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ORIGINAL ARTICLE

The Correlation Between Toll-Like Receptor-5 Gene Polymorphism with Serum Level of Toll–Like Receptor-5 and Interleukin-6 and Interleukin-12 Response to Toxoplasma Gondii in Pregnant Women

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ABSTRACT

Background: Toxoplasma gondii is an obligate intracellular parasite that can cause variable clinical symptoms or can even be asymptomatic in immunocompetent individuals. The parasite is known to cause congenital diseases, ocular, and miscarriage in pregnant women. Primary infections are dangerous in pregnant women, that occurring usually asymptomatically, especially in the first trimester. Different rates of pregnant women are infected with Toxoplasma gondii in different countries. Primary infections in pregnant women result in transmission of Toxoplasma. gondii through the placenta to the fetus and then in congenital infections, and it is not the only reason for miscarriage, the activity of Toll -like receptors in defense against Toxoplasma gondii infections was observed such as Toll-like receptor5 molecule, and some cytokines (such as IL-6, and IL-12), maybe lead to abortion. Several single-nucleotide polymorphisms (SNPs) residing in genes encoding these receptors were reported as significant genetic modifications of Toll- like receptors and correlated with miscarriage.

Objectives : Study the correlation of TLR-5 gene polymorphism in pregnant women infected with toxoplasmosis, and study association of TLR-5 polymorphisms with the serum level of TLR-5 and cytokines (IL-6, IL-12) in pregnant women infected with toxoplasmosis.

Methods: The present Case-control study was conducted on 100 women, of which fifty pregnant women seropositive (IgG, IgM) for Toxoplasma gondii (Group1), fifty pregnant women seronegative (IgG, IgM) for Toxoplasma gondii (Group2), as a control group, collected in the period from January 2021 to December 2021.

All patients were recruited from Obstetrics and Gynecology Department of Balad General Hospital in Balad city / Salah al-Din province/Iraq, and all women participating in the study were under the supervision of a consultant specialist gynecologist and obstetrician. All IgM and IgG seropositive samples for Toxoplasma gondii by rapid test were subjected for detection of IgM and IgG level by ELISA technique to confirm the diagnosis of toxoplasmosis. The serum level of TLR5 and cytokines (IL-6, IL-12) was measurement by ELISA technique. The selected SNPs (rs2072493, rs5744168) in Toll- like receptors 5 were detection by using real-time polymerase chain reaction (RT-PCR).

Results: The frequency of the heterozygous genotype (TC) for polymorphism of TLR-5 gene (rs2072493) was higher in pregnant women seropositive 20(40%) than pregnant women seronegative 2(4%) with high significant difference p=0.004 (OR=16, CI=3.48 to 73.4), at allelic level, the frequency of mutant allele (allele C) was in pregnant women seropositive and pregnant women seronegative (20% versus 2%) with high significant difference also p=0.009 (OR=12.25, CI=0. 2.77 to 53.99).

The frequency of the heterozygous genotype (GA) was higher in pregnant women seropositive 10(20%) than pregnant women seronegative 4(8%) with no significant difference (p=0.093) (OR=2.87, CI=0.83 to 9.88), at allelic level, in mutant allele (allele A) was in in pregnant women seropositive and pregnant women seronegative (10% versus 4%) with no significant difference p=0.10 also (OR=2.66, CI=0.80 to 8.80).

There are increase serum level of TLR-5, IL-6 and IL-12 in pregnant women seropositive. The pregnant women seropositive with rs5744168 show a positive correlation among TLR-5, IL-6 and IL-12. As well as, with rs2072493 show a negative correlation between TLR-5 and IL-6, but, IL-12 was positive correlation in pregnant women seropositive.

Conclusion: Overall, there was significant association of toxoplasmosis with mutant allele (allele C), however, the mutant allele (C) of the SNP rs2072493 may be considered as a risk factor for toxoplasmosis and stimulate miscarriage in pregnant women, whereas, the SNP rs5744168 was not considered as a risk factor for toxoplasmosis. There is a significant increase serum soluble level of TLR-5, IL-6 and IL-12 in pregnant women seropositive.

