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## Original article

# Impact of toxoplasma infection on level of vitamin D in random samples of Iraqi women

Jasim, Amani<sup>1\*</sup>, Rabia Ali Aboud<sup>2</sup>, Safa A. Fadil<sup>3</sup>

1- Middle Technical University, Baghdad, Iraq

2 Al-Farahidi University, Baghdad, Iraq

3 Ministry of Education, Baghdad, Iraq

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## ABSTRACT

**Background:** A cross-sectional study included 60 women attending medical city hospital, age range from 16 to 43 years, 30 women infected with *Toxoplasma gondii*, and other thirty women were taken as healthy control. **Methods:** Estimation of serum anti-*T. gondii* Ab (IgG) and IgM levels were done in this patient's group. The evaluation of serum Vitamin D (D3) was also determined to study the relation between infecting aborted women and the level of vitamin D in sera sample studied. **Results:** The results showed nonsignificant differences in the age of all cases studied and healthy control group, there was 4 (13.3%) of infected women had acute infected with toxoplasma IgM, while 26 (86.7%) had chronic infection of toxoplasma IgG antibodies. **Conclusion:** while there were highly significant differences according to toxoplasma infection also recorded. *Toxoplasma gondii* infections were common, especially in women who were clearly deficient in vitamin D, and toxoplasma infections were linked to vitamin D deficiency.

## Introduction

One of the most widespread parasites in the world, *Toxoplasma gondii* is an obligatory apicomplexan intracellular protozoan that causes toxoplasmosis in most genera of warm-blooded animals [1].

*T. gondii* comes in three infectious forms: sporozoites, which are found in oocysts, tachyzoites, and bradyzoites, [2] Toxoplasmosis can spread from mother to kid, through undercooked meat infected with latent cysts, through sporulated oocysts, and through contaminated food consumption in humans [3].

The regulation of food intake during pregnancy, energy metabolism, glucose and lipid

metabolism in women, and body weight is attributed to the levels of 25hydroxyl vitamin D [4]. Due to the great prevalence of vitamin D in Iraqi cultures, vitamin D insufficiency is currently unknown in that country. Reduced exposure to sunlight, which allows for enough penetration for the synthesis of enough vitamin D, may be one of the causes of this insufficiency; climatic changes also play an important role. However, because the bone is a hard structure and osteocyte shape is inappropriate for the development of the parasite inside of it, the effect of *T. gondii* on the bone itself is yet unknown [5].

Vitamin D is known to play an important role in bone tissue metabolism [6]. But it has been shown that vitamin D deficiency is linked to a number of neurological diseases, including multiple

sclerosis, depression, Alzheimer's disease, and Parkinson's disease [7]. Infertility issues include polycystic ovarian dysfunction, endometriosis, uterine fibroids, abnormal sperm function, and decreased success rates for in vitro fertilization have all been linked to vitamin D deficiency. [8] Recent studies documented that Nutrition and the level of vitamin D had a relation with immunological status and the amount of parasite swallowed, the virulence of *Toxoplasma* infection and its location inside the host are some the important factors that affect the severity of infection [9]

This study aimed to explore the association between the level of vitamin D in blood and *Toxoplasma* infection among women studied.

## Materials and Methods

### Subjects

A cross-sectional was performed between November 2021 to March 2022, a total of 60 women attending Baghdad Medical City Hospital, with an age range from 22 to 51 years, 30 women had infection with toxoplasmosis previously examined by latex agglutination test, and other thirty were taken as healthy control none infected with toxoplasma infection.

5ml of blood from each woman was collected, and sera were separated by centrifugation and stored in small tubes at -20C until used.

Exclusion criteria: all sera tested positive for human herpes simplex viruses, cytomegalovirus, and rubella.

Ethical approval: The permission for carrying on the study, according to the roles of the scientific committee in College of Medical Health laboratory Guidelines Ethical approval number 3/2120

Laboratory tests: Detection of *T. gondii* Immunoglobulin M and Immunoglobulin G antibodies in serum samples of infected women using the CASSETE technique, a burgundy conjugate pad with rabbit IgG-gold conjugates and recombinant *T. gondii* antigens conjugated with colloidal gold (*T. gondii* conjugates). A strip of nitrocellulose membrane including a control band (C band) and two test bands (M and G bands). The M band is pre-coated with monoclonal anti-human IgM, the G band is pre-coated with reagents, and the C band is pre-coated with a control line antibody in order to detect IgM anti-*T.gondii* antibodies [10].

The VIDAS® 25-OH Vitamin D total assay was estimated in all sera of studied group

(infected and healthy control) based on a 2-step competitive immune-assay. To rule out symptoms associated with a vitamin D lack, The serum level of vitamin D tracked. Since vitamin D2 (ergocalciferol) and/or vitamin D3 (hydroxy vitamin D3) are frequently found in vitamin D products and dietary supplements, the concentration of 25-hydroxy vitamin D3 (25-OH-D3, calcidiol) is usually determined. The storage form of vitamin D produced by the liver, 25-OH-vitamin D3, gives a distinct and significant picture of a patient's vitamin D status [11]

After a solid-phase wash, the fluorescence reaction is initiated by adding a substrate reagent. There is an inverse correlation between the amount of 25 (OH) D in the sample and the amount of relative fluorescence units in the serum. After 45 minutes, the results of each serum were collected, and the results showed that deficiency below 20 ng/ml, insufficient from 20 to 30 ng/ml, sufficient from 30 to 70 ng/ml, and above 70 ng/100ml considered as vitamin D toxicity [12]

### Statistical analysis

Data analysis was done using SPSS (version 17). utilized by percentages and standard error

## Results

Table 1 shows the mean and standard error of women infected women with *Toxoplasma gondii* (21.06±1.62) and control health group (27.50±2.28) , non-significant differences were found between the two groups studied

Table 2 showed non-significant differences in the age of all studied (infected and healthy control group) at p-value  $\geq 0.7$ , highly significant differences observed between pregnant and aborted women who had *Toxoplasma* infection and the infected group compared with healthy women at p-value  $\leq 0.6$ .

