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Investigation of *Toxoplasma gondii* in Pregnant Women: A Strategy for Personalized Medicine

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Abstract

Introduction: In this study, we evaluated the Seroepidemiology of *T. gondii* among470 pregnant women as well as association of infection with socio-demographic factors and risk factors such as age, and education was studied, which makes it a potential therapeutic option for personalized medicine.

Methods: This cross sectional study was conducted among 470 pregnant women who presented to health centers from February 2013 to January 2014. Serum samples were prepared via a commercial ELISA kit (Euroimmun, Germany) for the attendance of IgG and IgM toxoplasma antibodies and the avidity of the IgG antibody based on the manufacturer's protocol.

Results: We found 34.4% of *Toxoplasma* IgG. Among 470 pregnant women, 166 cases positive for IgG antibodies toxoplasma were detected, showing a serum incidence of 35.31% (95% confidence interval 27.8 to 37.06%),and thirty eight (22.89%) out of 166 IgG-positive women revealed specific IgM antibodies.

Conclusions: Our data showed that the prevalence of *T. gondii* infection is not related to age, gestational age, number of pregnancies, history of abortion, contact with soil, life in rural areas and education related to infection. as well as these findings may be of major interest for the select of the first-line anti-infection drug, and the urgent require for developing personalized medicine.

INTRODUCTION

Personalized medicine for infectious diseases is an expanding notion in which molecular biology instruments are utilized to provide further fast, informative, and precise diagnostic assays, enabling more impressive remedy and the past decade, multiple companies have expanded various tests of nucleic acid testing for the direct diagnosis of viral pathogens and several resistant bacteria in clinical specimens [1]. Toxoplasmosis is a parasitic disease created by the protozoan *T. gondii*. The most common routes of transmission in people are via corrosive raw meat including tissue cysts or by using water, soil, or vegetables infected with oocytes poured by contaminated cats and mother-to-fetus vertical transmission [2]. Persistent pre-pregnancy infection does not result in its transfer to the fetus, however, acute infections in un-remedied enceinte women may motive fetal transmission and congenital toxoplasmosis with fetal complications aftermath [3]. Connate infections may rarely happen during the mother's early infection and can be intense complications and diseases, such as premature birth.Seroprevalence of *T. gondii* was showed in various regions of the world [4].

Assessment of humans at hazard and risk factors for prophylactic measures and strategies are necessary. Diagnosis is regularly monitored by serologic methods by identifying specific antibodies to *T. gondii* [5, 6]. More researches have been performed on the

prevalence of *T. gondii* and the risk factors of Toxoplasma in Iran. Because of geographical and cultural distinctions, variable seroprevalence (low, moderate, or high) incidence has been reported in various areas of Iran. [7-9]. The present study was performed to investigation of *T.gondii* in pregnant women and usual risk factors for Toxoplasma infection and also, in parallel, medicine can be personalized stage by stage by using standard approaches and already available knowledge and hence paving way for personalized medicine.

METHODS

This cross sectional study was performed among 470 pregnant women who referred to health houses for antenatal checkups from February 2013 to January 2014. They had no record of connate or acquired immunodeficiency or diabetes. Next obtaining informed consent, the demographic data were collected using an untitled questionnaire augmented by the educated assistant via the interview. (Tables 1 and 2). Blood samples were collected for those who agreed to participate in the blood test. The blood samples were centrifuged and stored at −20°C until analysis by ELISA.

Table 1: Toxoplasmosis and Sociodemographic and Obstetric Factors

Sociodemographic factor (n = 470 subjects)	No. of subjects (%)		P value
	IgG negative	IgG positive	
	Number 304	Number166	
Age groups (yr)			
15–21	73 (61.34)	46 (38.65)	>0.05
22–26	85(68)	40(32)	
27–31	80 (64)	45(36)	
32–47	66 (65.34)	35 (34.65)	
Education			
Grade school	115(58.97)	80(41.02)	<0.05
High school	100 (64.93)	54 (35.06)	
University degree	89(73.55)	32 (26.44))	
Residence area			
Rural	125(57.87)	91 (42.12)	<0.05
Urban	179 (70.47)	75(29.52)	
Abortion history			
None	221(67.9)	105 (32.20)	>0.05
Once	59(56.73)	45 (43.26)	
More than once	24 (60)	16(40)	
No. of pregnancies			
1	144 (65.75)	75 (34.24)	>0.05
>1	160 (63.74)	91 (36.25)	
Gestational age			
1st trimester	165 (68.46	76(31.53)	>0.05
2nd trimester	110 (61.11)	70 (38.88)	
3rd trimester	29(59.18)	20 (40.81)	

Table 2: Toxoplasmosis and Risk Factors

Risk factor	No. of subjects (%)		P value
	IgG negative	IgG positive	e
	304	166	
Soil contact (n = 470 subjects)			<0.05
Yes	27 (45.76)	32 (54.23.)	
No	277 (67.39)	134 (32.60)	
Undercooked meat intake (n = 470subjects)			>0.05
Once a week or more	157 (63.56)	90(36.43)	
Once a month or less	147 (65.91)	76 (34.08)	

Serum samples were tested using a commercial ELISA kits (Euroimmun, Germany) for the presence of *Toxoplasma* IgG and IgM antibodies and avidity of IgG antibodies according to the manufacturer's protocol. Sera with positive IgG titers and negative IgM titers were considered a latent toxoplasmosis infection. Concurrent positive sera with IgG and IgM titers were analyzed by avidity examination. In line with manufacturer's recommendations, IgG and IgM indexes of <0.8 were considered as negative, between 0.8 to 1.1 were scored as borderline and testing was repeated and ≥ 1.1 as the positive results.