Keywords: TLR-5, polymorphism, Toxoplasma gondii, IL-6, IL-12.

INTRODUCTION

Toxoplasmosis infection is rarely symptomatic in immune - competent individuals, but in immunocompromised host may result in a sever disease or even lethal damage [1], it is caused by Toxoplasma gondii is an obligate intracellular protozoan parasite and considered the most common global parasite [2]. Toxoplasmosis is one of the most frequent pregnancy infections transmitted from mother to child and the major cause of perinatal morbidity and mortality [3].

T. gondii derived pathogen–associated molecular pattern (PAMPs), namely profilin which recognized by receptors present on macrophages and dendritic cells, triggering cell activation and production of proinflammatory cytokines, including IL-6 and IL-12 [2].

Profilin has been shown to mediate powerful production from mouse dendritic cells via activation of TLR11 , but in human TLR11 gene has several stop codons, which lead to transcription of it does not produce afunctional protein [4].

Human TLR5 and mouse TLR11 are part of an ancient cluster within the TLR phylogenetic tree, therefore human TLR5 could have conserved mouse TLR11 biological function and mediate T. gondii profilin recognition [5-6]. Flagellin and profilin share common binding sites within the ectodomain of human TLR5 [6].

The gene encoding TLR-5 is housed in the long arm of human chromosome 1 (hCh1q) and comprises six exons. So far, nine potential polymorphisms encompassing the promoter and coding regions of the gene were reported [7], the functional TLR gene polymorphisms (rs2072493, rs5744168) are within exon region [8].

METHODS

Fifty pregnant women seropositive (IgG, IgM) for Toxoplasma gondii and fifty pregnant women seronegative (IgG, IgM) for Toxoplasma gondii as a control group were inclusion in this study, collected in the period from January 2021 to December 2021. All

patients were recruited from Obstetrics and Gynecology Department of Balad General Hospital in Balad city / Salah al-Din province/Iraq, and all women participating in the study were under the supervision of a consultant specialist gynecologist and obstetrician .

Five ml of whole venous blood was taken from each patient, which it was leftover of blood from the laboratory, and patients information was taken from the data recorded. Two ml was collected in an ethylene diamine tetra acetic acid (EDTA) tube for extraction of DNA, and it was stored at -20 ºC until use, and the extracted DNA was stored at -20 ºC until use. The other three ml of blood collected in plain gel tube for separation of serum and stored at -20 ºC until use . All samples whether positive or negative for anti-T. gondii Abs, were subjected for detection of IgM and IgG level by ELISA technique to confirm the diagnosis of toxoplasmosis. Measurement the serum level of TLR5 and cytokines (IL-6, IL-12) by ELISA technique. The selected SNPs (rs2072493, rs5744168) in Toll- like receptors 5 were detection by using real-time polymerase chain reaction (RT-PCR) with specific primers .

Statistical analysis: The well- known statistical system (Graph Pad prism ver. 7) was adopted, and the analysis of variance table one – way anova (by Tukey´s multiple comparisons test) was used for the comparison among subdivided groups in the measured parameters and SNPs numbers. The results were expressed as (Mean ± Standard Error). Nominal variables were presented as frequency and percentage (%) were compared between studied groups using the Chi-square test.

Nominal regression data was expressed as odds ratios (OR), 95% confidence intervals (CI), and p values; Significance of differences was detected at ($p<0.05$) and is calculated by the MedCalc program. Correlation coefficients were calculated to estimate the correlation between markers. The descriptive statistics and correlation coefficients were performed by using mega stat (Version v 10.12) for excel 2010 [9].

RESULTS

Age Groups and Study Groups: The study groups were pregnant women seropositive (IgG, IgM) for T. gondii (Group1) and pregnant women seronegative (IgG, IgM) for T. gondii (Group2), where each group were 50 cases, so that the total number of cases are 100 case; the mean age of study groups were 30.36 ± 0.43 years, the age minimum is 18 year and the age maximum is 43 table (1).

