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Research Article

Knowledge, Risk Factors and Prevalence of Toxoplasmosis Among Pregnant Women at Primary Health Care Level in Ibadan, Southwestern Nigeria

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ABSTRACT

Recent information on prevalence of toxoplasmosis among pregnant women is lacking despite awareness of its teratogenicity. This study determines the prevalence of anti-Toxoplasma IgG and risk factors of Toxoplasma infection among pregnant women at primary health care level. In a cross-sectional study 377 pregnant women selected by two stage sampling from primary health care centres in Ibadan were interviewed using structured interviewer administered and pretested questionnaire. Information was collected on respondents socio-demographic characteristics, knowledge about Toxoplasmosis and exposure to associated risk factors. Two milliliters of blood was collected from each woman and screened for anti-Toxoplasma IgG using Enzyme Linked Immunoassay. Data were analysed using descriptive statistics, chi square and logistic regression at significant p-value = 0.05. Mean age of the respondents was 26.2±4.6years. Two hundred and fifteen 215(57.8%) were Christians, while 173 (49.4%) gestational age between 14 and 28weeks. There was no knowledge of toxoplasmosis and its transmission among respondents. Respondents reported habitual eating unwashed fruits and vegetables (150, 44.7%) and undercooked meat (172, 46.9%) while 48(13.2%) had pet in their houses and 16(4.4%) had ever received blood transfusion. There was significant association between Toxoplasma IgG seroprevalence and religion (p=0.015), eating unwashed vegetables and unwashed fruits (p=0.011), pet possession (0.037) and blood transfusion (p=0.014). Having ever received blood transfusion was 9 times more likely associated with Toxoplasma infection (OR = 8.76; CI: 1.14 – 67.129). Health education and screening for Toxoplasmosis among pregnant women is recommended to interrupt transmission of toxoplasmosis in the community.

Keywords: *Toxoplasma gondii, pregnant women, pet possession, unwashed fruits, undercooked meat*

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INTRODUCTION

Toxoplasmosis is an important parasitic infection with a cosmopolitan distribution and significant global impact. It is caused by intracellular protozoa *Toxoplasma gondii* (*T. gondii*), which is one of the most common parasites of humans worldwide, approximately one third of the world's population being at risk (Tenter *et al.*, 2000). *Toxoplasma gondii* is a zoonotic, obligate intracellular protozoan parasite that has the ability to infect all warm blooded animals. Although it does not cause clinical illness in the majority of animal species that it infects, it triggers acute life-threatening disease in others. In the human it manifests itself as a disease of pregnancy by multiplying in the placenta and fetus (Cunningham *et al.*,

1992). This infection is widespread probably because of its simple mode of transmission occurring simply by ingestion of food or water contaminated with toxoplasma oocysts or following handling of soil contaminated with cat litter (Walker *et al.*, 2008). It is estimated that between 30% and 65% of all persons worldwide are infected with *Toxoplasma* (Tenter *et al.*, 2000). In developed countries, it has been reported that congenital toxoplasmosis affects 0.01% - 0.1% of infants (Jones *et al.*, 2001). Some studies have reported incidence of primary maternal infection during pregnancy to range from about 1 to 310 per 10,000 pregnancies in different populations in Europe, Asia, Australia and the Americas (Opsteegh *et al.*, 2011). In Brazil, a report shows that 53.03% of pregnant women were positive for *Toxoplasma* IgG and 3.26% were

positive for Toxoplasma IgM (Vaz *et al.*, 2010). High prevalence rates of toxoplasmosis has been reported in Germany (68%), Netherlands (80%) and Brazil (67%) (Henriquez *et al.*, 2009). In Britain about 22% are carriers, while in South Korea the rate is 4.3% (Tenter *et al.*, 2000).

