International Journal of Research in Medical Sciences
Mikaeel FB. Int J Res Med Sci. 2020 Oct;8(10):3508-3512
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20203995

Original Research Article

The effect of *Toxoplasma gondii* infection in women on some biochemical and hormonal parameters in Duhok province, Iraq

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Received: 24 August 2020
Accepted: 03 September 2020

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ABSTRACT

Background: *Toxoplasma gondii* is protozoal parasite that cause Toxoplasmosis, which is an important protozoal disease that infect more around billion people globally. Toxoplasmosis transmitted by two way in human; the horizontal transmission by accidental and ingestion of oocysts of *Toxoplasma gondii* through contaminated water or food, and the second rout is vertical transmission by placenta from mother to the baby. The aim of the current study was to detect the effect of toxoplasmosis on kidney function, liver function enzymes and gonadotropin hormones like follicle-stimulating hormone (FSH) and Luteinizing hormone (LH).
Methods: A total of 101 (71 samples and 30 controls) of blood samples were collected from women, which were tested for seropositivity against anti-toxoplasma antibodies like immunoglobulin G (IgG), immunoglobulin M (IgM) by ELISA. After that the biochemical test (alanine aminotransferase-ALT, Aspartate transaminase-AST, Alkaline phosphatase-ALP, Urea and Creatinine) and hormonal assay (LH and FSH) and achieved for all samples.
Results: Results revealed a slight increase in the level of both urea and creatinine in infected women compared with the control group. A Pearson's Coefficient Correlation test was used to examine the positive correlations between ALT and Anaplastic lymphoma kinase (ALK), LH and FSH at p value (<0.001 for both). Preliminary studies indicate that the level of LH and FSH in infected women is lower compared to control healthy group. Finally, current study indicated that toxoplasmosis is effect on the levels of studied biochemical and hormonal parameters.
Conclusions: Current study shows a significant increase in the levels of biochemical and hormonal parameters in women infected with toxoplasmosis.

Keywords: Toxoplasmosis, Liver enzymes, Gonadotropin hormones

INTRODUCTION

Toxoplasmosis is an important protozoal disease which is caused by *Toxoplasma gondii* and that infect more than one billion people through the world. There are two important way of transmission of toxoplasmosis in human; the first rout is horizontal transmission by accidental ingestion of oocysts of *Toxoplasma gondii* through contaminated water or food, or by ingestion of undercooked meat containing bradyzoites and the second rout is vertical transmission by placenta from mother to the baby.[1] Toxoplasmosis is typically non-threatening and asymptomatic in healthy people, but in immune compromised patients it can cause severe congenital infections, such as in cases where immunosuppressive treatment is used.[2] In addition, women are more vulnerable to infection during pregnancy due to changes in hormones, which may contribute to development of symptoms. There are two types of toxoplasmosis; acute toxoplasmosis is occurring during pregnancy and result in congenital abnormalities of fetus and the second type is chronic toxoplasmosis.[3] An acute toxoplasmosis is distinguishing from a chronic Toxoplasmosis depend on the serological data.[4]

The initial diagnosis of toxoplasmosis in women during pregnancy is by using of serological tests detection for detection antibodies including IgG, IgM and IgA, because toxoplasmosis produce changes in serum antibodies like immunoglobulin (IgM), immunoglobulin G (IgG) and immunoglobulin A (IgA) in the body. There many serological test such as indirect fluorescent antibody test (IFAT), indirect hemagglutination test (IHAT), latex agglutination test (LAT), direct agglutination test (DAT), sabin-Feldman dye test (DT), and enzyme-Linked Immunoassay (ELISA).[5,6] Good marker for acute toxoplasmosis is when IgM for toxoplasma gives positive result and this IgM can be remain for many years and due to this may give false positive results by using of commercial toxoplasmosis IgM kits.[7] Follicle stimulating hormone (FSH) and luteinizing hormone (LH) are also called gonadotropins are secreted from pituitary cells and play a vital role in gestational women by regulation of hormones are released by ovaries.[8] Chronic toxoplasmosis that effect on the liver and lead to some changes on liver function such as an alanine aminotransferase (ALT) and aspartate aminotransferase (AST) tests.[9] Specific serum enzymes have been shown to continue to increase after Toxoplasmosis infection, which may correlate with the degree of liver damage.[10] *Toxoplasma gondii* parasite also effects on kidney and cause infiltration in renal cells.[11] In fact, there is a study was done by who demonstrated that change in the level of serum AST and ALT can be correlated to the severity of inflammation by strains of toxoplasma and host.[12]

