International Journal of Academic Research and Development
ISSN: 2455-4197, Impact Factor: RJIF 5.22
www.academicsjournal.com
Volume 1; Issue 11; November 2016; Page No. 20-23

Seroprevalence of *Toxoplasm gondii* among pregnant women attending health centres at Soba area, Khartoum/Sudan

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Abstract
Toxoplasmosis is a zoonotic disease which has a worldwide distribution. The infection may be acquired or congenitally transmitted to the foetus, where it causes severe birth outcomes.
The objective of this study was to determine the incidence of *Toxoplasma gondii* among pregnant women attending different health centres for routine pregnancy laboratory investigations in Soba area, Khartoum state, and to assess the risk factors associated with the infection.
65 participants were enrolled in this investigation. Sera samples were tested using Elisa technique for detection of anti *T. gondii* antibodies (IgG and IgM).Evaluation of risk factors and its relation to infection and collection of sociodemographic data were accomplished by designing a questionnaire.
The seroprevalence of anti *T.gondii* antibodies (IgG, IgM) were 33.8% (22/65).The results showed that 19(29%) of the participants were IgG +ve, while3 (4.6%) were found IgM +ve for Toxoplasma specific antibodies. The age groups of the participants ranged between (16 - 40) years.

Keywords: toxoplasmosis, seroprevalence studies, pregnancy, khartoum, *toxoplasma gondii*

1. Introduction
T. gondii is an obligate intracellular opportunistic protozoan parasite, and it is one of the most common parasites of humans in developing countries. The global population exposure to this parasite is estimated to be 30–50%. Human toxoplasmosis is acquired by ingestion of tissue cysts in raw or undercooked meat, or oocysts excreted in cats faeces, thus contaminating food or water [1]. This parasite can be detected by various techniques including serological tests, polymerase chain reaction (PCR), and histological examination [2].
Acute infection in pregnant women have non- specific symptoms, and is unrecognized in as many as 90% of cases, and it is falsely taken as a viral illness, and if untreated, it may result in premature birth, permanent neurological damage, and visual impairment, whereas chronic infection before pregnancy does not cause transmission to the foetus [3, 4].
Epidemiological studies suggest that prevalence of *T. gondii* infection in pregnant women varies substantially among different countries [5]. Many studies were performed to detect the prevalence rate of antibodies against *T. gondii* in pregnant women in different hospitals of Khartoum State [6, 7]. Recorded 34.1% IgG seroprevalence, 14.3% IgM antitoxoplasma antibodies using ELISA in pregnant women, and consumption of raw meat was recorded as risk factor for infection, while [7] found that 20.2% of the pregnant women were positive for (IgG) antitoxoplasma antibodies, and none of the examined women had IgM [8]. Recorded 38.9% IgG seroprevalence by ELISA and 12.9% by IgM in pregnant women in Omdurman [9]. Studied the relation of some risk factors to the disease, and found that consuming raw meat, and contact with pets other than cats and dogs were highly significant to infection [10]. In a study in Wad Medani hospital found a strong correlation prevalence of toxoplasmosis and risk factors specially eating undercooked meat (71%), consumption of raw meat (68.1%), and contact with cats (52.1%). Several workers investigated the prevalence rate of Toxoplasmosis in the Red Sea State [11], reported 68% seropositive pregnant women in Port-Sudan city. After that [12], reported 44.4% prevalence rate in the same area.
This study was conducted to determine the incidence of Toxoplasmosis among pregnant women in Soba district (Southern borders of Khartoum) as an example of an environment where elements of transmission are available. This area is one of the largest localities, where sheep, goat and cattle are kept in private farms for breeding and milk and meat production. Hence, the intermediate hosts for *T. gondii* are present in large populations.

2. Materials and Methods
2.1 Study Design
This study was conducted at Soba area (Southern border of Khartoum), to detect the prevalence of toxoplasmosis among pregnant women attending laboratories at different health centres for routine pregnancy laboratory investigations.

2.2 Sample Collection
A total of 65 venous blood samples were collected randomly from each participant under direct medical

supervision, using 5 ml syringes. Sera were separated after centrifugation for (15) minutes 3000 rpm. Then, they were stored in freezer (- 20 0C), till used.

2.3 Data Collection
A consent form was signed and fingerprinted by each patient after agreement to participate in the study. Then a questionnaire was filled for each individual, and it included personal information, demographic data, socio-economical data, and nutritional behavior data questions.

2.4 Serological Test of *T. gondii*
2.4.1 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 Data Analysis
Data from questionnaire and results of examination were recorded using PC computer. The statistical package for social science SPSS as used for analysis of the obtained data.

3. Results
3.1 Seroprevalence of IgG and IgM *T. gondii* antibodies
In this study the overall prevalence of *Toxoplasma gondii* infection among pregnant women was 33.8% (22/65) in the tested participants, where 29% (19/65) were IgG +ve for Toxoplasma specific antibodies, while 4.6% (3/65) were found IgM +ve (Table, 1).The age groups of the participants ranged between (16 - 40) years.

Table 1: Incidence of *T.gondii* IgG and IgM antibodies in the tested pregnant women in Soba

Type of antibody	Pregnant women tested (N)	+ve cases %	-ve cases %
IgG	65	19(29%)	46(70.85)
IgM	65	3(4.65)	62(95.4)

3.2 Distribution of Anti *T. gondii* Antibodies among different age groups:
The distribution of positive sera samples among the different age groups for anti *T.gondii* IgG showed that pregnant women in the age ≥35 years showed the highest prevalence (62.5%) followed by <20 (50%),followed by (30-34years) (30.8%), followed by (25-29 years) (19%), followed by (20-24 years) (17.6%) and the result was not significant p=0.1.

