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Influence of toxoplasmosis on some functional body proteins among pregnant women

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ABSTRACT— Toxoplasmosis represents one of the most widespread zoonosis caused by *T. gondii* parasite, which is an intracellular protozoan with a worldwide distribution. This disease infects all warm-blooded animals, including humans. The current study aimed to assess the influence of *Toxoplasma gondii* on some functional body proteins among infected pregnant women. The study was carried out during the period from October 2021 to first February 2022. Two hundred (200) pregnant women were attended to various governmental hospitals in Maysan province of Iraq with their ages ranged from (19-35) years. Venous blood samples were collected from all pregnant women enrolled in this study. The results showed that from total (200) pregnant women, 97(48.50%) had positive IgG antibodies to toxoplasmosis, while 103 (51.50%) had negative IgG antibodies to toxoplasmosis. The results also presented that from these (200) pregnant women, 11(5.50%) had positive IgM antibodies to toxoplasmosis, while 189(94.50%) had negative IgM antibodies to toxoplasmosis. Patients with IgG positive, the mean albumin level was (4.01 ±0.03), and in patients with IgG negative, the mean albumin level was (4.15 ±0.04), while it was shown that in patients with IgG positive, the mean globulin level was (2.85 ±0.06), and in patients with IgG negative, the mean globulin level was (2.65 ±0.07), whereas it was shown that in patients with IgG positive, the mean total protein level was (6.63 ±0.14), and in patients with IgG negative, the mean total protein level was (6.23 ±0.20). It can be concluded from the present study that no significant difference was shown between the number and percentage of IgG+ and IgG- toxoplasma patients, while a highly significant difference was shown between the number and percentage of IgM+ and IgM- toxoplasma patients. There was a significant difference between IgG+ and IgG- patients in relation to mean of both albumin and globulin levels, while no significant difference was shown between IgG+ and IgG- patients in relation to mean TSP levels. There was no significant difference between the number and percentage of IgM+ and IgM- toxoplasma patients in relation to albumin, globulin and TSP levels.

KEYWORDS: Toxoplasmosis, Albumin, globulin, TSP, Pregnant women

1. INTRODUCTION

Toxoplasma gondii, an obligate intracellular protozoan parasite with noteworthy zoonotic importance, causes toxoplasmosis in humans and warm-blooded animals [1].

Toxoplasmosis is a significant public health problem worldwide and qualifies as a One Health disease due to it significantly affects the health and well-being of humans, domestic animals, wildlife, livestock and ecosystems [2], [3]. So toxoplasma is estimated as globally roughly one third of the human population has latent *T. gondii* infections, with considerable regional variations in prevalence [4]. T. gondii associated abortions in sheep are generally attributed to recent oocyst exposure, and control measures are focused on biosecurity procedures and vaccines where available [5].

Consumption of uncooked meat and fish containing bradyzoites are routes for toxoplasmosis. Also water,

milk, and vegetables contaminated with oocysts and transfusion and transplantation of blood and organs, respectively, harboring tachyzoites from patients infected are the major sources of *T. gondii* infection in humans [6].

Cats as a final host, play an important role in spreading *T. gondii* infection. Therefore, poor hygienic management of farms, climate, presence of cats in farms, consuming raw or uncooked meat and vegetables, and inter-current diseases may act as potential risk factors influencing toxoplasmosis [7].

The parasite is transmitted mainly through many routes such as intake of undercooked meat infected with tissue cysts, drinking the water or consumption of unwashed vegetables infected with oocysts, and infection from mother to fetus [8].

The determination of the concentrations of serum proteins and the evaluation of their changes during the disease process is fundamental for their use as valid biomarkers [9]. Albumin, one of the main components of serum proteins, is negatively interrelated with the inflammatory process [10, [11]. Hypoalbuminemia, an index of malnutrition historically, has recently been a biomarker of inflammation [12], [13]. Serum globulin (GLB), such as components of complements and ceruloplasmin, increases during the inflammatory process [14], [15].