Table 1: Age Groups and Study Groups.

	Age stage				
Groups	Less than 20	20-30	31-40	More than 40	Total
Group1	2 (4%)	25 (50%)	21 (42%)	2 (4%)	50 (100%)
Group2	3 (6%)	26 (52%)	21 (42%)	0 (0.0%)	50 (100%)

TLR-5 Gene Polymorphism rs5744168: Genetic polymorphism of TLR-5 gene (rs5744168) which was observed with two genotypes (AG and GG) only, in all study groups figure (1). The frequency of the heterozygous genotype (AG) was higher in Group1 10(20%) than Group2 4(8%) with no significant difference (OR=2.87, CI=0.83 to 9.88) (p=0.093), and the homozygous genotype GG frequency 40 (80%) was no significant (OR=0.34 CI=0.10 to 1.19) (p=0.0936) in Group1 compared to Group2 46(92%), but homozygous genotype AA was not recorded any frequency 0(0%) in both groups.

At allelic level, the frequency of mutant allele (allele A) was in Group1 and Group2 (10% versus 4%) with no significant difference also (OR=2.66, CI=0.80 to 8.80, p=0.10), while in normal allele (allele G) was in Group1 and Group2 (90% versus 94%) with no significant difference also (OR=0.37, CI=0.11 to 1.23, p=0.10) as shown in table (2) .

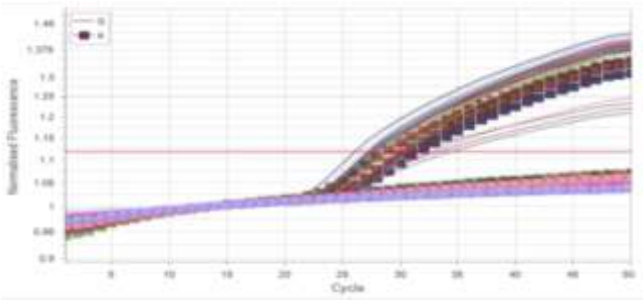

Figure 1: RT-PCR Result for Genetic Polymorphism of TLR-5 gene (rs5744168).

Table 2: Genotypes and alleles of TLR-5 Gene Polymorphism rs5744168 in Group1 and Group2.

	rs5744168	Group1 (n=50)	Group2 (n=50)	OR (95 % CI)	P-value
Genotypes	GG	40 (80%)	46 (92%)	0.34 (0.10 to 1.19)	0.093
	GA	10 (20%)	4 (8%)	2.87 (0.83 to 9.88)	
	AA	0 (0.0%)	0 (0.0%)		
Alleles	G	90 (90%)	96 (96%)	0.37 (0.11 to 1.23)	0.10
	A	10 (10%)	4 (4%)	2.66 (0.80 to 8.80)	

n = number of samples, OR = odds ratios, CI = confidence intervals.

TLR-5 Gene Polymorphism rs2072493: Genetic polymorphism of TLR-5 gene (rs2072493) which was observed with three genotypes (TT, TC and CC) figure (2). The frequency of the heterozygous genotype (TC) was higher in Group1 20(40%) than Group2 2(4%) with high significant difference (OR=16, CI=3.48 to 73.4, p=0.0004), and the homozygous genotype (TT) frequency 30 (60%) was high significant difference (OR=0.06, CI=0.01 to 0.28, p=0.0004) in Group1 compared to Group2 48(96%), but homozygous genotype CC was not recorded any frequency 0(0%) in both groups.

