



Effect of chronic toxoplasmosis in the function of pancreas, liver, and kidney in pregnant women in Makkah, Saudi Arabia

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Toxoplasmosis is a zoonotic parasitic disease worldwide which causes abortion to pregnant women. The aim of the current study to explore the effectiveness of chronic toxoplasmosis to the functions of pancreas, liver, and kidney to pregnant women. Case control study was performed in pregnant women in Makkah using ELISA IgG to differentiate chronic toxoplasmosis. Different biochemical tests were used to detect different substances indicated the functions of pancreas, liver, and kidney. ANOVA test was used to analysis the data in SPSS. Approximately, 326 pregnant women were participated in the present study. The results showed significance in the accumulated blood sugar in the grandmultigravida group with chronic toxoplasmosis p -value < 0.05 . The current study also found significant changes in AST which was increased in grandmultigravida with chronic toxoplasmosis p -value < 0.05 . The chronic toxoplasmosis increased the urea in multigravida infected with chronic toxoplasmosis significantly p -value < 0.05 . Also, serum urea increased at the first trimester stage in pregnant women p -value < 0.005 . Serum creatinine was significant in the pregnant women at first trimester p -value < 0.001 . chronic infection with *T. gondii* in pregnant women is associated with hypo-glycemia particularly in multigravida. Moreover, association was detected between liver necrosis particularly in grand multigravida and chronic toxoplasmosis. In addition, exposure to chronic toxoplasmosis may cause acute or chronic damage to the kidney

Keywords: Chronic toxoplasmosis; Pregnant women; Hypoglycemia; Liver necrosis; Kidney damage.

INTRODUCTION

Toxoplasmosis is zoonotic parasitic disease caused by protozoan known as *Toxoplasma gondii* (*T. gondii*). The definitive host of the parasite is cat and all feline groups (Sonar and Brahmhatt, 2010). The parasite can infect wide range of hosts included man and has global distribution (Sedlak and Bartova, 2012). People may acquire infection horizontally by ingestion raw meat contains bradyzoites or water contains oocysts or vertically from mother to her foetus or via blood transfusion by tachyzoites (Robert-Gangneux and Dardé, 2012). Toxoplasmosis was defined according to serological prevalence data as the most common disease in human throughout the world and the disease was common in worm climates area (Sonar and Brahmhatt, 2010).

Infection with *T. gondii* distributed worldwide and considered as one of famous prevalent parasite to human (Tenter, 2000).

The infection with *T. gondii* can lead to several immunological changes in the body of the host which are led to product different immunoglobulins such as IgM, IgA, and IgG (Dubey, 1994).

In acute stage of the disease, the parasite can be seen in the blood or others liquids of the body such as

cerebrospinal fluid, tears, semen, urine and saliva. The acute infection usually leads to abortion in human and animals (Guruz and Ozcel, 2007; Mahmood, 2016).

The disease classified to acute, sub-acute, and chronic according to immunoglobulins detected in the blood. Detection of IgM indicated the acute phase while detected of IgG leads to chronic phase of the disease (Lynn et al. 2023; Liu et al. 2015).

Few studies were done previously to elucidate the relationship between *T. gondii* infection and liver or kidney diseases. In Turkey some study associated liver cirrhosis with *T. gondii* infection (Kodym et al. 2023). Some other study found the association between toxoplasmosis and kidney function (Atmaca et al. 2012). Moreover, toxoplasmosis causes acute and severe damage in the infected liver (Atmaca et al. 2013; El-Sayed et al. 2016). The relationship between raising level of urea and creatinine in pregnant women infected with *T. gondii* were explored (Alvarado-Esquivel et al. 2011).

Previous study in pregnant women in Makkah found that the prevalence of chronic toxoplasmosis was 5.6% (Dalimi and Abdoli, 2012).

The main aim of the current study was to detect the effectiveness of the chronic infection of *T. gondii* to the liver, pancreas, and kidney functions.

