National Journal of Advanced Research
Online ISSN: 2455-216X; Impact Factor: RJIF 5.12
www.allnationaljournal.com
Volume 2; Issue 6; November 2016; Page No. 35-38

Incidence of toxoplasmosis and malaria among aborting women attending Elsheik Mohamed Ali Fadol maternity hospital in Omdurman state, Sudan

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Abstract
Pregnant women are at risk of development of complications due to infections with opportunistic parasites, since they have immuno-suppression during pregnancy. Infections with Toxoplasmosis and Malaria during pregnancy are known to cause serious problems. This study investigated infections with both diseases in aborting women attending Elsheik Mohamed Ali Fadol Maternity Hospital in Omdurman state. Risk factors associated with the infections were assessed by a questionnaire guide.
200 participants were included in this work, 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).The Latex +ve samples were105 (52.5%).
Thick blood films were screened to detect presence of malaria parasites, and 23(11.5%), blood films were malaria +ve. A questionnaire was then filled for each participant.
High seroprevalence of *T.gondii* antibodies were found in this study. Early diagnosis of *T.gondii* in pregnant women is needed for prevention of infection and its associated complications. Although, the environment was unsuitable for vector breeding at the time of this study, but infection with malaria parasites (*Plasmodium spp.*) was also detected in aborted women.

Keywords: abortion, *plasmodium falciparum*, risk factors, toxoplasmosis, Sudan

1. Introduction
Interactions between pregnancy and parasitic infection are well demonstrated by the problems of toxoplasmosis and malaria. Both diseases are major public health problems to the mother, fetus and newborns during pregnancy. Toxoplasmosis is considered as one of the neglected tropical diseases that have a cosmopolitan distribution [1], and it results in serious implications in immunocompromised individuals including pregnant women [2]. It is caused by an obligate intracellular protozoan parasite *Toxoplasma gondii*, which infects humans and other domestic and wild animals. The main routes of its transmission occurs by consumption of raw or undercooked meat contaminated with cysts, or by contact with infected cats or cat's faeces, contact with contaminated soil and ingestion of water or food contaminated with the oocysts.
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 chorioretinitis. In a proportion of cases, spontaneous abortion, prematurity, or stillbirth may result [3]. Accidental infection by *T. gondii* in immune-competent adults and children are usually asymptomatic or cause a mild disease. 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 [4, 5, 6]. Many workers investigated the seroprevalence of *T.gondii* in pregnant women, or the role of this parasite in abortions in different localities in Sudan [7, 8, 9, 10].
In Africa, 550 million people are at risk of malaria. It is estimated that there are 320million clinical cases annually and 970000 deaths, and in Sudan, malaria disease is one of the major causes of mortality [11] each year about 3,073,966 cases are reported, Also, high maternal and perinatal mortality have been observed in different regions, and malaria was one of the causes [12, 13]. In Khartoum, [14] found that the prevalence of malaria among pregnant women was 26.2%. In New Halfa, [15] found that the prevalence of falciparum malaria was 13.7% in pregnant women.Other previous studies in different malaria-affected regions reported high frequency of Malaria-related admissions among pregnant women compared to non-pregnant women [16, 17].
This study aims to detect the prevalence of malaria and Toxoplasmosis infections among aborted women, and to provide basic knowledge about risk factors of both diseases.

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 and Malaria 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 ® (SpinrerEacT, S. A. Ctra. Santa coloma, Spain) was used to screen the sera basically.

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.

2.5 Malaria Tests
Blood examination
Thick blood smears were prepared and stained with Field's stain to detect the presence of parasite. All the slides were double-checked, and only considered negative if no parasites were detected in 100 fields.

2.6 Statistical Analysis
The obtained results were recorded using PC computer, and the data were analyzed using the statistical package for social science SPSS version 10.0 (Neave, 1981). Chi-Squire test was used for assessing the relationship between current abortion and infection with malaria as risk factor in aborted women.

3. Results
3.1 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), (Table 1). The age groups of the participants were between 16 – 45 years, and the stages of abortion ranged between 1st, 2nd and 3rd trimesters.

Table 1: The titration results of samples +ve 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/Total number of aborted women 200.

