

# AFRICAN JOURNAL OF MEDICINE and medical sciences

VOLUME 36 NUMBER 2

JUNE 2007



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ISSN 1116—4077



## Seroprevalence of *Toxoplasma gondii* infection in Kwal, a rural district of Plateau – Nigeria.

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### Summary

*Toxoplasma gondii* infection has become a major public health concern in recent times due to the ravaging HIV/AIDS pandemic. The seroprevalence of *T.gondii* infection was determined in Kwal, a rural district of Plateau-Nigeria using IgG-ELISA. Epidemiological assessment was also conducted for the purpose of establishing the infection dynamics. Antibodies to *T.gondii* were detected in 30 (20.8%) of the 144 individuals studied. The prevalence of infection was slightly higher amongst the males (22.0%) than the females (20.0%), individuals of age group 21-30 years had the highest prevalence of 33.3% while the least (7.4%) occurred amongst the 41-50 years age group. No significant difference was noted ( $p < 0.05$ ). The seroprevalence of *Toxoplasma* antibodies was significantly higher amongst individuals who handle/eat rodents (29.6%) and those who constantly had contact with soil (21.2%). These were the predominant risk factors of *T. gondii* infection in the area. Consequently, the infection occurred most amongst farmers (25.0%). This study contributes to the development of guidelines for the prevention and management of toxoplasmosis. Results were discussed in relation to the *T.gondii* epidemiological factors inherent within the population studied.

**Keywords:** *Toxoplasma gondii*, seroprevalence, IgG-ELISA, epidemiology

### Résumé

Récemment, l'infection du *toxoplasme gondii* est devenue un problème de santé publique majeure du à la pandémie du VIH/SIDA ravageant. La séroprévalence d'infection du *T. gondii* était déterminé en utilisant la méthode d'IgG-ELISA à Kwal, un district rural dans l'état de plateau au

Nigeria. L'évaluation épidémiologique était conduite dans le but d'établir le dynamisme de l'infection. Les anticorps du *T.gondii* étaient détectés chez 30 (20.8%) des 144 individus étudiés. La prévalence de l'infection était légèrement élevée parmi les males (22.0%) que les femelles (20.0%). Le groupe d'âge de 21-30 ans avait le taux le plus élevée de 33.3% et le moindre de 7.4% était parmi ceux d'âge 41-50 ans, sans aucune différence significative ( $P > 0.05$ ). La séroprévalence des anticorps de toxoplasme était significativement plus élevée parmi les individus qui élèvent ou mangent les rongeurs (29.6%) et ceux qui sont en contact permanent avec le sol (21.2%) étant les facteurs à risque de l'infection du *T.gondii*. Les résultats étaient discutés en relation aux facteurs épidémiologiques du *T. gondii* dans la population étudiée.

### Introduction

Toxoplasmosis is a zoonosis that has a world-wide distribution. It is caused by an obligate intracellular eucoccidian parasite *Toxoplasma gondii* which has an extremely broad host range [1].

Infection due to *T.gondii* is typically not highly virulent except in the developing foetus and immunocompromised hosts where it can grow unchecked and cause fatal illness [2] Toxoplasmosis has become a major public health concern in the event of the unprecedented upsurge in Acquired Immuno-deficiency Syndrome (AIDS) in many rural areas of the sub-Saharan Africa, causing an opportunistic infection. As a facultative 2-host parasite that uses felines as definitive hosts and various vertebrates as intermediate hosts, cats are the key host involves in the transmission of the infection to humans. This is because cats are the only hosts closest to man that can excrete environmentally resistant infective oocysts [3]. Human infection resulting from ingesting raw or partially cooked meat containing infective *T. gondii* cysts (bradyzoites) has been described [4]. Food or water contaminated with



infected cat faeces, unpasteurized milk from infected goats, and infected whole blood for transfusion have been reported as possible sources of *T. gondii* infection [4,5].

One of the major problems associated with toxoplasmosis in most developing tropical nations is its diagnosis because its symptoms mimic those of many infectious and non-infectious diseases [6]. In Nigeria, available data and other information on toxoplasmosis are grossly insufficient as there are very few documented studies [7,8] to establish the true status of the disease amongst the population. This is attributed to the dearth of *T. gondii* diagnostic facilities in many hospitals and diagnostic laboratories in the country.

The objectives of this study therefore, were to determine the prevalence of *T. gondii* infection and to evaluate the epidemiological factors which influence the susceptibility of individuals to the infection in a rural locality, as part of strategy for the management of the infection.