MATERIALS AND METHODS

Study design and population

A case control study was performed to study the effectiveness of chronic toxoplasmosis to liver and kidney functions in pregnant women. Pregnant women in different stages of pregnancy and different ages were considered in the current study. The study was done in two groups of pregnant women; the first group with chronic toxoplasmosis (IgG positive) and the second group without chronic toxoplasmosis (IgG negative) both groups were (IgM negative). Also, the effectiveness was studied according to the age-group; pregnant women were divided into two groups; group one with chronic toxoplasmosis and age between 16-26 years with control from the same age group and the group two ages between 27-46 years with control. The study also considered the stages of pregnancy, each stage with control.

Data collection

Data was collected from each subject after signed the consent form and accepted to include in the study. The questionnaire was distributed to individual; the questionnaire included socio-demographic information including age, education, with clinical information such as history of abortion, and pregnancy stage.

Samples collection

Blood sample of 5 ml was collected from each participant and divided into two EDTA tubes. The first tube was separated and plasma was stored in -20 °C to be used in ELISA to differentiate between pregnant women in getting chronic toxoplasmosis. The second tube was used to measure some enzymes and other biochemical tests.

ELISA IgG and IgM

Using ELISA IgG and IgM to differentiate between chronic infection, acute infection, and control. Human TOXO kit- Germany was used according to manufactory constructions. All plasma samples from pregnant women were analysed using the above-mentioned kits. The results divided the participants into three groups: group one which were positive to IgM and excluded from the study, group two positive to IgG and group three which were negative to IgG and IgM. Both group two and three were considered in the current study.

Biochemical analysis

Biochemical analysis was carried out to determine the functions of pancreas, liver, and kidney. Different kits were used to determine different enzymes according to the certain organ. The techniques were followed the manufacturing procedures for each kit.

Data analysis

Analysis data was performed using SPSS program version 26. The form of variable put in mean \pm SD. Data were analysed using independent t test besides ANOVA test. Significance was approved for p -values less than 0.05.

RESULTS

Chronic toxoplasmosis was found more in grandmultigravida at third trimester with no history of abortion and their age group between 28 and 45 of pregnant women when compared with other groups as seen in table (1).

Table 1: Detection of *T. gondii* IgG in both groups

Variable	Toxo IgG		Total
	Positive (Infected Group)	Negative (Control Group)	
Age Group			
Years			
17-27	21(17.9%)	96(82.1%)	117
28-45	48(23.0%)	161(67.0%)	209
Gravity			
Primgravida	5(12.5%)	35(87.5%)	40
Multigravida	14(23.0%)	47(77.0%)	61
Grand multigravida	40(23.7%)	129(76.3%)	169
Pregnancy			
Stage			
First trimester	17(24.3%)	53(75.7%)	70
Second trimester	20(23.5%)	65(76.5%)	85
Third trimester	32(19.0%)	136(81.0%)	168
History of			
Abortion			
Yes	23(18.3%)	103(81.7%)	126
No	46 (23.0%)	154(77.0%)	200

The effectiveness of chronic toxoplasmosis to pancreas activity detected by using the level of blood glucose, lactate dehydrogenase (LDH), and an amylase test. The results showed significance changes in the accumulated blood sugar in the multigravida group with chronic toxoplasmosis p -value < 0.031 table (2) while no significance changes in lactate dehydrogenase or in an amylase.

The effectiveness of chronic toxoplasmosis to liver functions detected by measuring the level of serum alanine amino transferees (ALT), serum aspartate aminotransferase (AST), and serum alkaline Phosphatase (ALP).

Table2: The effectiveness of chronic toxoplasmosis on pancreas functions in pregnant women