Table (3) showed there was 4 (13.3%) of infected women had acute infection with toxoplasma (IgM), while 26 (86.7%) had chronic infection of *Toxoplasma* (IgG).

Table (4) showed there was 22 (73.3%) out of 30 cases had *Toxoplasma* infection and deficiency in the concentration of Vitamin D while there was only 5(16.7 %) out of 30 healthy women had deficiency in Vitamin D levels among non-infected individuals.

Table 5 illustrates the mean and standard error levels of Vit-D (ng/dl) highly significant difference in the mean and standard error *Toxoplasma* infection (21.06 ±1.62) and healthy

control women (27.50±2.28) in concentration of Vitamin D deficiency at p value ≤0.03

**Table 1.** The mean and standard error of toxoplasmosis patients and control healthy women group.

Cases	N	M ±SE	P- VALUE	
Women infected with toxoplasma	30	21.06±1.62	2.29	0.03 *N S
Control	30	27.50±2.28		

\* N S : Non-significant

**Table 2.** Distribution of age group of women studied among cases and healthy control.

Parameter		Cases(N=30)	control(N=30)	p-value
<b>Age group</b>	22-31	10(33.3 %)	5 (16.6 % )	0.7 *(N S)
	32- 41	10(33.3%)	4(13.3%)	
	42-51	6(42.9%)	45 (57.1%)	
	> 51	4 (13.3%)	2 (50%)	
<b>Pregnant states</b>	Pregnant	8(26.1 %)	0 (0%)	0.6
	Aborted women	22(.9 %)	0 (0%)	** (HS)

\*N: Nonsignificant

\*\*HS: highly significant

**Table 3.** Distribution of acute and chronic infection of toxoplasma in patients group.

<b>Toxoplasma infection</b>	N	<b>Toxo- seropovitive</b>		<b>Total</b>
		IgG	IgM	
<b>Type of immunoglobulin</b>	N	26(86.7%)	4(13.3 %)	30(100%)
<b>Total</b>	N	30(100%)	30(100%)	100%

**Table 4.** Distribution of level of Vitamin -D (ng/dl) according to toxoplasmosis status among studied groups.

Studied group	Vitamin D concentration (ng/dl)	Normal N(%)	Deficient N (%)	Total N (%)
<b>Toxoplasmosis</b>		8 (26.7%)	22(73.3%)	30 (100%)
Healthy control		25 (83.37%)	5 (16.7)	30 (100%)

**Table 5.** The mean and standard error levels of Vitamin-D (ng/dl) between the studied group (N=60).

Parameter	Study Groups	N	Mean	Std. Error	T-test	P-value
Vitamin D average concentration (ng/dl)	Infected Patients	22	21.06	1.62	2.29	0.03 *(HS)
	Healthy Control	5	27.50	2.28		

\*HS: highly significant

## Discussion

It is well-recognized that a variety of internal and external factors may affect vitamin D levels. [13]. Thus, it's possible that a *Toxoplasma* infection actually decreases vitamin D levels. [14]

Congenitally infected newborns' clinical illness severity is negatively correlated with the mother's gestational age at the time of the primary maternal infection; more severe symptoms are associated with first-trimester maternal infection. The most widely used diagnostic techniques are serological methods, which rely on the detection of specific *Toxoplasma gondii* antibodies [15]. Abortions that are missed, habitual, or spontaneous are examples of compliance in women. Birth abnormalities that cannot be reversed may arise from acquiescing in the toxoplasmosis infection during the third trimester. Pathogenesis included meningoencephalitis, hydrocephalus, microcephaly, chorioretinitis, and maybe even stillbirth. [16]

The results agreement with [17] indicated that there was no significant relationship between the age of toxoplasmosis and healthy control groups

In regard to the study's findings, *Toxoplasma* infection was linked to vitamin D insufficiency, and there was a noticeable difference between the prevalence of *T. gondii* infection and vitamin D deficiency in individuals, these results offer proof that vitamin D deficiency or insufficiency is prevalent during pregnancy and can result in a number of adverse pregnancy outcomes, including abortion [18]. Factors that complicate the estimation of the relationship between vitamin D level and *T. gondii* infection could account for the results that we obtained, in addition to a direct protective impact of vitamin D. Patients with metabolic syndromes often have decreased levels of vitamin D, according to previous studies A diet lacking in some minerals, especially S. magnesium, may be the cause of a vitamin D deficiency. Thus, oral vitamin D, Ca<sup>2+</sup>, and mineral supplements for women may play a significant part in avoiding vitamin D deficiency [19]. The cytokine is also involved in the activation of immune response against parasitic diseases [20]. Several studies stated the increasing of parasitic infection due to contamination and deficient in mineral and vitamins [21].

## Conclusion :

1- Their was 13.3% of infected women had acute infection with toxoplasma IgM, while 86.7% had chronic infection of toxoplasma IgG antibodies. 3- Highly significant differences according to toxoplasma infection.

2-Toxoplasma. gondii infections were common, especially in women who were clearly deficient in vitamin D, and toxoplasma infections were linked to vitamin D deficiency.

**Conflicts of interest:** None to be declared.

**Financial disclosure:** None.

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