In sub-Saharan Africa, studies have shown a consistently high *T. gondii*-seroprevalence, ranging from 35% to 84% (Tenter *et al.*, 2000). Although in Nigeria, toxoplasmosis infection has been found both in man and some important animals, the focus of reports had been on veterinary toxoplasmosis. High seroprevalence of toxoplasmosis have been reported among some animals of economic importance such as pet dogs in Maiduguri and Zaria (Kamani *et al.*, 2010; Aganga and Ortese, 1984) and chicken in Zaria (Aganga, 1985). In Northern Nigeria, Kamani *et al.* (2010) reported 23.9% seroprevalence of toxoplasmosis among adult men and women in Zaria, with 20% prevalence among the women. A higher prevalence of toxoplasmosis (71.4%) has been reported among pregnant women aged 39-42 years, in Benue State also in Northern Nigeria (Olusi *et al.*, 1996). In south western Nigeria, Akinbami *et al.* (2010) reported 40.8% seropositivity for toxoplasmosis among pregnant women attending Lagos State University Teaching Hospital. In another study among pregnant women attending Antenatal Clinics at University College Hospital and St. Mary's Catholic Hospital, both in Ibadan, very high prevalence of Toxoplasma antibodies were found in the sera of both pregnant (75.4%) and postpartum (80.5%) women (Onadoko *et al.*, 1996). These studies reveal the high transmission and spread of veterinary toxoplasmosis in the southern and northern parts of Nigeria. The simultaneous presence of the parasite in both humans and animals also suggest possible zoonotic transmission of toxoplasmosis to humans in the region.

The teratogenic effects of toxoplasmosis was implied by studies which observed that polydactylism, a common congenital abnormality, was associated with high antibody levels which resulted from reinfection or recrudescence of toxoplasmosis. The report also showed an association between high prevalence of toxoplasmosis and overcrowding; poor environmental sanitation and considerable contamination with cat faeces (Onadoko *et al.* (1996). Toxoplasmosis in pregnancy has also been associated with miscarriage, hydrocephalus, cerebral calcification and chorioretinitis in the newborn (Elmore *et al.*, 2010).

Although In Nigeria, routine screening during antenatal care for pregnant women is done for certain transmissible infections during pregnancy, there is no public enlightenment programme towards prevention and control of toxoplasmosis as is the case in some other developed countries. Information that will be used to justify introduction of antenatal toxoplasma screening programme and aid the development of guidelines and recommendations to public health regulatory bodies with the aim of reducing the prevalence of toxoplasmosis among the high risk individuals in Nigeria is highly needed. This study is designed to determine the prevalence, risk factors and knowledge of toxoplasmosis among pregnant women at primary health care level in Ibadan, Nigeria.

MATERIALS AND METHODS

The study was carried out in Ibadan located in South-Western Nigeria and in the southeastern part of Oyo state. The ancient city of Ibadan lies within coordinates: 7°23'47''N 3°55'0''E. The city is situated at about 119 kilometres northeast of Lagos state and lies between the forest and the derived savanna vegetation zones of the country. Ibadan ranges in elevation from 150m in the valley area, to 275m above the sea level on the major north-south ridge which crosses the central part of the city. Ibadan covers a total area of 3,080 square kilometres. Ibadan has a tropical climate with relatively constant temperature throughout the year. In the recent years, the mean maximum temperature is 26.46C while the minimum is 21.42C and the relative humidity is 74.55%. Its wet season runs from March through October while the dry season is from November to February. Ibadan is the third largest metropolitan area by population, after Lagos and Kano in Nigeria. It has a population of over 3million and a population density of 2,140/sq mi (828/km²). There are eleven Local Governments in the city of Ibadan. Its Metropolitan area consists of five local governments; Ibadan North, Ibadan North East, Ibadan North West, Ibadan South East and Ibadan South West local government area, and six non-urban local government area, namely Akinyele, Egbeda, Ido, Lagelu, Ona Ara, and Oluyole local government areas.

Study design: A descriptive cross-sectional study was employed.