Variable	Positive IgG (Infected Group)						Negative IgG (Control Group)					
	Glucose mmol/L	P-value	LDH IU/L	P-value	Amy	P-value	Glucose mmol/L	P-value	LDH IU/L	P-value	Amy	P-value
Age Group Years												
17-27	4.3705±0.69	0.766	202.2±29.5	0.089	61±17.8	0.274	4.4317±1.1	0.766	182.5±31.7	0.089	48.6±17.5	0.274
28-45	5.0852±1.87		194.14±33		45±13.7		4.9698±1.78		178.04±44		37.6±18.8	
Gravity												
Primgravida	4.5280±0.45	0.031	173.0±42.6	0.681	50.5±36.1	0.893	4.4960±0.64	0.031	173.0±42.6	0.681	50.5±36.1	0.893
Multigravida	4.1957±0.73		208.5±20.1		41.0±0.0		4.7687±1.1		183.1±32.9		47.6±15.4	
Grandmult igravida	5.2088±1.9		196.1±35.4		52.5±18.7		5.0717±1.8		178.5±45.1		39.1±19.6	
Pregnancy Stage												
First trimester	4.9129±1.3	0.785	161.0±24.8	0.089	67.5±10	0.274	4.7338±0.8	0.785	169.5±27.1	0.089	25.6±4.5	0.274
Second trimester	5.5110±2.4		189.5±27.6		49.6±20		4.8149±1.9		182.1±32.3		37.3±3.7	
Third trimester	4.4244±0.9		207.3±29.5		50.2±17		4.8237±1.5		183.1±46.5		51.1±16.8	
History of Abortion												
Yes	4.9400±1.3	0.780	180.6±36.2	0.089	39.00±12.7	0.274	5.0872±1.9	0.780	207.63±24.26	0.089	37.11±18.8	0.274
No	4.5896±1.8		173.7±41.5		60.00±14.7		4.6107±1.2		186.17±38.5		48.88±17.3	

Table3: The effectiveness of chronic toxoplasmosis on liver functions in pregnant women

Variable	Positive IgG (Infected Group)						Negative IgG (Control Group)					
	ALT IU/L	P-value	AST IU/L	P-value	ALP IU/L	P-value	ALT IU/L	P-value	AST IU/L	P-value	ALP IU/L	P-value
Age Group Years												
17-27	19.99±50.2	0.175	25.5313±32.4	0.067	108.0±49.7	0.550	10.19±6.8	0.175	20.0247±5.1	0.067	123.2±66.1	0.550
28-45	10.43±6.1		20.7703±8.0		104.5±55.4		9.96±9.4		19.1266±5.5		105.9±61.3	
Gravity												
Primgravida	7.1667±3.7	0.123	18.1333±4.5	0.013	-	0.679	11.1367±9.8	0.123	19.3533±6.2	0.013	144.9±100.8	0.679
Multigravida	8.9077±7.7		21.2154±10.5		110.25±54.1		10.7189±12.5		19.1622±6.3		133.65±65.1	
Grand multigravida	16.8448±34.5		24.9815±24.9		104.38±55.1		9.4363±6.5		18.8057±4.5		99.42±54.2	
Pregnancy Stage												
First trimester	12.2909±6.2	0.180	19.3000±6.4	0.070	64.4±17.9	0.493	12.6364±6.5	0.180	18.7978±4.2	0.070	69.1±22.9	0.493
Second trimester	22.0643±49.7		27.6667±37.5		77.7±34.1		11.3556±11.2		19.2833±5.7		72.1±22.8	
Third trimester	8.0000±5.6		21.2179±8.2		145.5±64.7		8.3679±7.2		19.8991±5.6		144.7±50.1	
History of Abortion												
Yes	11.5647±4.7	0.172	21.2125±6.2	0.069	107.1±65.8	0.511	9.9540±6.4	0.172	18.9978±4.6	0.069	100.7±60.1	0.511
No	13.7057±31.9		22.6378±5.4		118.9±62.1		10.1025±9.7		19.8628±5.4		108.6±49.4	

Table4: The effectiveness of chronic toxoplasmosis on kidney functions in pregnant women

Variable	Positive IgG (Infected Group)				Negative IgG (Control Group)			
	Urea (mg/dl)	P-value	Creatinine(mg/dl)	P-value	Urea (mg/dl)	P-value	Creatinine(mg/dl)	P-value
Age Group Years								
17-27	2.2±0.8	0.788	47.9±5.7	0.778	2.7±1.6	0.788	47.9±6.0	0.778
28-45	2.8±2.0		48.0±4.8		2.6±1.5		48.1±6.4	
Gravity								
Primigravida	2.2±0.6	0.034	48.6±8.2	0.531	2.2±0.6	0.034	47.1±5.2	0.531
Multigravida	3.2±2.6		47.3±3.2		2.9±1.7		48.9±6.2	
Grandmultigravida	2.5±1.6		48.1±5.2		2.7±1.4		48.4±6.7	
Pregnancy Stage								
First trimester	2.9±2.1	0.009	50.3±4.5	0.001	3.1±1.6	0.009	50.4±6.4	0.001
Second trimester	2.6±1.7		47.1±6.3		2.7±1.6		47.9±6.3	
Third trimester	2.4±1.5		47.3±4.2		2.4±1.2		47.2±5.9	
History of Abortion								
Yes	2.2±1.0	0.258	50.6±4.6	0.433	2.6±1.3	0.258	47.9±5.9	0.433
No	2.8±2.0		46.7±4.7		2.7±1.6		48.2±6.5	