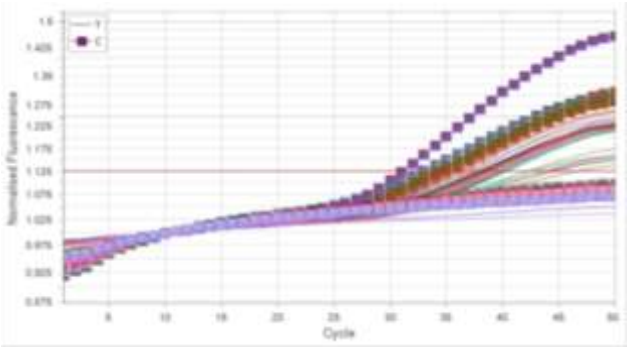

Figure 2: RT-PCR Result for Genetic Polymorphism of TLR-5 gene (rs2072493).

Table 3: Genotypes and alleles of TLR-5 Gene Polymorphism rs2072493 in Group1 and Group2.

	rs2072493	Group1 (n=50)	Group2 (n=50)	OR (95 % CI)	P-value
Genotypes	TT	30 (60%)	48 (96%)	0.06 (0.01 to 0.28)	0.0004
	TC	20 (40%)	2 (4%)	16.00 (3.48 to 73.41)	
	CC	0 (0.0%)	0 (0.0%)		
Alleles	T	80 (80%)	98 (98%)	0.08 (0.01 to 0.35)	0.0009
	C	20 (20%)	2 (2%)	12.25 (2.77 to 53.99)	

At allelic level, the frequency of mutant allele (allele C) was in Group1 and Group2 (20% versus 2%) with high significant difference also (OR=12.25, CI=0. 2.77 to 53.99, p=0.0009), while in normal allele (allele T) was in Group1 and Group2 (80% versus 98%) with high significant difference also (OR= 0.08, CI=0.01 to 0.35, p=0.0009) as shown in table (3).

The Serum Soluble Level of TLR-5, IL-6 and Il-12: Table 4 showing the results of TLR-5 ,IL-6 and Il-12 .There were significantly higher in Group1(48.43, 151.1, 27.71) than Group2 (14.72, 151.1, 27.71) respectively.

Table 4: The Serum Soluble Level of TLR-5, IL-6 and Il-12

Groups	TLR-5 ng/L	IL-6 ng/L	IL-12 ng/L	P value
Group1	48.43 ± 3.7	151.1 ± 17.42	27.71 ± 2.22	p<0.05
Group2	14.72 ± 2.2	83.45 ± 7.5	15.77 ± 2.28	

Correlations Among TLR-5, IL-6 and IL-12 and rs5744168 in Group1: As shown in table (4) the results of the present study revealed a positive correlation and significant difference (p<0.01) between TLR-5 and rs5744168, while positive correlation and no significant difference (p>0.01) among IL-6, IL-12 and rs5744168; and positive correlation and no significant difference (p>0.01) among TLR-5 and IL-6 and IL-12, while positive correlation and significant difference (p<0.01) between IL-6 and IL-12.

Table 4: Correlations Among TLR-5, IL-6 and IL-12 and rs5744168 in Group1.

			rs5744168	TLR5	IL12	IL6
Spearman's rho	rs5744168	Correlation Coefficient	1.000	0.582**	0.080	0.005
		Sig. (2-tailed)	.	0.001	0.582	0.971
	TLR5	Correlation Coefficient		1.000	0.070	0.142
		Sig. (2-tailed)		.	0.627	0.325
	IL12	Correlation Coefficient			1.000	0.831**
		Sig. (2-tailed)			.	0.001
	IL6	Correlation Coefficient				1.000
		Sig. (2-tailed)				.

Correlation is significant at the 0.01 level (2-tailed).

Correlations Among TLR-5, IL-6 and IL-12 and rs2072493 in Group1: As shown in table (5) the results of the present study revealed a negative correlation and no significant difference (p>0.01) among TLR-5, IL-6 and rs2072493, while positive correlation and no significant difference (p>0.01) between IL-12 and rs2072493; also positive correlation and no significant difference (p>0.01) among TLR-5, IL-6 and IL-12, while positive correlation and significant difference (p<0.01) between IL-6 and IL-12.