Study population: Only the pregnant women attending primary health care centres in Ibadan were studied. Only those who provided the informed consent were included in the study.

Sample size: The sample size formula for estimating a single proportion, $N = Z^2 pq / d^2$ was used for determination of minimum sample size for this study; where n=sample size, Z=95% confidence interval (1.96), p=prevalence of Toxoplasmosis (40.8%) among pregnant women (Akinbami *et al.* 2010), q=1- 40.8%, and d=level of precision (5%). Sample size estimated was therefore three hundred and seventy seven pregnant women.

Sampling Technique: Two Stage Sampling Technique was adopted to select the participants as follows:

Stage 1: Two primary health care centres were selected from each of the 11 local governments using simple random sampling method (use of balloting method). Twenty two Primary Health Centre were selected in total; Stage 2: All the pregnant women that attended each of the health centres on the day of visit and who provided informed consent were enrolled into the study.

Data collection, management and analysis : A well-structured and pretested interviewer's administered questionnaire was used for the data collection. The questionnaire extracted information on socio-demographic characteristics, habits of eating undercooked meat, eating unwashed fruits, eating unwashed vegetables, sanitation and hygienic practices, contact with pets like dog and cat, history of blood transfusion, knowledge about Toxoplasmosis transmission and complications of its infection on the fetus.

Data was double entered and analyzed using Microsoft Excel and software SPSS application package to determine

frequency, proportions, of descriptive variables. Chi square test was used to assess association. Confounders were adjusted for using the using logistic regression model. Level of significance was set at a p value of 0.05.

Sample Collection and Serological tests: Two millilitres of intravenous blood sample was collected through venipuncture after the administration of questionnaire. Standard Operating Procedure for venipuncture was strictly followed and each sample was labeled with a code given to each participant. Serum was tested for anti-*T. gondii* antibodies using Enzyme Linked Immunosorbent Assay (ELISA) test kits for anti-*T. gondii*-specific IgG antibody only. Samples were analysed at the laboratory of Anointed Dynasty Diagnostics, Ibadan, using ELISA microplate washer and ELISA microplate reader.

Ethical considerations

Ethical approval was obtained from Oyo State Ministry of Health. Written informed consent was sought from each pregnant woman prior their involvement in the study. Information collected from each study participant was kept confidential and venous blood specimens collected were preserved anonymously.

RESULTS

A total of 377 pregnant women at primary health centre in Ibadan in 2017 participated in this study. The mean age of the pregnant women was 26.19 years ± 4.6years. Most (144, 38.2%) of the participants were aged 25-29 (years). Majority 342 (92.4%) were married, 248 (67.9%) had Secondary education, 184 (50.3) engaged in trading, 340 (91.9%) were Yorubas, 317 (88.8%) were from monogamous family, 215 (57.8%) practiced Christian faith while 188 (49.9%) had more than 3 children. Also, 173 (49.4%) were between 14 and 28 weeks (second trimester) of their pregnancy. One hundred and fifty (40.7%) pregnant women had ever eaten unwashed fruits and vegetables, 172 (46.9%) had ever eaten undercooked meat like “suya”, “asun”, “ponmo”, “tinko”. Forty three (11.8%) had pet like cat and dog in their houses, 16 (4.4%) had received blood transfusion while 184 (48.8%) were living at rural area of Ibadan at the time of the study.

None of the pregnant women had knowledge of Toxoplasmosis; its route of transmission, its signs and

symptoms, its effect on pregnant women, its effect on a new baby and the way to prevent or avoid the infection.