## Patients and methods

### Study area and population

Kwal is a rural community located in an area generally referred to as the Jos-Plateau, covering about 9,400km<sup>2</sup> of the crystalline complex in central Nigeria. Its average elevation is about 1,250m above mean sea level and has average annual rainfall of about 1100mm, with temperature ranging from 14°C-32°C. Farming and trading are the major occupation of the people.

The primary health care clinic (PHCC) is the only modern health facility available in the area. After a successful community mobilization by the research team, 144 individuals from the four Wards (Kimakpa, Dan-Mangu, Power-House and Dan Bello) were recruited into the study. Both young and old persons willingly presented themselves for sampling at the PHCC. Blood (3ml), was obtained by venepuncture from each individual in sterile tube and the serum separated and stored – 20°C until used. Socio-demographic data and information on *T. gondii* epidemiological factors were obtained from each subject by interview.

### *Toxoplasma gondii* serology:

This was done using the *T. gondii* IgG-Enzyme linked immunosorbent assay (ELISA) test kit (Biowhittaker, Walkersville). Briefly; diluted serum samples and controls were dispensed into the *T. gondii* antigen

coated microelisa wells and incubated at 37°C for 30 minutes. Wells were washed (with phosphate buffered saline PBS). Goat antihuman immunoglobulins peroxidase was added to each well and incubated at 37°C for 30 minutes and washed with PBS. O-phenylenedimine dihydrochloride (OPD) substrate solution was added to each well and incubated at room temperature 20-25°C) in the dark for 30 minutes. Reaction was stopped by adding the stop solution (2NH<sub>2</sub>SO<sub>4</sub>) to each well. Absorbance of the solution in each well was read at 405nm using ELISA plate reader. Cut off value was calculated according to kit manufacturer's instructions. Specimen with absorbance value greater than cut-off was considered positive for *T. gondii* infection.

### Statistical analysis

This was performed using the Chi-square test. Statistical significance was achieved if  $P < 0.05$ .

**Table 1:** Socio-demographic parameters of *T. gondii* infected individuals in Kwal.

Factors considered	Number studied (144)	Number infected	Percentage infected (20.8)
<i>Sex</i>			
Male	59	13	22.0
Female	85	17	20.0
<i>Age (years)</i>			
< 10	21	5	23.8
11 – 20	41	11	26.8
21 – 30	18	6	33.3
31 – 40	27	2	7.4
41 – 50	17	3	17.6
51 – 60	10	3	30.0
> 60	10	-	-
<i>Occupation</i>			
School children	56	13	23.2
Farmer	18	6	25.0
Business	53	9	17.0
Civil servants	11	2	18.0
<i>Ward</i>			
Kimakpa	41	7	17.1
Dan Mangu	47	9	19.1
Power House	14	2	14.3
Dan Bello	42	12	28.6

## Results

Of the 144 subjects studied, 59 were males while 85 were females. The age range was 6 – 60years with a mean age of 28years. Antibodies to *T. gondii* were detected in 30 (20.8%) of the study population. The



prevalence was slightly higher among the males (22.0%) than the females (20.0%), (Table 1) but there was no significant difference in the trend ( $X^2 = 0.086$ ,  $P < 0.05$ ). The highest prevalence of 33.3% occurred amongst individuals in the age group 21-30 years and the least (7.4%) amongst those in 41-50 years but the difference was not statistically significant ( $X^2 = 7.77$ ,  $P < 0.05$ ). Individuals who were predominantly farmers had the highest prevalence of 25.0%, followed by school children (23.2%) with the lowest prevalence observed among the business men and women (Table 1). There was also no significant difference in the trend ( $X^2 = 2.269$ ,  $P < 0.05$ ). The highest prevalence (28.6%) was recorded among individuals from Dan Bello Ward while the least (14.3%) was from Power-House Ward.

**Table 2:** *Toxoplasma gondii* epidemiological factors in the study population of Kwal.

Epidemiological factor	Number of individuals exposed	Number infected	Percentage infected
Cats in the house	16	2	12.5
Contact with cats	16	3	18.8
Eating raw/partially cooked meat	17	3	17.6
Drinking Unpasteurized goat milk	23	4	17.4
Handling/Eating rodents	54	16	29.6
Contact with garden or soil	132	28	21.2
History of blood transfusion	15	2	13.3

Epidemiological assessment (Table 2) showed that the highest prevalence values of 29.6% and 21.2% were obtained in those who handle/eat rodents and those who constantly had contact with soil. Two of 16 persons who admitted having cats and 2 of 15 who have history of blood transfusion were *T.gondii* positive. Three of the 17 persons who eat raw or partially cooked meat were positive for *T.gondii* infection.

