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Mini-Review

Toxoplasma gondii Infection in Free-Range Chicken: Mini-Review and Seroprevalence Study in Oyo State, Nigeria

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ABSTRACT: Free-range chickens are sentinels for the presence of *Toxoplasma gondii* oocysts in the environment because they feed from ground. *T. gondii* infected chickens are also an important source of infection for cats that shed environmentally resistant oocysts after eating infected chicken tissues. We surveyed 50 free-range chickens from Oyo State, Nigeria for the presence of *T. gondii* antibodies using the modified agglutination test (MAT). All chickens tested seropositive with MAT titers of 1:5 in 8 chickens, 1**:** 1:25 in 9 chickens, 1:100 in 19 chickens, and 1:500 in 14 chickens. Thus, even at a very conservative cut-off titer of 1:100, antibodies were found in 33 of 50 chickens, indicating a high prevalence of *T. gondii* in chickens.

Keywords: *Toxoplasma gondii*; Free-range chicken; Nigeria

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INTRODUCTION

Toxoplasmosis

Toxoplasma gondii infections are widely prevalent in humans and other animals worldwide. *Toxoplasma gondii* is an obligate intracellular protozoan parasite that infects warm-blooded vertebrates and the infection is now known to be widely prevalent in humans and animal worldwide (Dubey and Beattie, 1988; Tenter *et al.* 2000).

Humans and animals (intermediate host) get infected via the ingestion of food or water contaminated with environmental resistant oocysts shed by cats the definitive hosts. *Toxoplasma gondii* can also be transmitted to humans by the consumption of undercooked, or raw, meat containing tissue cysts (Tenter *et al*. 2000). Cats become infected with *T. gondii* by eating infected tissues from intermediate hosts that include birds and rodents.

Epidemiology of Toxoplasmosis and Free-range Chicken

Oocysts shed into the environment by felids have been reported to cause several outbreaks of Toxoplasmosis in humans. While, direct contact with felines is thought to

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be of little epidemic consequence (Tenter *et al*. 2000; Benson *et al*., 1982; Teutsch *et al*., 1979). Detection of *T. gondii* oocysts in the environment is difficult, since domestic cats normally choose to bury their feces in soft and moist soil. However, free-range chicken have been used as one of the best indicators for soil contamination with *T. gondii* oocysts because they feed from the ground, and tissues of infected chickens are considered a good source of infection for cats (Dubey, 2010b). Cat fed with infected chicken tissue has been demonstrated to shed large number of oocysts (Dubey, *et al.*, 2002; Ruiz and Frenkel, 1980) Ingestion of infected chicken meat can also be a source of infection for *T. gondii* infection in humans and other animals (Dubey, 2010b). Chicken has been suggested as a more efficient intermediate host for *T. gondii* and possibly plays more important role in the epidemiology of the parasite than rodents, because they are clinically resistant to *T. gondii* and live longer than rodents (Dubey, 2010b).

Chickens as Source of *T. gondii* Infection for Humans

Ingestion of infected chicken meat can be a source of infection for *T. gondii* infection in humans and other animals (Dubey, 2010b). There are lots of report indicating that both chicken raised in backyard and commercial free-range systems harbour viable *T. gondii* (Dubey *et al.*, 2004; 2005), most chicken raised under these operations in developing countries are slaughtered at home without supervision, this can allow the transmission of *T. gondii* infection to humans if care is not taken to wash hands thoroughly after cutting meat and during cooking of meat. Furthermore, the viscera of such chicken are usually not properly disposed but left for scavengers thereby encouraging the transmission of *T. gondii* to reservoirs like rodents or even cat the final host.

The probability of humans getting infected from eating eggs from infected chicken is not yet substantiated, although *T. gondii* has been shown to survived in egg yolk and albumin egg boiled and yolk of egg fried for 3 minutes, but there are lots of evidence that showed that raw eggs are not likely to be a source of infection for humans (Dubey, 2010b). However, to prevent incidents of *T. gondii* infection and more importantly salmonellosis and *E. coli* infection, it is important that humans should not consume raw eggs.

