigerator overnight. Serum was separated by centrifugation at 3000 rpm for 15 minutes and stored at  $-20^{\circ}\text{C}$  till examination. Another non-clotted blood samples were stored in  $-20^{\circ}\text{C}$  refrigerator until use for genomic DNA extraction.

### Latex agglutination test (LAT)

Sera were examined using the latex agglutination slide test (LA) (SGM

Italia, Roma, Italy) as described earlier (13). The titer 1:8 or higher was considered as positive.

**Genomic DNA extraction:** Genomic DNA was extracted from frozen blood samples by using (Genomic DNA mini Extraction kit, Geneaid, USA). 200  $\mu\text{L}$  blood placed in 1.5 ml microcentrifuge and 20  $\mu\text{L}$  proteinase K (10mg/mL) was added for cell lysis. Then genomic DNA extracted according to kit instructions. The purified DNA was eluted in elution buffer provided with kit and stored at  $-20^{\circ}\text{C}$ , and the extracted DNA was checked by Nanodrop spectrophotometer.

### Real-Time PCR

Real-Time PCR based TaqMan probe was performed for rapid detection of *T. gondii* according to method described by Meihuili et al. (11). Real-Time PCR TaqMan probe and primers were used for amplification of conserved region B1 gene in *T. gondii*. These primers were provided by (Bioneer Company, Korea) as shown in following table (1):

The Real-Time PCR amplification reaction was done by using (AccuPower® DualStar™ qPCR PreMix Bioneer, Korea) and the qPCR master mix were prepared for each sample according to company instruction as following table (2):

Table (2): The qPCR master mix

These qPCR master mix reaction components that mentioned in table above were added into AccuPower® DualStar™ qPCR PreMix tubes which containing Taq DNA polymerases, dNTPs, 10X buffer for TaqMan probe amplification. Then tubes placed in vortex centrifuge at 3000 rpm for 3 minutes, after that transferred into MiniOpticon Real-Time PCR system and applied the following thermocycler conditions as the following table (3):

Table (3): Thermocycler conditions

## Results and Discussion

Toxoplasmosis encompasses a large variety of hosts including human, animals and birds, the main sources of infecting humans, is bird meat, so besides another indicators to detect the distribution of *T. gondii* oocysts in the environment, the determination of *T. gondii* prevalence in domestic birds is of great importance (12).

The Results of this study proved the occurrence of considerable percentages of *T. gondii* infection in aborts woman and local breed chickens. The confirmed positive samples to latex agglutination test by real-time PCR technique. The 50 positive blood samples by LAT test collected from the aborts woman showed only 8 positive samples by Real-Time PCR technique based TaqMan probe for detection of *Toxoplasma gondii* which represented (16%); whereas, the 50 positive blood samples by LAT test collected from local breed chicken showed only 12 samples being positive by Real-Time PCR technique, (24%). These results agree with a number of studies that have already shown that a positive PCR result is not always accompanied by positive serology indicating local synthesis of antibodies (14,15)

The positive samples in Real-Time PCR which appear in threshold cycle ( $C_T$  value) ranged from  $C_T$ : 25 to  $C_T$ : 36 as shown in (Figure-1).

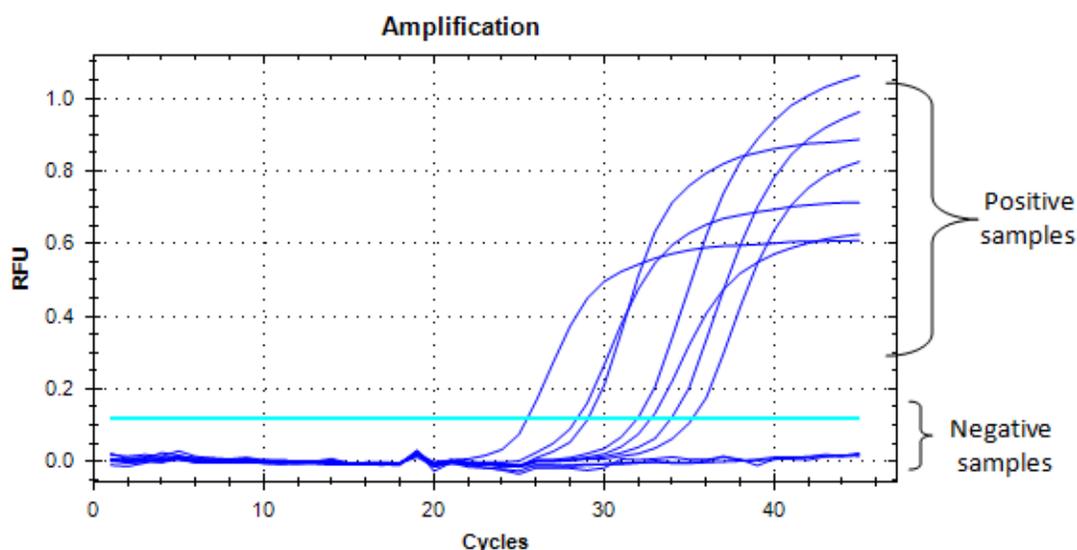
**Table (1): Real-Time PCR TaqMan probe and primers**

Primer	Sequence	
B1 gene Primers	F	TCCCCCTCTGCTGGCGAAAAGT
	R	AGCGTTCGTGGTCAACTATCGATTG
B1 gene	FAM-TCTGTGCAACTTTGGTGTATTTCGCAG-TAMRA	

Probe	
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qPCR master mix	Volume
Genomic DNA template	5 $\mu$ L
B1 Forward primer (20pmol)	1 $\mu$ L
B1 Reverse primer (20pmol)	1 $\mu$ L
B1 TaqMan probe (25pmol)	2 $\mu$ L
DEPC water	11 $\mu$ L
Total volume	20 $\mu$ L

qPCR step	Temperature	Time	Repeat cycle
Initial Denaturation	95 °C	5 minute	1
Denaturation	95 °C	15 sec	45
Annealing\ Extension	60 °C	1 minute	
Detection(scan)			



**Fig (1): Real-time PCR amplification plot of B1 gene *T. gondii* from blood samples of human and chicken source.**

Molecular detection of *Toxoplasma gondii* by Real-Time PCR was appeared specific and highly sensitive assay, this results was consistent with (2) who developed a rapid, sensitive, and quantitative real-time PCR for detection of *T. gondii* from different clinical specimens. Therefore, this technique has advantages rapid molecular tools for diagnosis of toxoplasmosis in a clinical laboratory, rather than serological test.

These results included public health significance, especially through consumption of undercooked poultrymeat. It can be certain on that PCR technique is considered a sensitive tool for the diagnosis of toxoplasmosis where a

positive results can be counted on as an early marker for reactivations. Also, this technique proved to be a powerful tool for monitoring therapy.

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