3.2 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), (table 1).

3.3 Malaria Results
Thick blood films
A total of 23(11.5%) out of 200 blood samples from aborted women, were found malaria +ve in thick blood films.

3.4 Risk factors
3.3.1 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, and the results were significant, (p=0.031).Significant relationship was also found between sero +ve cases and contact with cats (p=0.492) (table 2), while 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 2).

Table 2: Information generated from 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	

3.3.2 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).

Table 3: Relation between abortion and acute and chronic infection with Toxoplasmosis:

Number of abortion	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

3.3.3 Malaria and Toxoplasmosis in the Three Trimesters

The relationship between infection with Malaria and Toxoplasmosis (chronic and acute) in the first and second trimesters were found highly significant (p=0.000) (table 4).

Table 4: The relation between abortion in the three trimesters and infection with chronic or acute toxoplasmosis and malaria in the collected samples:

	Toxoplasmosis			**Malaria**	
Trimester / Test	+ve LAT	+ve IgG	+ve IgM	+ve Blood film	P< 0.05 Variation Levels
1st trimester	74 70.5%	72 70.6%	56 73.7%	18 78.3%	*P*= 0.000*
2nd trimester	28 26.7%	27 26.5%	17 22.4%	5 21.7%	*P*= 0.000*
3rd trimester	3 2.8%	3 2,9%	3 3.9%	0 0%	-
Total	105	102	76	23	-

3.5 Toxoplasmosis and Malaria and Abortion in Different Trimesters

Among the (LAT) +ve cases, 74(70.5%) participants were in the first trimester, whereas, 28(26.7%) participants were in the second trimester. 3(2.8%) were in the third trimester, and no +ve Malaria case were found among them. A significant relationship was found in first and second trimesters (table 3.5), (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 positive 1gG and 17 women were positive for IgM in the second trimester, whereas in the third trimester, 3 women were with positive IgG and 3 women were with positive IgM as shown in (table 3.5).

Increasing the number of abortion is significantly related to the cases that showed acute infection of toxoplasmosis (p=0.049), no significant relationship was found among those that showed chronic infection (p=0.449) as show in (table 3.4). The relationship between infection with malaria and toxoplasmosis (chronic and acute) in the first and second trimester aborting women, were found highly significant (p=0.000) (table 3.5).

4 Discussion

The study results showed a high sero prevalence of *Toxoplasma gondii* among aborting women in Elsheikh Mohammed Ali Fadol hospital, and low prevalence rate of Malaria. The seroprevalence of Toxoplasmosis in this study, (52.5%) was found higher than that reported by [6] 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 [8], 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 [18].

In this study the sero-prevalence of lgG LAT +ve was found (51.3%) and that of lgM was (38%), and this may be attributed to the extremely short duration between the appearance of lgM and lgG, and hence the probability to find an lgM positive / lgG negative infected subject seems to be quite low [19]. Also, it is well known that anti-*T. gondii* lgG antibodies appears very early after infection [20]. Contact with cats, eating clay, and consuming raw meat were investigated in this study as risk factors for Toxoplasmosis infection. The results revealed that there is a positive relationship between cat contact and the infection, and that is in agreement with the findings of [6, 21, 22]. No significant association between clay eating and infection in aborted women, this agrees with the results of [22, 23]. A negative association was also found between consumption of uncooked meat and acquiring Toxoplasmosis. This is dissimilar with the results of [10, 22], where a strong correlation between prevalence of Toxoplasmosis and consumption of raw meat was detected. Residence and its relation in acquiring Toxoplasmosis was also investigated in this work. The sero-prevalence was highest in rural areas, and this also agrees with the findings of [22] 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 prevalence rate of malaria in this study was found 11.5% in aborting women. This result might be attributed to that, in Omdurman there are no agricultural activities to create a habitat of mosquitoes, and thus the population is low. The association between acute and chronic infection of toxoplasmosis and presence of malaria in aborted women in 1st trimester and 2nd trimester is quite clear in this study, and this confirms the hypothesis that toxoplasmosis and malaria could be risk factors of abortion which agrees with [24, 2].

5. References

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