Prevalence rate of anti-toxoplasma IgG among the pregnant women was 35.8% (Table 1). Sero-positivity of Toxoplasmosis was associated with consumption of unwashed fruits and vegetables (p<0.05), pet possession (p<0.05) and blood transfusion (p<0.05) among the pregnant women (Table 2). The risk of contracting *Toxoplasma gondii* infection increases with blood transfusion (OR = 8.76; 95% CI: 1.14 – 67.13). Table 3

Table 1:

Anti-toxoplasma IgG test results among the pregnant women that attended ante-natal clinic at Primary Health Centers in Ibadan, Nigeria, 2017

Result	Frequency	Percent
Positive	135	35.8*
Negative	242	64.2
Total	377	100

*Prevalence of Anti-toxoplasma IgG by ELISA method

DISCUSSION

Since the isolation of *Toxoplasma gondii* over a century ago, it has become one of the most successful parasites. This is evident in its worldwide distribution, broad host range and its ability to maintain a passive co-existence with its host. Moreover, the ability to culture *T. gondii*, its genetic manipulative property and its excellent animal model made studying *T. gondii* fairly not difficult. While it is known that *T. gondii* rarely cause acute disease in healthy individual, different studies have established its exceptional high infection rates and this proves it as a serious threat to human health. Presently, very low mortality rate has been observed with Toxoplasmosis globally but the most serious form of Toxoplasma infection is congenital. Different studies have shown that Toxoplasmosis is accompanied with serious foetal complication based on gestational age at the time of the infection.

Table 2:

Association between sero-positivity of Toxoplasmosis and risk factors among pregnant women at Primary Health Centre, Ibadan, Nigeria, 2017

Variables	Sero-positivity		χ^2	P - value
	Positive (%)	Negative (%)		
Consumption of unwashed fruits and vegetables	Yes	66(44.0)	6.941	0.011
	No	67(30.6)		
Consumption of undercooked meat	Yes	62(36.0)	0.055	0.828
	No	68(34.9)		
Pet Possession	Yes	24(50.0)	4.514	0.037
	No	108(34.2)		
Received Blood Transfusion	Yes	1(6.2)	6.425	0.014
	No	130(37.4)		
Residence in Rural Area	Yes	68(37.0)	0.206	0.668
	No	67(34.7)		

Table 3:

Logistic regression of sero-prevalence of Toxoplasma IgG and risk factors among pregnant women at primary health care level in Ibadan, Nigeria.

Variable	*OR	95% C. Interval		P-value
		Lower	Upper	
Received blood transfusion				
Yes	8.76	1.14	67.13	0.037
No		1		

According to this study, prevalence of anti- Toxoplasma IgG antibody among pregnant women at primary health care level in Ibadan, is 35.8%. This is in agreement with report of Akinbami *et al* (2010) in which Toxoplasma IgG seroprevalence of 40.8% was found among pregnant women at Lagos State University Teaching Hospital in southwestern part of Nigeria. In other parts of the world other studies reported higher rates such as 80.3% in Kinglash and 75.2% in Sao Tome & Principe (Hung *et al*, 2007).

The age specific seroprevalence was higher among pregnant women aged 25-29 years (43.7%) than the overall seroprevalence of 35.8%. This actively reproducing age group are thus more at risk of giving birth to infants who are exposed to the teratogenic effects of toxoplasmosis and should therefore take appropriate precautions to protect themselves against this infection.

In this study also, a significant association between Toxoplasma infection among pregnant women and religious commitment was found. It has been known that Islam forbade the consumption of meats of certain animals and the keeping of certain pets such as dogs, which had been labelled unclean by the Quoran. These animals could harbour oocysts of toxoplasma gondii thus aiding the transmission of the infection to humans. Thus the lower prevalence of toxoplasmosis among muslims in this study could be attributed to the avoidance of these reservoirs of the infection. Consumption of unwashed vegetables and unwashed fruits has been shown to be statistically significant risk factors associated with T. gondii infection (P <0.05). This was observed in studies done in Lagos (Deji-Agboola *et al*, 2011), Ethiopia (Walle *et al*, 2013), Mexico (Alvarado-Esquivel *et al*, 2012) and China (Zhong *et al*, 2016). Contaminated water and soil may act as vehicles for transfer of oocysts to vegetables and fruits for human consumption. Liu *et al*, (2009) reported strong association between Toxoplasma infection during pregnancy and consumption of unwashed raw vegetables and fruits and pet possession in China. Association with consumption of unwashed fruits and vegetables will be product of use of contaminated water and soil contamination by oocysts of Toxoplasma gondii in the cultivation and preparation of fruits and vegetables.