Table 5: Correlations Among TLR-5, IL-6 and IL-12 and rs2072493 in Group1.

			rs2072493	TLR5	IL12	IL6
Spearman's rho	rs2072493	Correlation Coefficient	1.000	-0.255	0.076	-0.025
		Sig. (2-tailed)	.	0.074	0.598	0.861
	TLR5	Correlation Coefficient		1.000	0.070	0.142
		Sig. (2-tailed)		.	0.627	0.325
	IL12	Correlation Coefficient			1.000	0.831**
		Sig. (2-tailed)			.	0.000
	IL6	Correlation				1.000
		Coefficient				
		Sig. (2-tailed)				.

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations Among TLR-5, IL-6 and IL-12 and rs5744168 in Group2: As shown in table (6) the results of the present study revealed a positive correlation and significant difference (p<0.01) among TLR-5, IL-6 and rs5744168, while negative correlation and no significant difference (p>0.01) between IL-12 and rs5744168; also positive correlation and significant difference (p<0.01) among TLR-5 and IL-6, while negative correlation and no significant difference (p>0.01) between TLR-5 and IL-12, while positive correlation and no significant difference (p>0.01) between IL-6 and IL-12.

Table 6: Correlations Among TLR-5, IL-6 and IL-12 and rs5744168 in Group2.

			rs5744168	TLR5	IL12	IL6
Spearman's rho	rs5744168	Correlation Coefficient	1.000	0.465**	-0.161	0.434**
		Sig. (2-tailed)	.	0.001	0.264	0.002
	TLR5	Correlation Coefficient		1.000	-0.032	0.745**
		Sig. (2-tailed)		.	0.828	0.001
	IL12	Correlation Coefficient			1.000	0.120
		Sig. (2-tailed)			.	0.405
	IL6	Correlation Coefficient				1.000
		Sig. (2-tailed)				.

Correlation is significant at the 0.01 level (2-tailed).

Correlations Among TLR-5, IL-6 and IL-12 and rs2072493 in Group2: As shown in table (7) the results of the present study revealed a positive correlation and no significant difference (p>0.01) among TLR-5, IL-6, IL-12 and rs2072493, while negative correlation and no significant difference (p>0.01) between TLR-5 and IL-12, and positive correlation and significant difference (p<0.01) between TLR-5 and IL-6, while positive correlation and no significant difference (p>0.01) between IL-6 and IL-12.

Table 7: Correlations Among TLR-5, IL-6 and IL-12 and rs2072493 in Group2.

			rs2072493	TLR5	IL12	IL6
Spearman's rho	rs2072493	Correlation Coefficient	1.000	0.202	0.014	0.057
		Sig. (2-tailed)	.	0.160	0.922	0.696
	TLR5	Correlation Coefficient		1.000	-0.032	0.745**
		Sig. (2-tailed)		.	0.828	0.001
	IL12	Correlation Coefficient			1.000	0.120
		Sig. (2-tailed)			.	0.405
	IL6	Correlation Coefficient				1.000
		Sig. (2-tailed)				.

Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

One of the main factors that increases the likelihood of abortion is maternal acute toxoplasmosis or congenital toxoplasmosis during pregnancy. Toxoplasmosis has a significant frequency worldwide, according to serological evidence **[10, 11, 12]** Innate immunity has a major role in toxoplasmosis and recurrent miscarriages, including TLR-5 and some cytokines, both human and mouse TLR5 seemed

to be evolutionarily the oldest relatives of mouse TLR11, therefore human TLR5 could have conserved mouse TLR11 biological function and mediate T. gondii profilin recognition. Flagellin and profilin share common binding sites within the ectodomain of human TLR5 **[5]**.

TLR5 might play important role in the pathogenesis of unexplained recurrent spontaneous abortion since TLR5 signaling could result in inflammatory cytokine production (such as IL-6, IL-12) **[13]**,especially when there is no reason for the miscarriages, so T. gondii infection could be considered a potential risk factor for abortion. In addition to the pathogen's virulence factors, host genetics have a significant influence in defining disease susceptibility, clinical symptoms, treatment response, and disease outcome.