2. Materials and methods

The study was carried out during the period from October 2021 to February 2022 on (200) pregnant women who attended to various governmental hospitals in Maysan province-Iraq with their ages ranged from (19-35) years. Venous blood samples were collected from all pregnant women enrolled in this study. Blood samples were put in plane tubes for 15 minutes to clot, then centrifuged for 10 minutes at 3000 rpm to obtain serum. The following tests were done for the pregnant infected women: Toxoplasma IgG antibodies, Toxoplasma IgM antibodies, serum albumin and serum total protein. The cobas c 311/501 system analyzer was used to estimate serum albumin and total serum protein levels, while serum toxoplasma IgG and IgM levels were detected by cobas e 801 system analyzer. Serum globulin was calculated mathematically from subtracting serum albumin value from the total serum protein.

3. Statistical Analysis

The Statistical Analysis System (SAS, 2012) program was used to detect the effect of different factors on the study parameters. T-test (Analysis of Variation-ANOVA) was used to compare between means. Chi-square test was used to compare between percentages and (0.05 and 0.01) probability values were used to estimate the correlation coefficient between the variables in this study.

4. Results

This study included (200) pregnant women infected with toxoplasmosis. The results showed that (97) of them were infected with toxoplasmosis, while (103) of them were not infected (controls).

Table (1): Distribution of Toxoplasmosis results according to IgG+ and IgG- in the study samples

Toxoplasmosis (IgG)	No	Percentage (%)
IgG + (Patients)	97	48.50 %
IgG – (Control)	103	51.50 %
Total	200	100%

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P-value	---	0.671 NS
NS: Non-Significant		

Results of table (1) showed that of the total (200) pregnant women, 97(48.50%) had positive IgG antibodies to toxoplasmosis, while 103(51.50%) had negative IgG antibodies to toxoplasmosis, with a non-significant difference (p=0.671).

Table (2): Distribution of Toxoplasmosis results according to IgM+ and IgM- in the study sample

Toxoplasmosis (IgG)	**No**	**Percentage (%)**
IgM +	11	5.50 %
IgM –	189	94.50 %
Total	200	100%
P-value	---	0.0001
** (P≤0.01).		

Results in table (2) showed that of the total (200) pregnant women, 11(5.50%) had positive IgM antibodies to toxoplasmosis, while 189(94.50%) had negative IgM antibodies to toxoplasmosis, with a highly significant difference (p=0.0001).

Table (3): Comparison between IgG+ (Patients) and IgG- (Control) groups/ Toxoplasmosis in relation to mean albumin, globulin and total protein levels

Group	Mean ± SE		
	Albumin ( )	Globulin ( )	Total protein ( )
IgG + (Patients)	4.01 ±0.03	2.85 ±0.06	6.63 ±0.14
IgG – (Control)	4.15 ±0.04	2.65 ±0.07	6.23 ±0.20
T-test	0.117 *	0.195 *	0.501 NS
P-value	0.0243	0.0422	0.112
* (P≤0.05), NS: Non-Significant.			

As shown in table (3), in patients with IgG positive antibodies, the mean albumin level was (4.01 ±0.03), and in patients with IgG negative antibodies, the mean albumin level was (4.15 ±0.04), with a significant difference (p=0.0243), while it was shown in table (3) that in patients with IgG positive antibodies, the mean globulin level was (2.85 ±0.06), and in patients with IgG negative antibodies, the mean globulin level was (2.65 ±0.07), with a significant difference (p= 0.0422), whereas it was shown that in patients with IgG positive antibodies, the mean total protein level was (6.63 ±0.14), and in patients with IgG negative antibodies, the mean total protein level was (6.23 ±0.20), with no significant difference (p= 0.112) as illustrated in table (3).

Table (4): Comparison between IgM+ and IgM- groups/Toxoplasmosis in relation to albumin, globulin and total protein levels

Group	Mean ± SE		
	Albumin ( )	Globulin ( )	Total protein ( )

IgM +	3.94 ±0.08	2.69 ±0.11	6.63 ±0.11
IgM –	4.09 ±0.03	2.75 ±0.05	6.41 ±0.13
T-test	0.256 NS	0.429 NS	1.098 NS
P-value	0.512	0.474	0.941
NS: Non-Significant.			