As shown in table 2, the distribution of positive sera samples among the different age groups for anti *T.gondii* IgM showed the age group<20 had the highest prevalence (33.3%), followed by ≥35 (12.5%), while the other age groups showed negative results. The result was significant p <0.005.

Table 2: Seropositive pregnant women for Toxoplasmosis among different age groups

Age Group (years)	Pregnant women Tested	IgM +ve pregnant women N (%)	P-value	IgG +ve pregnant women N (%)	P-value
<20	6	2(33.3)	0.005*	3(50.0)	0.103
20-24	17	0		3(17.6)	
25-29	21	0		4(19.0)	
30-34	13	0		4(30.8)	
≥35	8	1(12.5)		5(62.5)	
Total	65	3(4.6%)		19(29%)	

* P-value<0.05 result is significantly different.

3.3 Risk Factors
The habits of eating raw or undercooked meat, and drinking unboiled milk showed no significant results in pregnant women who had acute or chronic infections and the results were not significant, p=0.64, p=0.33 respectively.

A significant relation was found between acute Toxoplasmosis and the habits of eating soil, p=0.019.This was in pregnant women who had +ve IgM, while the relation was not significant in pregnant women with chronic infection, who had +ve IgG, p=0.876 (Table 3).

Keeping of cats and domestic pets at house showed no significant result in pregnant women with acute or chronic Toxoplasmosis (Table 3), p=0.048, 0.77 respectively.

Table 3: Risk factors associated with *T. gondii* infection in pregnant women:

Risk factor	No. Examined		IgM +ve N (%)	P-value	IgG +ve N(%)	P-value
Drink unboiled milk/eating Undercooked meat	Yes	35	2(5.7)	0.648	12(34.3)	0.333
	No	30	1(3.3)		7(23.3)	
Eat soil	Yes	11	2(18.2)	0.019*	3(27.3)	0.876
	No	54	1(1.9)		16(29.6)	
contact with Cats/pet	Yes	29	3(10.3)	0.048	9(31.0)	0.774
	No	36	0		10(27.8%)	

*p value $\leq$ 0.05 result is significantly different.

3.4 Socio-economic factors

The prevalence of *T. gondii* IgM and IgG in non-educated group was (16.7% & 66.7% respectively). When the profession of the women was assessed, the prevalence rate of IgM in house wives was 7.0%, while none of the other investigated categories had IgM. The prevalence of IgG was highest in workers, and the results were statistically not significant, p> 0.05 (Table, 4).

Table 4: Seroprevalence of *T.gondii* infection in relation to demographic characteristics among participant pregnant women

Characteristic		No. Examined	IgM+ve N (%)	P-value	IgG+ve N (%)	P-value
Education Level	Non-educated	6	1(16.7)	0.355	4(66.7)	0.124
	Basic	14	1(7.1)		5(35.7)	
	High	23	1(4.3)		6(26.1)	
	University	22	0		4(18.2)	
Occupation	Housewife	43	3(7.0)	0.807	12(27.9)	0.473
	Student	4	0		1(25.0)	
	Employee	10	0		2(20.0)	
	Worker	7	0		4(57.1)	
	Farmer	1	0		0	

*p value $\leq$ 0.05 result is significantly different

4. Discussion

Serodiagnosis in this study revealed that 29% were IgG +ve by Elisa (indicating chronic infection), while (4.6%) IgM +ve for Toxoplasma specific antibodies (indicating acute infection), which is higher than that which was reported by [7], where 20.2% were found IgG +ve, and no IgM were detected. Also the current obtained results are lower than those found by [8], where 38.9% were detected IgG +ve and 12.9% IgM +ve in pregnant women in Omdurman.

When compared with prevalence in other African countries, the prevalence rates results are lower than those obtained by [13] in Cameroon, and [14] in central Ethiopia,

Moreover, many risk factors, such as cat contact or domestic pets, handling or eating raw or undercooked meat are known to have an influence on *T. gondii* transmission. In the present study, the only risk factor which was recorded is the habit of eating soil. No statistical association was found between seroprevalence of anti-toxoplasma antibodies and other risk factors including drinking raw milk, under-cooked meat and cat contact which is in agreement with the results found in other studies in Sudan, Palestine and Saudi Arabia [6, 7, 15, 16] respectively.

IgG are passed from the mother to the foetus through the placenta, while IgM cannot pass the placenta. If these are found, infection of the baby is ensured [17]. In the current investigation, the prevalence rate of IgG in all the tested participants was higher than that of IgM. Pregnant women in the age ≥35 years showed the highest prevalence rate of IgG antibodies (62.5%), which could be due to accumulated opportunities for exposure. This is dissimilar to the results obtained by [10, 17]. No significant association was found between prevalence rates of IgG and IgM among participants, and their education level and occupations. When the prevalence rates of IgG of the studied individuals were compared according to their professions, it was highest in workers, followed by housewives. This could be attributed to that both groups are more exposed to parasite source of infection (contaminated soil for workers, and household tasks for housewives) [18], than those who did not.

This study showed that toxoplasmosis infection exists among pregnant women in Soba area, as indicated by +ve seroprevalence of antitoxoplasma antibodies (IgG, IgM). It is recommended that routine serological screening for anti-toxoplasma antibodies should be performed for pregnant women attending health centres, for early detection of infection. Also, health education programmes should be implemented to the general population in this area, to reduce infection with *T.gondii*.

5. Acknowledgment

The authors express their sincere thanks to TMRI institute, Khartoum, for permitting the use of the laboratory facilities.

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