Age Groups and Study Groups: The current study showed the distribution of toxoplasmosis among age groups was converged. These findings were agreed with **Batool et al**. 2019, who reported that the distribution among these ages was converged, maybe because the women participating in this study were in the reproductive stage **[14]**.

TLR-5 Gene Polymorphism: Throughout the human genome, a huge number of single nucleotide polymorphisms (SNPs) have been discovered. SNPs are becoming more important and useful in the search for the causes of human diseases and features, as well as in drug development and the research of human treatment response, and may affect the innate immune response by changing the amplitude and quality of intracellular signaling cascades, which has consequences for infection susceptibility and disease outcomes. This is backed up by a growing body of evidence **[15]**.

The current study showed no significant association between the TLR-5 gene polymorphism rs5744168 with the susceptibility to toxoplasmosis in Group1. As similar studies are very rare to support of evidence, so this study is considered one of the recent studies which addressed this issue, in other studies, SNP rs5744168 was associated with various infectious, breast cancer and autoimmune diseases, such as Crohn's disease SLE **[16]**.

This finding was agreed with the majority of researches regard out that polymorphism rs5744168 was no significant association with the susceptibility to some diseases or infection **[16, 17, 18]**, may be because rs5744168 has a stop codon, so produces a premature protein and the mutant allele frequency was very low in population. According to these researches, it is reasonable TLR-5 rs5744168 polymorphism is associated with a reduced interaction between TLR-5 and the of pathogen-associated molecular patterns of T. gondii, with reduction in the signaling cascade which limit the immune response.

TLR-5 signaling is inhibited when the SNP rs5744168 encodes a stop codon at codon 392 (TLR5r392x) of the TLR5 gene, resulting in truncation of the TLR5 transmembrane signaling domain. Because TLR-5 is normally a homodimer, the TLR5r392x variation may also inhibit TLR5 from assembling and localizing, limiting immunological responses **[19]**.

Furthermore, there was a significant association between the heterozygous genotype (TC) of TLR-5 gene polymorphism rs2072493 and susceptibility to toxoplasmosis in Group1. This implies that carrier of (TC) genotype of this polymorphism are higher risk of having the disease compared with (TT) genotype carrier, causes according to odd ratio by (16) under 95% CI (3.48 to 73.4). While it showed no significant between the heterozygous genotype (TC) of TLR-5 gene Polymorphism rs2072493 and susceptibility to toxoplasmosis in Group2.

There are very a few studies that have researched into this topic (TLR-5 gene polymorphism with toxoplasmosis) globally. The observed allele frequency for (rs2072493) polymorphism in the current study were 40% in Group1, these results were disagreed with some researches ,who the reported allele frequencies in Caucasians were 15% **[20]**, Chinese were 26% **[21]**, and north Indians were 12 % **[22]**, maybe because these researches used a population sample, as well the genetic heterogeneity among different ethnicities, diversity can be attributed to the differences in the minor allele frequencies, and SNP rs2072493 was associated with various infectious such as colorectal cancer, graves' disease, and chronic hepatitis B virus (HBV) infection **[23, 24, 25]**.

The Serum Soluble Level of TLR-5: In the current study, the serum soluble level of TLR-5 was a significant increase ($p<0.05$) more in the Group1, this results were agreed with **Feryal, et al**. 2014, who indicated that the expressions of TLR-5 was significantly increased in both maternal part, although it used the expression for TLR-5, the results were agree, TLR-5 ligation activates the production of pro-inflammatory cytokines via the NF-κB pathway, regardless of the trigger factors or ligands, and chronic inflammation is thought to be a primary contributor to the progression of abortion **[26]**.

According to **Rosa Maria, et al**.2014, this result is maybe accordance with the hypothesis that human TLR-5 is involved in innate recognition and induction of cytokine production by Toxoplasma gondii - derived profiling **[6]**.

