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Sero-prevalence of *Toxoplasma gondii* infection among pregnant women attending antenatal clinics in Khartoum and Omdurman Maternity Hospitals, Sudan

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PEER REVIEW

Peer reviewer

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Comments

A good work with acceptable sample size and well known technique has been applied. The study determined the sero-prevalence of T. gondii infection among pregnant Sudanese women.
Reviewing and writing is acceptable, bit many typographic errors.
Details on Page 498

ABSTRACT

Objective: To determine the sero-prevalence of *Toxoplasma gondii (T. gondii)* infection among pregnant Sudanese women.
Methods: One hundred and sixty three pregnant women attending antenatal care in Omdurman Maternity Hospitals, Khartoum, Sudan during June to August in 2013 were enrolled and screened for immunoglobulin G (IgG) and IgM antitoxoplasma antibodies using enzyme linked immunosorbent assay technique.
Results: Among 163 pregnant women, 33 (20.2%) were positive for (IgG) antitoxoplasma antibodies, while 130 (79.8%) were seronegative. None of the examined women had IgM antitoxoplasma antibodies. The highest rate of infection (26.7 %) was detected among women aged 21-29 years. No statistically significant relation was observed between *T. gondii* sero-prevalence and the other variable of risk factors studied.
Conclusions: Over 79% Sudanese women screened for antitoxoplasma IgG antibodies were seronegative and they were at risk of seroconversion during pregnancy. Moreover, the study showed that screening of *T. gondii* infections during antenatal care should be considered in Khartoum state as the main strategy to minimize congenital toxoplasmosis.

KEYWORDS

Toxoplasma gondii, Pregnant women, Sudan

1. Introduction

Toxoplasmosis is a universal zoonotic disease caused by the protozoan parasite, *Toxoplasma gondii (T. gondii)*. About 20% to 90% of the world's adult population in different regions are reported to have had contact with the parasite[1]. Toxoplasma infection are acquired through direct or indirect contact with cat faeces. Thus consumption of unwashed vegetables, undercooked meat and unpasteurized milk from infected animal are sources of the infection[2,3]. Toxoplasmosis is important for its serious implications in immuno-suppressed individuals including pregnant women as well as its severe consequences on fetuses in congenital transmission[4]. The disease in pregnancy has been associated with miscarriage, hydrocephalus, cerebral calcification and chorioretinitis in the newborn[4]. Primary infection with *T. gondii* during the third trimester of pregnancy carries a higher risk of congenital transmission than that acquired during the first trimester[5,6]. In Sudan, the first report of

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human toxoplasmosis was dated back to 1966, with different prevalence rates according to the regions and the people's habits[7]. Around 65% of Sudanese domestic animal were infected with toxoplasmosis[8]. 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[9,10]. Maternal toxoplasmosis is usually asymptomatic and if the diagnosis was delayed, unavoidable and irreversible fetal damage might take place. A serological survey during pregnancy represents a valuable tool for the diagnosis of infection in the neonate and may bring a rapid and effective treatment of an affected child. Thus, all pregnant women should be examined at spot and seronegative women followed at intervals for evidence of seroconversion.

Such few data is available of toxoplasmosis in pregnant Sudanese women. Therefore, this study was conducted in order to determine the sero-prevalence of *T. gondii* infection and its associated factors to provide basic information that could be used to develop an appropriate control strategy for prevention and treatment of toxoplasmosis.

2. Materials and methods

2.1. Study area and population

A cross-sectional study was carried out between June to August in 2013. All pregnant women attending antenatal clinics of Khartoum Teaching Hospital and Omdurman Maternity Hospital, during this period were asked to participate in the study. After a verbal consent, questionnaire containing demographic, social (age, education and ethnic group), questions regarding habits and contact with cats was carried out (cat contact, eating raw liver and viscera, undercooked meat and raw milk).

2.2. Samples collection and antibody testing

Five millimeter of venous blood was collected from each participant using a sterile disposable syringe and dispensed into a sterile tube and allowed to clot. Clots were removed and discarded and the sample tubes span at 500 r/min to precipitate red blood cells (RBCs). Clear sera were carefully collected, aliquot into Eppendorf tubes and stored frozen at −20 °C until tested. Each sample was tested for the presence of anti-toxoplasma antibodies, IgG and IgM using commercial enzyme-linked immuno sorbent assay (ELISA) Kit (Omega diagnostics Kit) and following manufacturer's instructions. ELISA results were recorded using a micro-plate reader, as a measure of optical densities of the reaction intensity of *T. gondii* antigen and serum anti-*T. gondii* antibodies. Cut-off points and antibody index calculations were done according to manufacturers' recommendation to categories seropositive (antibody index 1.2 to 1.5) and sero-negative (antibody index 0.9 to 1.1). All serum samples with intensity of antibody index 1.6 to 2.0 were classified as high sero-positive rate.

2.3. Data analysis

Data were analysed using statistical package for social science version 12 software (SPSS for Windows). Data were recorded as number and percentages. The relation of sero-prevalence of *T. gondii* infection and its associated factors was compared using the ×2 test. Differences were considered significant when the *P*-value was less than 0.05.

3. Results

A total of 163 pregnant women were recruited during the study period, the majority of women 60/163 (36.8%) aged between 21-29. About 13.5% (22/163) of the pregnant women were in the first trimester with 63.2% (103/163) and 23.3% (38/163) in the second and third trimesters, respectively. As it shown in Table 1, twenty point two percent (33/163) were positive for anti-*T. gondii*-specific IgG antibodies while 130/163 (79.8%) were seronegative for anti-toxoplasma antibodies (titre<0.9). The highest prevalence of *T. gondii* IgG antibodies (26.7%) was seen in the age stratum 21-29 years old, while the age group≤20 showed the lowest IgG seroprevalence (12.1%) shown in Table 1. High titre rate of IgG (1.6-2) was detected in the sera of six women (18.2%). None of the studied population was found to be positive IgM result. There was no statistical difference in age groups, parity and education levels and drinking raw milk, cat contact and under-cooked meat between the seropositive and seronegative groups.