Association of Toxoplasma infection with pet possession has been reported in different studies. Possession of cat will expose human to having contact with the oocysts in the faeces of the cat. Also, interaction between any other pets and cats can facilitate the transmission of oocysts from the cats faeces to the animals and ultimately man.

This study also reveals an association between Toxoplasma infection and blood transfusion. Transmission of toxoplasma infection through a blood transfusion is possible if the donor has recently acquired a Toxoplasma infection and is parasitemic at the time of blood collection. Presently, screening blood for Toxoplasma antibodies is not routinely done in Nigeria. From this study, 35.8% of the pregnant women were positive with T. gondii IgG antibody but due to insufficient fund, recent infection was not confirmed in the women using anti -Toxoplasma IgM which could be useful to detect possible congenital transmission. The finding on association between receiving blood transfusion and toxoplasmosis is an indication of the need for screening before transfusion especially in pregnancy. Policy on inclusion of Toxoplasma screening for blood donor will be of great benefit. It has been shown by studies that 43 cases of toxoplasmosis acquired during pregnancy would be expected to result in 11 – 21 cases of congenital toxoplasmosis, assuming a 25-50% probability of transmission to the foetus in the uterus (Abu-Madi *et al*, 2010). However, the possibility of congenital toxoplasmosis in Ibadan may be significantly high among the pregnant women. In the presence of prevalence of congenital malformation of 5.5/1000 total birth, with postnatal mortality rate of 60.7/1000 total birth reported recently in Kano, Nigeria (MukhtaiYola *et al.*, 2015), it is very imperative to introduce measure that will further monitor and prevent toxoplasmosis and its congenital consequences in Nigeria. Introduction of toxoplasmosis screening for pregnant women and health education to inform pregnant women was commenced in Italy where 1 – 2 congenital Toxoplasma cases per 10,000 birth was estimated (Stagni *et al.*, 2009). Furthermore, Wallen *et al.*, (2013) have demonstrated that monthly prenatal screening and improvements in ante-natal diagnosis may lead to decrease in the congenital infection rate and a better outcome of infected children. Presently, the government of Italy, China and Canada provide free voluntary serological screening for Toxoplasmosis in pregnancy.

This study shows that none of the pregnant women studied had any knowledge of Toxoplasmosis; its route of transmission, its signs and symptoms, its effect on pregnant women, its effect on a new baby and the way to prevent or avoid the infection. Unlike in United States of America where 48% of their pregnant women indicated that they have heard or seen information leaflet about Toxoplasmosis and were aware of the need to be screened for the infection (Jones *et al.*, 2003). It is important to educate the public and most especially the pregnant women and the immunosuppressed patients that are more vulnerable to pathologic effects of Toxoplasma infection.

Although a high sero prevalence of toxoplasma antibodies was found in this study, a major limitation of this report was that recent infection with toxoplasma gondii was not investigated. Since recent infection has been implicated in the teratogenic effects of toxoplasmosis, the findings in this study cannot be linked to the incidence or prevalence of congenital anomalies in the infants.

In conclusion, seroprevalence of toxoplasmosis IgG antibody among the pregnant women in this study is high. However, follow up study on IgM antibody status of their

babies will be very important because it is the indicator of recent exposure. Seropositivity to Toxoplasma IgG was associated with blood transfusion practices, a range of hygiene and food consumption practices which can be prevented. Health education on food hygiene and health services infrastructural upgrade and improved blood screening practices is recommended for the interruption of transmission of toxoplasmosis in the community.

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