The Serum Level of IL-6: In the current study, the serum level of IL-6 a significant increase ($p<0.05$) more in the serum of Group1, this finding was agree with **Meixiang et al.2017**, Tyagi and Nahed 2020, who indicated that plasma concentrations of IL-6, IL-10, and IL-18 are higher in women with successful pregnancies than in women with recurrent pregnancy loss, and IL‑6 was decreased in pregnant women with a history of recurrent spontaneous miscarriage patients.

IL-6 plays a role In trophoblast proliferation, differentiation, and invasion, as well as follicle development and embryonic implantation, the IL-6 protein is also involved in the first spiral artery remodeling process, which necessitates the production of vascular smooth muscle cells and morphological changes. IL-6 levels that are lower inhibit trophoblast invasion and spiral artery remodeling **[28]**.

Therefore in this regard, the current result is consistent with numerous earlier investigations **[29, 30]**.

The general rule is that Th2 cytokines, such as IL-6, are thought to encourage a normal pregnancy, IL-6 functions as a messenger for notifying the body to the occurrence of an unexpected event. In an infected lesion, IL-6 is produced and transmits a warning signal throughout the body. Increased or decreased levels of this cytokine in serum or gestational tissues appear to have negative consequences for pregnancy. Excessive IL-6 may limit the development of CD4+T regulator cells, which are essential for pregnancy tolerance, according to one theory **[31]**.

The Serum Level of IL-12: In the current study, the serum level of IL-12 a significant increase ($p<0.05$) more in the serum of Grou1, this result was disagree with **Tyagi, and Nahed 2020**, who reported that Th1 activity (including IL‑12) was higher in pregnant women with a history of recurrent spontaneous miscarriage irrespective of whether continuing their pregnancy or aborting in comparison to healthy pregnant, maybe this disagree because that might be a persistent imbalance of Th1/Th2 in pregnant women.

The generation of IFN- γ by interleukin-12 (IL-12) causes Th1 cells to differentiate. Because Th1-dependent processes are potentially involved in allograft rejection, researchers have revealed that Th1-type immunity may be detrimental during pregnancy, then an augmented Th1-type cytokine response may result in pregnancy loss **[32]**, also according to a study **K. Rezende-Oliveira, et al**. 2012, it was suggested that immunomodulation, which was observed during pregnancy, was involved in Toxoplasma gondii evading the immune response**[33]**.

IL-12 level in the blood were shown to be higher in failing pregnancies than in normal pregnancies. Patients with a history of miscarriage had higher levels of IL-12 in their blood and tissues, cytokines had significant regulatory functions during pregnancy; an excessive decrease or increase of these cytokines may result in spontaneous abortion, implantation failure, or preeclampsia **[34]**.

Therefore in this regard, the current result is consistent with numerous earlier investigations **[32, 33, 34]**. This concordance,

however, does not fit the IL-12 results in Group2, may be because different in study group.

According to our knowledge there is no any previous studies included study the correlations among TLR-5, IL-6 and IL-12 and SNPs (rs5744168 and rs2072493) in pregnant women. To the best of our knowledge, this study is the first to suggest.

CONCLUSIONS

1 There are a significant correlation between the heterozygous genotype (TC) of TLR-5 gene polymorphism rs2072493 and susceptibility to toxoplasmosis in pregnant women seropositive group.

2 There are no significant correlation between the heterozygous genotype (AG) of TLR-5 gene polymorphism rs5744168 and susceptibility to toxoplasmosis in both group pregnant women seropositive.

3 There is a significant increase serum soluble level of TLR-5 IL-6 and IL-12 in group pregnant women seropositive.

5 The pregnant women seropositive with rs5744168 in the current study show a positive correlation among TLR-5, IL-6 and IL-12.

6 Thepregnant women seropositive with rs2072493 in the current study show a negative correlation between TLR-5 and IL-6, but, IL-12 was a positive correlation.

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