International Journal of Advanced Scientific Research
ISSN: 2456-0421; Impact Factor: RJIF 5.32
www.allscientificjournal.com
Volume 1; Issue6; September 2016; Page No. 15-18

Sero-prevalence and risk factors of *Toxoplasma gondii* infection among aborting women attending Elsheik Mohamed Ali Fadol Maternity Hospital in Omdurman state, Sudan

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Abstract
Toxoplasmosis is known to cause serious problems during pregnancy. The aim of this study is to determine the prevalence of *Toxoplasma gondii* in aborted women attending Elsheik Mohamed Ali Fadol Maternity Hospital in Omdurman state, and to assess the possible risk factors associated with the infection. Two hundred participants were enrolled, and sera were first screened by LATEX for detection of *T. gondii*. Further confirmation was accomplished for LATEX +ve sera, by using ELISA test for detection of (IgG, IgM).
105 samples (52.5%) were Latex +ve, and76 (38%) of them were +ve by lgM, 102 (51.3%) were +ve by IgG ELISA test. High seroprevalence of *T. gondii* antibodies were found in this study. According to the results, residence, contact with cats were significantly correlated to infection with Toxoplasmosis, (p=0.031, p=0.492), respectively, while no significant relationship was found between infection and the habit of clay eating during pregnancy or uncooked meat, (p=0.492, p=0.058) respectively.
Since high prevalence was detected among aborting women attending the hospital, infection of pregnant women could be prevented if good health program is implemented for education about the precautions to avoid being infected with the disease.

Keywords: Abortion, Toxoplasmosis, risk factors, Sudan.

1. Introduction
Toxoplasmosis is a zoonotic disease which is caused by the apicomplexan parasite, *T. gondii* [1]. This parasite is an obligatory intracellular protozoa, which has a cosmopolitan distribution. The disease during pregnancy is a major public health problem to the mother, fetus and newborns [2] It is caused by an obligate intracellular protozoan parasite *Toxoplasma gondii*, which infects humans and other domestic and wild animals. The sexual reproduction of this parasite occurs in the intestine of cats, which are the only definitive hosts, and it ends by shedding of oocysts with the cat feces. The disease is transmitted by ingestion of raw or undercooked meats, exposure to oocyst-infected cat feces, or by vertical transmission [3, 4].
Congenital transmission occurs after primary infection of a pregnant woman, and results in many clinical manifestations, which are usually more sever if infection occurred during the first-trimester, such as hydrocephaly, mental retardation or chorio-retinitis. In a proportion of cases, spontaneous abortion, prematurity, or stillbirth may result [5].Accidental infection by *T. gondii* in immune-competent adults and children are usually asymptomatic or cause a mild disease. Studies showed that there could be a correlation between toxoplasmosis and change in behavior and it might result in many psychiatric disorders such as depression, anxiety and schizophrenia [6]. Acute and latent *T. gondii* infections during pregnancy are mostly diagnosed by serological tests including detection of anti-*T. gondii*-specific IgM and IgG antibodies [7, 5].
In Sudan, the first report of human toxoplasmosis was in 1966, with different prevalence rates according to the regions and the people's habits [8].Many workers investigated the seroprevalence of *T. gondii* in pregnant women, or the role of this parasite in abortions in different localities in Sudan [9,10,11,12].
This study aims to detect the prevalence of *T. gondii* among aborted women, and to provide basic knowledge about risk factors of the disease.

2. Materials and Methods
2.1 Study Design
This study was conducted at Elsheik Mohamed Ali Fadol Maternity Hospital, Omdurman locality, to detect the prevalence of toxoplasmosis among aborted women attending the hospital.

2.2 Sample Collection
A total of 200 blood samples from aborted women, were collected under direct medical supervision using 5 ml syringe into plain vacutainers. Sera were separated after centrifugation for (15) minutes 4000 rpm. Then, they were stored in freezer (-20 0C), till used.

2.3 Data Collection
Consent form was signed and fingerprinted by each patient after agreement to participate in the study. Then a questionnaire was filled for each individual. Data were collected after convenient interview. It included questions eliciting socio - demographic data including age, education, occupation, residency, number of births and abortions, stage of pregnancy at abortion and other related risk factors.