METHODS

The current study was carried on 101 women and their age ranged from 20 to 45 years old. Five milliliters of peripheral blood samples were collected from all women came to Duhok Obstetrics and gynecology Hospital in Duhok province, Kurdistan Region, Iraq, during the period from January to April of 2020. Blood samples were put on test tube and left at room temperature for 30 minutes and after that centrifuge d for five minutes at 3000 rpm and collected the sera for investigations.

Methods were used during this study including: first serological test was done for detection of anti-Toxoplasma antibodies (IgG and IgM) by using of ELISA and measurement of anti-toxoplasma antibodies were done according kit's manufacturer (Biorex Diagnostics, United Kingdom), the second one was measured the level of FSH, LH, ALT, AST and ALP in all sera according to kit's manufacturer (Roch Company, Germany)

Statistical methods

The level of biochemical parameters was determined in mean and standard deviation. The comparison of biochemical parameters between cases infected with *T. gondii* and their non-infected controls was examined in an independent t-test. The correlation of biochemical parameters in infected cases with *T. gondii* was examined in the pearson correlation and was presented in matrix scatter plots. The level of significant difference was determined in a p-value of less than 0.05. The statistical analyses were performed by statistical package for social sciences version 25 (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp).

RESULTS

ELISA results show 71 seropositive cases (infected group) and 30 seronegative cases (control group) against anti-toxoplasma antibodies.

Table 1 shows the comparison biochemical parameters between *T. gondii* injected subjects and controls as following; first shows the changes in the liver function enzymes in serum including (ALT, AST and ALP) between seropositive and seronegative women for toxoplasmosis. The above serum enzymes were elevated significantly at ($p \leq 0.01$). Also, there is a slight increase in the level of both urea and Creatinine at p (0352, 0337) respectively and this mean that toxoplasmosis also effects on kidney function. Finally, there is a significant decrease in the level of serum FSH and LH in seropositive women for toxoplasmosis compared to control group at $p<0.001$.

Table 1: Group stastics and comparison of biochemical parameters between *T. gondii* injected subjects and controls.

Groups	Urea mg/dl	Creatinine mg/dl	ALT IU/l	AST IU/l	ALP IU/l	LH mIU/ml	FSH mIU/ml
Cases (n=71)	21.87 (6.76)	0.73 (0.12)	27.77 (12.84)	26.85 (11.38)	83.75 (41.72)	1.07 (1.17)	1.32 (1.27)
Controls (n=30)	23.23 (6.61)	0.75 (0.10)	11.13 (6.86)	12.00 (7.04)	58.53 (23.16)	7.78 (5.53)	6.49 (2.34)
P value	0.352	0.337	<0.001	<0.001	<0.001	<0.001	<0.001

Independent t-test was performed for comparison of biochemical parameters.

In this study (Figure 1 and 2) shows the Comparison of LH and FSH between infected women with Toxoplasmosis and their healthy control. The level of LH and FSH were low in infected women compare to healthy one (1.17, 1.32) and (7.78, 6.49) respectively at $p<0.001$.

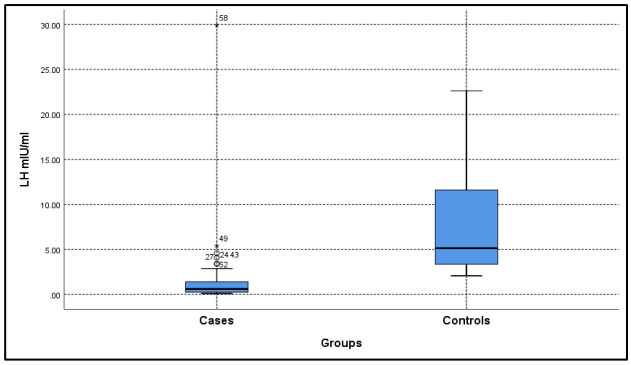

Figure 1: Comparison of LH between infected cases with *T. gondii* and their healthy control.