As shown in table (4), in patients with IgM positive antibodies, the mean albumin level was (3.94 ±0.08), and in patients with IgM negative antibodies, the mean albumin level was (4.09 ±0.03), with a non-significant difference (p=0.512), while it was shown in table (4) that in patients with IgM positive antibodies, the mean globulin level was (2.69±0.11), and in patients with IgM negative antibodies, the mean globulin level was (2.75 ±0.05), with a non-significant difference (p= 0.474), whereas it was shown that in patients with IgM positive antibodies, the mean total protein level was (6.63 ±0.11), and in patients with IgM negative antibodies, the mean total protein level was (6.41 ±0.13), with a non-significant difference (p=0.941) as illustrated in table (4).

5. Discussion

Toxoplasma gondii is an important obligate intracellular coccidian that infects virtually all warm-blooded mammals and birds. It has been documented that the pathogen affects approximately 30% of the world human population [16].

The infection of pregnant women results in miscarriage or congenital infection that causes hydrocephalus, blindness, fetal death, neurological damage/intracranial calcification and retinochoroiditis [17]. Hence, early serological screening for toxoplasmosis in pregnant women is imperative [16].

This disease affects women in different countries of the Arab world. For example, in Iraq, it has been reported an infection rate with toxoplasmosis of 34.7% among pregnant women in Baghdad [18]. Women infected with Toxoplasma before conception with rare exception do not transmit the infection to their fetuses, while women infected with Toxoplasma after conception (during pregnancy) may transmit the infection across the placenta to their fetuses [19].

In the current study, the results showed that the number and percentage of pregnant women with toxoplasmosis who had positive IgG-toxoplasma antibodies was higher than the number and percentage of pregnant women with toxoplasmosis who had positive IgM-toxoplasma antibodies.

The clinical diagnosis of toxoplasmosis includes serological tests detecting T. gondii IgG and IgM antibodies. The IgG antibody test is used to detect acute or chronic phases, while the IgM antibody test is used to confirm acute phases [20].

As the infection is usually asymptomatic in pregnant women, toxoplasmosis detection and screening during pregnancy rely on serological techniques. Although detection of both T. gondii-specific IgM and IgG in a single serum sample must suggest an acute infection, a past infection cannot be excluded either because T. gondii-specific IgM antibodies can persist for months or years after infection [21].

Results of current study was agreed with an Indian study, which revealed that the seroprevalence of toxoplasma IgG and IgM among Indian pregnant women was 45% and 3.3% respectively [22], and also agreed with a study which showed that among Turkish pregnant women, the seropositive toxoplasma IgG

and IgM was 60.4% and 3.0% respectively [23].

The high level of anti-*T. gondii* IgG levels in toxoplasma patients might be explained by the declining of cell-mediated and humoral immune response in chronically infected patients due to subsequent reactivation of latent infection [24].

However, these results disagreed with the findings of [25] in Kut province of Iraq, who found a higher rate of toxoplasma IgM antibodies among pregnant women than IgG on using the ELISA technique. The main problem in diagnosis among pregnant women is long-term antibody IgM, but *T. gondii*-specific antibody (IgM) does not necessarily indicate acute infection [26].

In many cases, laboratory diagnosis of latent and acute *T. gondii* is based on detecting *T. gondii*-specific IgM and IgG antibodies [27].

Regarding to albumin, globulin and total serum protein, it was found in our study that there was a significant difference in albumin and globulin levels between IgG+ve and IgG-ve pregnant women infected with toxoplasmosis, while no significant difference appeared in total serum protein levels between IgG+ve and IgG-ve pregnant women infected with toxoplasmosis.

Results of present study was disagreed with [28], [29] who revealed an increase in the levels of total protein, but agreed with what was found by [30] who recorded non-significant differences in severity of liver damage, and thus no significant alterations in the levels of total proteins among pregnant women infected with toxoplasmosis. While extensive and progressive damage in liver and changes of protein fractions appeared in the sera of infected women as observed by [31- 33].

The current study exhibited a significant increase in globulin fraction levels among IgG+ve pregnant women infected with toxoplasmosis. This could be explained by the fact that the prolonged infection leads to increased immunoglobulin (important part of globulins) production, thus it is expected to detect high levels of this type of protein in the sera of patients.

The accompanied titers appeared to rise almost parallel with raise in serum gamma globulins which mean that the reaction of the immune system of the body against Toxoplasmosis or its resistance [34, 35].

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