## Discussion

Toxoplasmosis has been described as a "neglected" disease [9]. However, with the emergence of HIV, *T.gondii* has become an important opportunistic pathogen. Indeed, it is reported that the diagnosis of

toxoplasmosis leads, in turn to the diagnosis of approximately 5% of new cases of AIDS [10,11].

As noted previously, recent data on the prevalence of toxoplasmosis in Nigeria are essentially lacking, due largely to the problems of non-availability of adequate and reliable diagnostic tools. Our choice of IgG-ELISA was to overcome the limitation associated with reactivated latent infection usually observed in individuals with immune deficiency and who do not generally react to IgA and IgM-ELISA because of B-cell defects [12,13].

Earlier assessment of *T.gondii* infection in Zaria [7] and Benue State [8] of Nigeria showed a prevalence of 39.5% and 57.0% respectively. In our study, a prevalence of 20.8% was observed which represented a decline. However, the differences in the prevalence figures confirmed a previous report [14] which indicated that the seroprevalence of *Toxoplasma gondii* varies with geographical location and dependent upon cultural and behavioural characteristics of the population under study. Furthermore, findings from other parts of the world showed varying prevalence figures. In Norway 12.0% was reported, 31.7% in the United States, 46.0% in Lebanon, 35-60% amongst children in Kenya and 23-84% in Brazil [15,16,17].

The comparatively low prevalence (20.8%) may not be unconnected to the culture, behaviours and habits of the inhabitant of Kwal district which probably minimized exposure to the risk factors of *T.gondii* acquisition. Besides, epidemiological assessment showed that a limited number of subjects actually keep or have contact with cats, eat raw or partially cooked meat, handle animals or drink unpasteurized goat milk.

Eating raw or partially cooked meat is a cultural practice in Kwal district of Jos Plateau-State and has been perpetuated by the local people on the believe that raw or partially cooked meat has more nutrient and vitality than properly cooked meat consequently, 17.6% of the people that eat raw or partially cooked meat had *T.gondii* infection as observed in this study.

The major sources of the infection in the area appeared to have resulted from handling/consumption of rodents and contact with garden or soil. This probably explains why the highest prevalence (28.6) occurred amongst individuals from Dan Bello Ward because they are predominantly farmers and least (14.3%) from Power-House Ward who are mainly civil servants and traders.



This observation is in conformity with an epidemiological study conducted in Brazil [18] which showed the highest *T.gondii* prevalence of 55% amongst individual who constantly had contact with garden or soil, follow by 32% amongst those who eat raw or partially cooked meat. In addition it has also been observed in Canada that high rate of toxoplasmosis seroconversion in pregnant women was significantly associated with handling and skinning of animal for fur, food consumption, animal contact and soil [19].

It is early evident from this study that risk factors such as; cats in the household, contact with cats, drinking unpasteurized, goat's milk and blood transfusion are not very important sources of exposure to *T. gondii* infection in Kwal, compared to contact with soil or handling/ eating rodents. This is not surprising as human infection with *T.gondii* is mainly effected by ingestion of oocyst from cat's faeces usually picked from the soil [4,20]. Moreover the highest prevalence of the infection which was observed amongst farmer and school children is presumably due to the high degree of contact with soil (farming activity) and handling/consumption of rodents, activities very common in these categories of the population.

Also farming is a predominating male occupation in the area, especially among age group 21-30 years, thus higher percentage of males than females were infected. This is similar to earlier finding in Japan [21] from the study of the prevalence and sources of *Toxoplasma* infection in the environment of which farmers were the highest infected individuals with more males (28.8%) than females (16.3%) being infected.

In conclusion, this study makes a strong case for the provision of *T.gonodii* diagnostic facilities in hospital, clinic and diagnostic laboratories in this part of the globe. This is to ensure prompt diagnosis and immediate chemotherapy especially on the face of the current unprecedented increase in prevalence of HIV infection in rural areas [22]. Preventive measures such as avoiding uncooked meat, control of infected cat faeces and soil as well as limiting cat population should be adhered to. Until a suitable and effective human vaccine against *T. gondii* is discovered, the preventive measures still remain the best approach.

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Received: 12/01/04

Accepted: 30/04/07