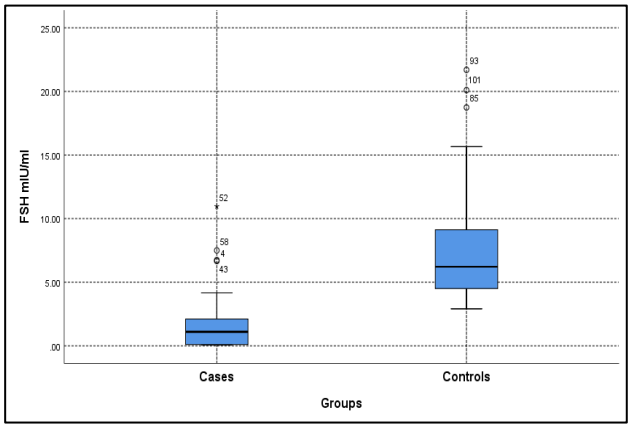

Figure 2: Comparison of FSH between infected cases with *T. gondii* and their healthy control.

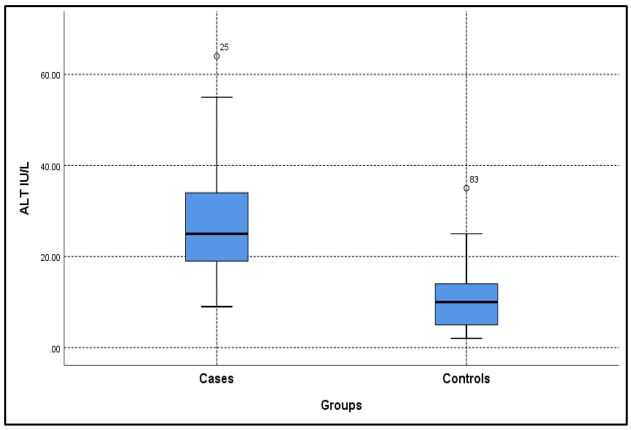

Figure 3: Comparison of ALT between infected cases with *T. gondii* and their healthy control.

In the study (Figure 3 and 4) shows the comparison of ALT between infected cases with *T. gondii* and their healthy control. Showed significant increase in the level of ALT and AST of infected women with toxoplasmosis (27.77, 26.85) at p<0.001 respectively. In contrast, the level of ALT and AST in serum were lower in healthy one (11.13, 12) respectively.

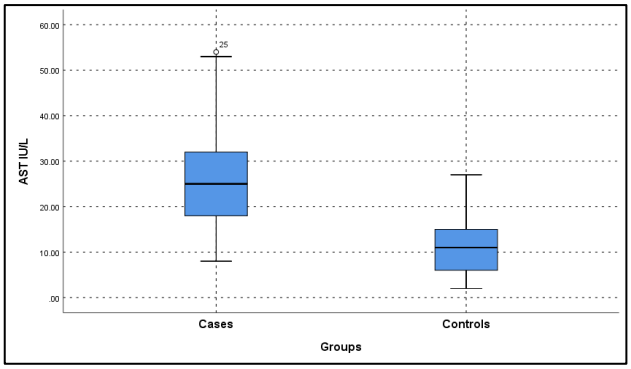

Figure 4: Comparison of AST between infected cases with *T. gondii* and their healthy control.

In the study (Figure 5) shows the comparison of ALP between infected cases with *T. gondii* and their healthy control. There significant increase in the level of ALP at p<0.001 compared to control.