2.4 Serological Tests of Toxoplasmosis

2.4.1 Latex Agglutination Test (LAT)

This is a slide agglutination test for the qualitative and semi quantitative detection of *T. gondii* antibodies. Latex agglutination test Toxo-Latex ® (Spinrer Eac T, S. A. Ctra. Santa coloma, Spain) was used to screen the sera basically, and the procedures were done as recommended by the manufacturers' protocol.

2.4.2 ELISA Test

This test was used to detect anti-*Toxoplasma* (1gM & 1gG) antibodies in sera samples. ELISA (Test-lin®) kit was used, and the procedures were done as recommended by the manufacturers' protocol

2.6 Statistical Analysis

The statistical package for social science SPSS version 10.0 was used to analyze the data (Neave, 1981).

3. Results

3.1 Toxoplasmosis Sero- prevalence

A total of 200 samples from aborted Sudanese women attending Elshikh Mohammed Ali Fadol Maternity hospital were collected and screened using different serological tests against Toxoplasmosis. The age groups of the participants were between 16 – 45 years, and the stages of abortion ranged between 1st, 2nd and 3rd trimesters.

3.1.1 Latex Agglutination Test (LAT)

Screening tests of the sera samples by (LAT), revealed that 105 (52.5%) of the 200 samples were +ve for Toxoplasmosis, and the results were significant (p =0.000), (Table3.1).

3.1.2 ELISA Test (IgM, IgG)

A total of 76 out of 105 (38%) LAT +ve samples revealed acute infection with Toxoplasmosis, since they were found +ve by lgM test. Chronic infection was detected in 102 of the 105 (51.3%) LAT +ve samples, since they were found positive by IgG test, and the results were significant (p =0.000), (Table3.1).

Table 3.1: The titration results of samples positive for Toxoplasmosis drawn from women who aborted using LAT and ELISA (IgM & IgG) tests

LAT titer	1:8	1:16	1:32	1:64	*p. value*
LAT	105 52.5%	56 28%	5 2.5%	0 0%	*P* = 0.000 significant
lgM	76 38%	41 20.5%	5 2.5%	0 0%	*P* = 0.000 significant
lgG	102 51.3%	55 27.5%	5 2.5%	0 0%	*P* = 0.000 significant

P < 0.05

No. of aborted women= 200.

3.2 Risk factors

3.2.1 Residence, clay eating, cat contact

A total of 74 of 127(38%) women who lived in rural areas, were found serologically +ve with Toxoplasmosis, while only 31 of 73(15.5%) women who lived in urban areas, were serologically +ve with Toxoplasmosis. The results were significant, (p=0.031).

Significant relationship was also found between sero +ve cases and contact with cats (p=0.492) (Table 3. 2).

The habit of eating clay during pregnancy or uncooked meat showed no significant relationship with Toxoplasmosis infection, (p=0.492) (p=0.058) respectively, (Table 3.2).

Table 3.2: Information generated from the questionnaire

Result / Risk factors	Not eating of clay	Eating of clay	Not eating uncooked meat	Eating uncooked meat	Absent cats at home	Presence of cats at home	Remote area	Urban area
LAT +	67 (50.8%)	38\ (55.9%)	19 (40.4%)	86 (56.2%)	39 (41.5%)	66 (62.3%)	74 (58.3%)	31 (42.5%)
LAT -	65 (49.2%)	30 (44.1%)	28 (59.6%)	67 (43.8%)	55 (58.5%)	40 (37.7%)	53 (41.7%)	42 (57.5%)
Total	132	68	47	153	94	106	127	73
***P*< 0.05 Variation level**	*P* = 0.492 Not Significant		*P* =0.058 Not Significant		*P* =0.003* Significant		*P* = 0.031* Significant	

3.3 Acute and Chronic Toxoplasmosis and Number of Abortions

A significant relation was found between the number of abortions and acute infection with Toxoplasmosis (IgM); (p=0.049), while there was no significant relation between the number of abortions detected in cases of chronic infections with Toxoplasmosis, (IgG), (p=0.449) (Table 3.3).Increasing the number of abortion is significant related to the cases that showed acute infection of Toxoplasmosis, while no significant relationship was found among which showed chronic infection.