***Toxoplasma gondii* infection: Nigerian situation**

Several seroprevalence studies on *Toxoplasmosis* in Nigerian livestock were focused mainly on ruminants, while only scanty reports are available on canids (Kamani and Egwu, 2010). Most of these studies showed that scavenging on refuse dumps where stray cats abound are the primary source of livestock infection that could subsequently become the infection source for humans. However, while there is increased investigation into the role of livestock and other domestic animals in the epidemiology of *Toxoplasma gondii* infection, the role of free-range chicken is overlooked.

Free-range chicken is a delicacy in Nigeria and it is preferred to the commercial chicken because of the tough meat quality and also the practice of rearing them without drugs and artificial feed additives. Although, there are a lot of free-range chickens in Nigeria, little attention is paid to their management system and most are slaughtered at the backyard without inspection.

Unlike in the developed countries, the practice of keeping cats as household pets is not popular in Nigeria because of socio-cultural values that vary from one place to another. However, recent studies showed high seroprevalence of *Toxoplamsa gondii* antibodies among the Nigeria population that does not keep pets (Akinbami *et al.*, 2010; Kamani *et al.*, 2009). Although these studies were unable to determine the infection sources, the role of the free-range chicken cannot be undermined as source of transmission of *T. gondii* infection to humans, since most household have free-range chicken in Nigeria. There is no information on the role of free-range chicken in assessing the level of environmental contamination by *T. gondii* and in the transmission of the infection to humans, cat and other livestock in Nigeria.

This paper in addition to a brief review on the role of Free-range chicken in the epidemiology of *T. gondii infection also* reports a high prevalence of *T. gondii* in free-range chickens in Oyo State, Nigeria

MATERIALS AND METHODS

Sampling:

Free-range chickens were bought from villages in Moniya local government area of Oyo State, Nigeria. Blood, heart and serum samples were collected and stored at 4^0c. Samples were sent within 3 days of collection to United States Department for Agriculture, Maryland, for serology and isolation of *Toxoplasma gondii*.

Serology:

Chicken sera at 5, 25, 100 and 500 dilutions were screened for the presence of *T. gondii* antibodies using the Modified agglutination test (MAT) as described by Dubey and Desmonts (1987).

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RESULTS

All chickens (50 of 50 free-range chickens) tested seropositive with MAT. Antibodies to *T. gondii* were found with titers of 1:5 in 8 chickens, 1:25 in 9 chickens, 1:100 in 19 chickens, and 1:500 in 14 chickens. Thus, even at a very conservative cut-off titer of 1:100, antibodies were found in 33 of 50 chickens, indicating a high prevalence of *T. gondii* in the chickens. Results of this preliminary investigation indicate a very high prevalence of *T. gondii* antibodies in chickens in studied area. Although there is no validation of MAT for the diagnosis of *T. gondii* infection in chickens, viable *T. gondii* was isolated from high percentage of chickens with MAT titers of 1:25 or higher, including occasional isolates from chickens with MAT titer of 1:5 (Dubey, 2010b). Therefore, chicken sera in the present study were tested starting with 1:5 serum dilutions.

Table 1.
Seroprevalence of *Toxoplasma gondii* in free-range chickens from Oyo State, Nigeria using the Modified Agglutination Test

No of Chicken Tested	Modified Agglutination Test Titers	No of Positive (%)
50	5	8 (16)
50	25	9 (18)
50	100	19 (38)
50	500	14 (28)

DISCUSSION

Toxoplasma gondii infections are widely prevalent in human beings and animals worldwide (Dubey, 2010a). However, only a small percentage of exposed adult humans develop clinical signs. It is unknown whether the severity of toxoplasmosis in immunocompetent persons is due to the parasite strain, host variability, or to other factors. Recently, attention has been focused on genetic differences among isolates of *T. gondii* from clinically ill and asymptomatic hosts (Dubey, 2010a). In humans, severe cases of toxoplasmosis in immunocompetent patients have been related to *T. gondii* strains with atypical genotypes (Ajzenberg *et al*., 2004; Demar *et al*., 2007; Elbez-Rubinstein et al., 2009). Nothing is known of genetic characters of *T. gondii* isolates from Nigeria. However, tissues from seropositive free-range chickens should provide a good opportunity to isolate viable *T. gondii* isolates. Larger scale study is needed to investigate the seroepidemiology, isolation and characterization of *Toxoplasma gondii* in free chicken in Nigeria.

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