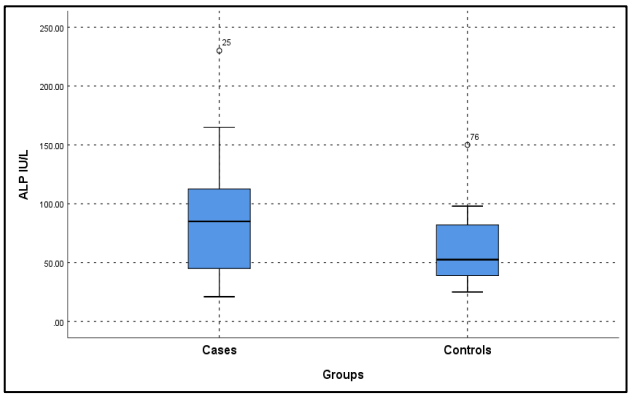

Figure 5: Comparison of ALP between infected cases with *T. gondii* and their healthy control.

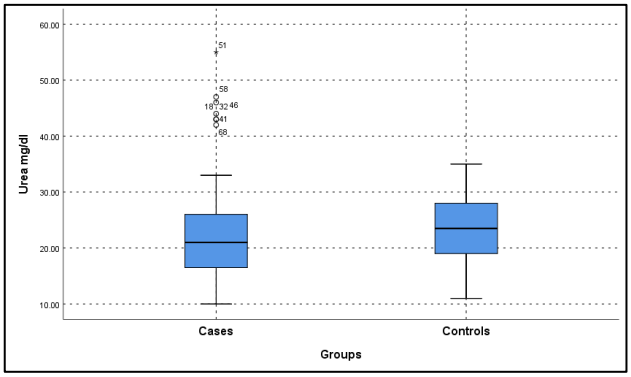

Figure 6: Comparison of urea between infected cases with *T. gondii* and their healthy control.

In this study (Figure 6 and 7) shows the comparison of urea and creatinine between infected cases with *T. gondii* and their healthy control. There is a slight increase in the level of urea and creatinine in serum at p=0.352.

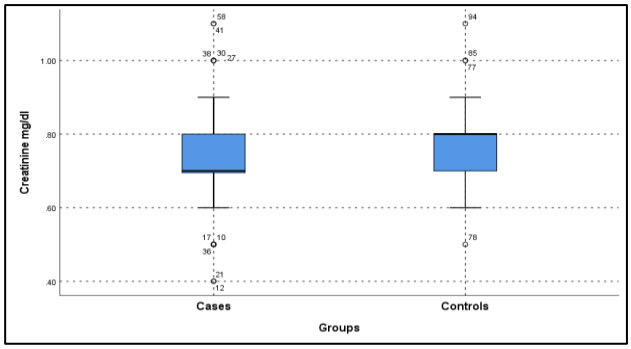

Figure 7: Comparison of creatinine between infected cases with *T. gondii* and their healthy control.

In the study (Table 2) and (Figure 8) a Pearson correlation analysis was used to examine the correlations of biochemical parameters in infected women with Toxoplasmosis as shown in Table 2. There is a poor positive correlation between Creatinine and urea in serum of women with Toxoplasmosis as shown in Table 2 and Figure 8 and this correlation is significant at the p=0.01. There is a powerful positive correlation between ALT and AST, ALP at p value 0.01, which is clearer in Table 2 and Figure 8. In another hand ALT is increase statistically in infected women with toxoplasmosis. There is a powerful positive correlation between FSH and LH in serum of infected women with toxoplasmosis as described in Table 2 and Figure 8 and is significant statistically at p value (0.01).

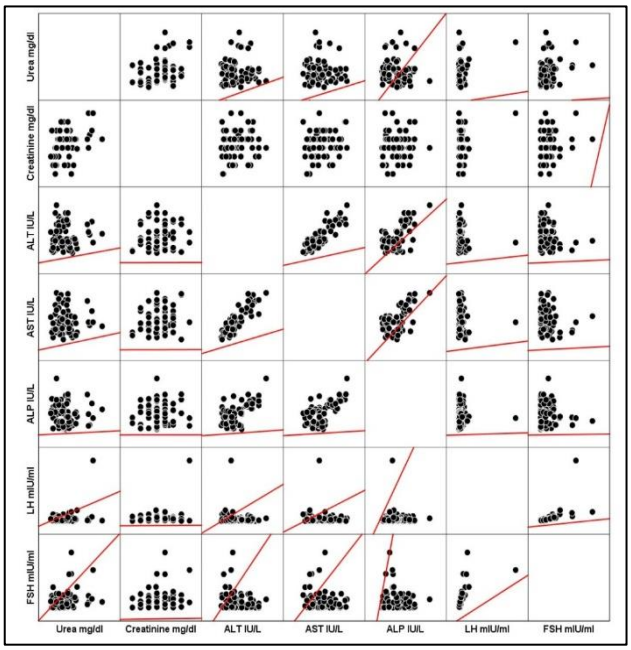

Figure 8: Scatter plots of correlations of biochemical parameters in *T. gondii* infected subjects.