The results which obtained from the current study found significant changes in AST which was increased in grandmultigravida with chronic toxoplasmosis p - value < 0.013 as showed in table (3) but no significance changes were detected in serum aspartate aminotransferase (AST), and serum alkaline Phosphatase (ALP).

The effectiveness of chronic toxoplasmosis to kidney functions clarified by estimation the level of urea and creatinine in the serum. According to the results obtained, the chronic toxoplasmosis increased the urea in multigravida infected with chronic toxoplasmosis significantly p - value < 0.034. Also, serum urea decreased at the first trimester stage in pregnant women p - value < 0.009 as appeared in table (4). Serum creatinine was significant in the pregnant women at first trimester p - value < 0.001 as mentioned in table (4)

DISCUSSION

Very little is known about the effectiveness of chronic toxoplasmosis in pregnant women. The current study adjusts to go behind epidemiological studies and study the effectiveness of latent *T. gondii* in a natural host without manipulation, particularly recent studies confirmed that latent toxoplasmosis unsafe for human (Flegr et al. 2003). The majority of the studies connected between latent toxoplasmosis and the behaviour changes in human (Novotna et al. 2008; Lindova et al. 2006; Mihiu et al. 2020). This study aimed to clarify the effectiveness of chronic toxoplasmosis on the function of some organs via studying the changes in the level of some important secession.

As the study targeted the impact of chronic toxoplasmosis therefore, it was ordinary to find that the majority of chronic infection in grandmultigravida or in aged women. Similar study found that chronic toxoplasmosis tended to increase with age in Romina (Majidiani et al. 2016).

According to the finding in the current study, the association between chronic toxoplasmosis and hypoglycemia observed in the multigravida. Several studies done recently concluded that there is no correlation between infection with toxoplasmosis and type-1 or type-2 *diabetes mellitus* (Khalili et al. 2018; Catchpole et al. 2023). Other study found correlation between toxoplasmosis infection and type-1 diabetes mellitus (Molan et al. 2020). Moreover, some studies found correlation between infection of toxoplasmosis and type-2 diabetes mellitus (Roller et al. 1987). The target group of our study was different, as the study here targeted pregnant women beside the result showed hypoglycemia in pregnant women at multigravida stage. This finding needs more studies as hypoglycemia during pregnancy may lead to complicates to women and her foetus included difficult labours and additional monitoring.

Studying hepatic enzymes are good marker for hepatocellular injury (Mahmood and Dawood, 2012). In

the present study, the results shown significant in AST compared with control and the significant found exactly in grandmultigravida which is elevated. The current results matching with different results publishing (Limdi and Hyde, 2003; Babekir et al. 2022a). This result may link between chronic toxoplasmosis and liver necrosis particularly in grandmultigravida. As in some previous study found that *T. gondii* exposure was associated with an elevated relative risk of chronic liver disease and nonalcoholic fatty liver disease (Ocak et al. 2005) therefore, clinical study should be performed to confirm the effectiveness of chronic toxoplasmosis in liver cells.

In the kidney the results being contrasting regarding urea level, the level of urea increased significantly in multigravida while decreased significantly in the first trimester. The level of creatinine was decreased particularly in the first trimester. Exposure to *T. gondii* may cause acute or chronic damage to the kidney, triggering injury, which can affect the exposure over their life course. Prior studies have found a link between undergoing dialysis and an increased rate of *T. gondii* infection (Saadat et al. 2020; Babekir et al. 2022b).

CONCLUSION

In conclusion, chronic infection with *T. gondii* in pregnant women is associated with hypoglycemia particularly in multigravida. Moreover, association was detected between liver necrosis particularly in grandmultigravida and chronic toxoplasmosis. In addition, exposure to chronic toxoplasmosis may cause acute or chronic damage to the kidney

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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