Table 1

Sero-prevalence of anti-toxoplasma IgG and IgM in relation to participant's age.

Age group in years	IgG titre				IgM titre		
	0.9 (−ve)	1.2−1.5 (+ve)	1.2−1.5 (+ve)	1.6 − 2.0 (high +ve)	(−ve)	(+ve)	Sero-prevalence rate %
≤20	29	4	0	12.1	33	0	0
21−29	44	12	4	26.7	60	0	0
30−39	33	7	2	21.4	42	0	0
40−49	24	4	0	14.3	28	0	0
Total	130	27	6	20.2	163	0	0

4. Discussion

The current study is one of few studies in Sudan to explore the prevalence of *T. gondii* infection among one of the most important clinical categories of toxoplasmosis in immunocompetent hosts who are pregnant women. IgG anti-toxoplasma antibodies sero-positive rate in this study (20.2%) is near to that found by Nijem[11], 27.9% in Palestine pregnant women using the same method, but lower than that observed by Elnahas *et al.*[12], who found sero-prevalence rate of 30.1% and 34.1% respectively. Also the sero-prevalence in this study was low compared to studies in Nigeria[13], Tanzania[14], Morocco[15], Saudi Arabia[16] and Ethiopia[17]. This could partly be explained by the behaviroal variation and differences in climatic conditions, where higher sero-prevalence is associated with hotter and wetter areas, which is favourable for sporulation of oocysts compared to less humid areas[17]. The high seronegative rate (79.8%) reflects the large number of pregnant women at high potential risk of seroconversion during pregnancy and consequently could transmit the infection to the fetus. The negative anti-toxoplasma IgM reported in this study may exclude cases with recent infection. This agreed with results obtained from Griffin and Williams[18], where no recent infections were found in a sample of Kenyans with 42% seropositivity using the dye test. However, comparisons with reports from different countries have to be interpreted cautiously, since different methods were used in the screening. In this investigation the highest prevalence rate of IgG antibodies (26.7%) was detected in the age group of 21-29. This in our opinion is highly risky, as it is the most fertile period of childbearing age and this also highlights the need to continue to educate women of child-bearing age on prevention of toxoplasmosis. However, different studies reported an increase in seropositivity of anti-*T. gondii* antibodies with increasing age[18,19]. Nevertheless, this association does not mean that older age is a risk factor predisposing to infection but might be explained by the older the person the longer time being exposed to the causing agent and may retain a constant level of anti-toxoplasma IgG in serum for years. In the present study we did not find statistical association between seroprevalence of anti-toxoplasma IgG antibodies and other risk factors including education levels, drinking raw milk, under-cooked meat and cat contact which is in agreement with result found in other studies in Sudan, Palestine and Saudi[11,12,19] respectively. However, the absence of a statistically significant relationship between the prevalence of *Toxoplasma* infection among investigated population and many of the factors explored in the study, does not confirm that these factors have no influence on the transmission of toxoplasmosis.

To conclude, our results showed that women in Khartoum state are susceptible to the toxoplasmosis parasite. The implementation of regular serological testing during pregnancy is important to reduce the effects of the disease on mothers as well as on newborn babies.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgements

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Comments

Background

It may be essentially to know the distribution and sero-prevalnce of *T. gondii* infection among pregnant women. The results showed that women in Khartoum state are susceptible to the toxoplasmosis parasite. Thus, the implementation of regular serological testing during pregnancy is important to reduce the effects of the disease on mothers as well as on newborn babies.

Research frontiers

Screening of *T. gondii* infections during antenatal care is essential to minimize congenital toxoplasmosis. Factors and some basic information for control strategy, prevention and treatment of toxoplasmosis have been outlined.

Related reports

IgG anti-toxoplasma antibodies sero-positive rate in this study (20.2%) is almost similar to the rate reported in Sudan by Al-Hindy (23.1%) and near to that found by Nijem (Nijem KA) (27.9%) in Palestine pregnant women using the same method, but lower than that observed by Adnan (Adnan I.) and Elnahas *et al.*, who found sero-prevalence rate of 30.1% and 34.1%, respectively. Also the sero-prevalence in this study was low compared to studies

in Nigeria, Tanzania, Morocco, Saudi Arabia and Ethiopia. This could partly be explained by the behaviroal variation and differences in climatic conditions, where higher sero-prevalence is associated with hotter and wetter areas, which is favourable for sporulation of oocysts compared to less humid areas (Endalew Z.).

Innovations & breakthroughs

The current study is one of not many studies in Sudan to explore the prevalence of *T. gondii* infection among pregnant women. This study has shown that over 79% of Sudanese women screened for antitoxoplasma IgG antibodies were seronegative and they were at risk of sero-conversion during pregnancy. Moreover, the study showed that screening of *T. gondii* infections during antenatal care should be considered in Khartoum state as the main strategy to minimize congenital toxoplasmosis.

Applications

It may be essentially to know the distribution and sero-prevalnce of *T. gondii* infection among pregnant women. The results showed that women in Khartoum state are susceptible to the toxoplasmosis parasite. Thus, the implementation of regular serological testing during pregnancy is important to reduce the effects of the disease on mothers as well as on newborn babies.

Peer review

A good work with acceptable sample size and well known technique has been applied. The study determined the sero-prevalence of *T. gondii* infection among pregnant Sudanese women. Reviewing and writing is acceptable, bit many typographic errors.

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