Table 2: Correlations of biochemical parameters in *T. gondii* infected subjects

Correlation		Urea mg/dl	Creatinine mg/dl	ALT IU/l	AST IU/l	ALP IU/l	LH mIU/ml	FSH mIU/ml
Urea mg/dl	Pearson Correlation Sig. (2-tailed)	1	0.342** 0.003	-0.031 0.795	-0.053 0.661	-0.181 0.131	0.225 0.059	0.255* 0.032
Creatin-ine mg/dl	Pearson Correlation Sig. (2-tailed)	0.342** 0.003	1	0.109 0.366	0.153 0.202	0.110 0.359	0.131 0.275	0.117 0.330
ALT IU/l	Pearson Correlation Sig. (2-tailed)	-0.031 0.795	0.109 0.366	1	0.862** 0.000	0.583** 0.000	-0.216 0.070	-0.250* 0.036
AST IU/l	Pearson Correlation Sig. (2-tailed)	-0.053 0.661	0.153 0.202	0.862** 0.000	1	0.600** 0.000	-0.125 0.300	-0.164 0.172
ALP IU/l	Pearson Correlation Sig0. (2-tailed)	-0.181 0.131	0.110 0.359	0.583** 0.000	0.600** 0.000	1	-0.037 0.762	-0.070 0.562
LH mIU/ml	Pearson Correlation Sig. (2-tailed)	0.225 0.059	0.131 0.275	-0.216 0.070	-0.125 0.300	-0.037 0.762	1	0.904** 0.000
FSH mIU/ml	Pearson Correlation Sig. (2-tailed)	0.255* 0.032	0.117 0.330	-0.250* 0.036	-0.164 0.172	-0.070 0.562	0.904** 0.000	1

**0. Correlation is significant at the 0.01 level (2-tailed). *0. Correlation is significant at the 0.05 level (2-tailed).
Pearson correlation was used to examine the correlations of biochemical parameters.

DISCUSSION

Among all the various population groups studied type II asterion was more common than type I. The incidence of During this study shows increase in the level of urea and creatinine in serum of infected women with toxoplasmosis compared to their healthy control and this due to tachyzoites of *Toxoplasma gondii* invades the kidney and replicated inside it and this damage the kidney and lead to low excretion of both urea and creatinine form the body, therefore its level increase in the serum and this agree with study was done by Montoyaand Liesenfeld.[13]

Generally, decrease in the level of gonadotropin hormones (FSH and LH) is interact with poor immune system and increased their susceptibility to parasitic diseases Oktenli et al and Robbers et al who suggested that toxoplasmosis, can effect on FSH and LH and result in changes in secretion of hormones during pregnancy and this agree with current study.[14,15]

A Study which carried up by Ibrahim et al who found during his study an increase in the level of both serum ALT, ATS and APL and this increase is due to hepatic necrosis that is caused due to replication of tachyzoites of *T. gondii* in hepatic cells and these results are in agreement with that recorded by current results.[16]

CONCLUSION

This study shows a significant increase in the levels of biochemical parameters in women infected with Toxoplasmosis and this indicates that T. gondii cause necrosis in vital organs such as kidney and liver and these results in abnormal secretion of liver function enzymes and in levels of both urea and creatinine. Current study, realized that chronic Toxoplasmosis is more dangerous in pregnant women than the acute Toxoplasmosis.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Mikaeel FB. The Effect of *Toxoplasma gondii* infection in women on some biochemical and hormonal parameters in Duhok province, Iraq. Int J Res Med Sci 2020;8:3508-12.