Table 3.3: Relation between the abortion and acute and chronic infection with Toxoplasmosis in the collected samples

Number of abortions	Positive lgM acute	Positive lgG chronic
Once	40 /76 (52.6%)	51 /102 (50%)
Twice	13 /76 (17.1%)	22 /102 (21.5%)
Third	13 /76 (17.1%)	17 /102 (16.7%)
Fourth	3 /76 (4%)	4 /102 (3.9%)
Fifth	5 /76 (6.6%)	5 /102 (5%)

Sixth	0 /76 (0%)	1 /102 (1%)
Seventh	2 /76 (2.6%)	2 /102 (2%)
Variation level	*P* = 0.049 significant	*P* = 0.449 not significant

P< 0.05 is significant

3.4 Toxoplasmosis and Abortion in Different Trimesters

Among the (LAT) +ve cases, 74(54 %) participants were in the first trimester, whereas, 28(45.9%) participants were in the second trimester, and only 3 aborted cases were in the third trimester. A significant relationship was found in first and second trimesters (Table 3.4), (p=0.000).

A relationship between aborted cases in the three trimesters and chronic infection of toxoplasmosis (IgG) and acute infection of toxoplasmosis (IgM) showed high significance (p=0.000), in 1st trimester 72 women were 1gG positive and 17 women were IgM positive, in third trimester 3 women were IgG positive and 3 women were IgM positive as shown in (Table 3.4).

Table 3.4: The relation between abortion in the three trimesters and infection with chronic or acute toxoplasmosis infection in the collected samples

Trimesters / Test	+ve LAT	+ve lgG	+ve lgM	***P*< 0.05 Variation Levels**
1st Trimester	74 70.5%	72 70.6%	56 73.7%	*P*= 0.000*
2nd Trimester	28 26.7%	27 26.5%	17 22.4%	*P*= 0.000*
3rd Trimester	3 2.8%	3 2,9%	3 3.9%	-
Total	105	102	76	-

* Significant

4 Discussion

The current work studied the possibility of infection with Toxoplasmosis as a risk factor leading to abortion during pregnancy, among aborting women attending Elsheik Mohamed Ali Fadol hospital, in Omdurman. The seroprevalence of Toxoplasmosis in this study, (52.5%) was found higher than that reported by [10] in Khartoum state using LAT, this may be due to that the target groups in this study focused only on aborted women which are highly suspected to get the disease, while in the other work, all different groups of population were included. When compared to the results obtained by [13], the findings of this study are similar to it, since high seroprevalence was detected. Also the first trimester patients recorded the highest seroprevalence, when compared with that of the second and third trimester patients, and this agrees with the findings of [14].

As stated by [15], anti-*T. gondii* lgG antibodies appears very early after infection, hence the duration between the appearance of lgM and lgG is extremely short and the probability to find an lgM positive / lgG negative infected subject seems to be quite low [16], this is in agreement with the result of the present study, where the sero prevalence of lgG LAT +ve was found (51.3%) and that of lgM was (38%).

Contact with cats as a risk factor for infection was investigated in many studies, and some found that it has no association with infection with Toxoplasmosis [16]. The present investigation ensured a positive relationship between contact with cats and acquiring Toxoplasmosis infection, and this is similar to the findings of [17, 18, 19]. It is likely that the sero-prevalence is highest in rural areas, and this also agrees with the findings of [19] and might be due to the high abundance of cats. The lower seroprevalence in urban areas detected might be due to that the deposition of feces in peripheral areas is not frequented by humans. In addition, it is well known that cats mostly spend the day away from the domestic premises and visit mainly at night.

The role of eating clay as a risk factor for transmitting *T.gondii* in this study was investigated and the result showed no significant association between it and infection in aborted women, this agrees with the results of [19,20].In this study, consumption of uncooked meat showed no association with acquiring Toxoplasmosis. This is dissimilar with the results of [17, 19], who found a strong correlation between prevalence of Toxoplasmosis and consumption of raw meat.

5. Conclusion

Regular serological investigation during pregnancy is important for early detection of infection and hence reduction of negative impacts on mother and newborns. Also contact with cats and consumption of raw meat were identified as risk factors for being infected with toxoplasmosis. Hence, health education concerning the role of these factors in acquiring the infection is important. Location of residence was detected as the most determinant factors for prevalence of toxoplasmosis in this study.

Acknowledgments

The authors express their great appreciatiation for the for TMRI institute for permitting us to use their laboratories with all its facilities.

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