In line with manufacturer's recommendations for avidity kit, an avidity index of <40% was considered as low avidity antibodies and between 40 and 60% indicated the equivocal range and >60% was considered as high-avidity antibodies.

ELISA outcome and findings were collected using questionnaires using Chi-square test with a 95% confidence interval through SPSS software version 16. The software, SPSS Version 16.0 for Windows (SPSS Inc., Chicago, IL, USA), was used for analysis. Differences were considered significant when $P < 0.05$ using (ANOVA) and chi-squared tests.

RESULTS

Among 470 pregnant women, 166 tested positive for *Toxoplasma* IgG antibodies, indicating a seroprevalence of 35.31% (95% confidence interval 27.8 to 37.06%).Thirty Eight (22.89%) out of 166 IgG-positive women showed specific IgM antibodies. It is worth noting that four of them had IgG avidity indicators in the defective range, and the residual was shown an elevated avidity indicator. There was a significant relationship among soil impact and attendance of IgG ($P < 0.05$) as well as rural abidance and attendance of IgG ($P < 0.05$) (Table 1 and 2). Our data revealed that women living in rural regions significantly had more soil abidance and lower education area ($P < 0.05$). The odds ratio for this association was 2.51 with 95% CI = 1.60-3.12. Furthermore, Low level of education was associated with higher rate of toxoplasmosis and women who had primary education were many regularly infected with Toxoplasma ($P < 0.05$). The incidence of *T. gondii* infection was not related to age, gestational age, the number of pregnancies, history of abortion and low-fat consumption ($P > 0.05$). Outcomes, containing serological data with personal and demographic variables, are described in Table 1.

DISCUSSION

Inborn toxoplasmosis can guidance to miscarriage and also nascence to hydrocephalus or microcephaly, cerebral calcification and retinochoriditis in the foetus and child [10, 11].Among 470 pregnant women, *T. gondii* IgG was positive in 166 cases (35.31%). This is in agreement with other previous studies in pregnant women residing in mountainous or dry parts of Iran [9, 12-14]. North of Iran has suitable climate for oocyst sporulation of *T. gondii*, so high prevalence of infection was reported there**.** Despite the moderate to high prevalence of Toxoplasma (20 to 70%) in different parts of Iran [7, 8, 13],. But, no guidance on the burden of infection in any clinical setting is available because the health ministry is reported as an infectious disease. Thirty Eight (22.89%) out of 166 IgG-positive women showed specific IgM antibodies**.** Our result was shown a high avidity antibody, indicating ruled out the occurrence of an infection during the past 3 months. IgM antibodies may persist for 1 year after infection is documented [15].

Our outcome demonstrated a notable difference among T. *gondii* infection and soil contact ($P < 0.05$)**.** Ingestion of *T. gondii* oocysts in soil is a considerable transfer route for humans acquiring toxoplasmosis**.** Contaminated water and soil may act as vehicles for the transfer of oocysts to vegetables and fruit for human consumption [16, 17]. Conversely, in that study, the risk for infection was highly associated with rural living ($P < 0.05$), suggesting acquisition through contaminated soil (gardening or farming activities) [17],. It is commonly avowed that a superior level of training generally means much information about infection and its interdiction. The training rate was a predictor of toxoplasma infection and may be better than the socioeconomic level. Our study showed that women living in rural areas had significantly both more soil contact and lower educational levels ($P < 0.05$). Similar to many studies, the prevalence of *T. gondii* infection was not associated with age in this study [17, 18]. The prevalence of *T. gondii* infection was not associated with age, gestational age, number of pregnancies, historyof abortion ($P > 0.05$). Consumption of raw or undercooked meat was a risk factor in most of the studies, but no relation was observed between consuming undercooked meat or kebab and Toxoplasma infection. This difference is probably due to different meat-eating habits [17, 19].

CONCLUSIONS

Taken together, our data indicated that life in a rural environment is heavily infected and also other remained risk factors, soil contact and level of education was also was associated with T. *gondii* infection in our study. Detection of IgM among women who were positive for IgG antibody indicates the possible role of *Toxoplasma gondii* in abortion phenomenon in the region and the urgent require for developing personalized medicine. The results of this study emphasize the requirement for preventive measures and public education especially in rural area.

Conflict of Interests

The authors declare that they have no competing interests.

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