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Research Article

Toxoplasma gondii Infection in Chickens (*Gallus domesticus*) from McComb, Mississippi, USA – A Retrospective Study

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Abstract

Toxoplasma gondii is an intracellular parasite of cats but can infect many animals including birds and humans. While its prevalence has been reported in pigs and goats in Mississippi, it has not been reported in chickens. The objectives of this study are to assess the prevalence of *T. gondii* in chickens from Mississippi, to compare the prevalence with those in pigs and goats and to bring out its public health and economic importance to Mississippi and the need to carry out this kind of study in the future. During the month of October 2010, chicken blood samples were collected from slaughtered chickens from Wayne-Sanderson Farms Processing Plant in McComb, Mississippi. They were taken to the Alcorn State University Laboratory for processing. The collected blood samples were centrifuged and the sera were put in vials, labeled and stored in the freezer at -20 degrees centigrade until tested for *T. gondii* antibodies. The modified agglutination tests (MAT) were performed at serial dilutions of 1:25, 1:50 and 1:500. A titer of 1:25 was considered to be seropositive. Of a total of 612 chicken blood samples tested, 68 (11.1%) were seropositive for *T. gondii*. The prevalence was comparatively lower than reported in pigs and goats from Mississippi. The result obtained is however similar to those of some previous studies. The economic and public health importance of *T. gondii* infection in chickens from Mississippi was emphasized. It is necessary that this kind of study be conducted in more areas or counties of Mississippi especially in free range chickens. Chicken is a new host record for *T. gondii* in Mississippi.

Keywords: *Toxoplasma gondii*; Chickens; Economic and Public Health Importance; Mississippi; USA

Introduction

Toxoplasma gondii is a parasite which is intracellular. Its definitive host is the cat. But it is a promiscuous pathogen that has the propensity to infect many animals including birds and mammals. So it is non-host specific and zoonotic. It has even been reported in marine organisms including sea otters [1,2], oysters [3] and multiple species of marine fish [4]. It is also believed to be ubiquitous and has been reported worldwide or globally [5-7]. *T. gondii* is recognized as a foodborne risk. Infection is common in many domesticated animals used for food including pigs, chicken, lambs and goats. Animal infections with *Toxoplasma*, especially infections in those raised in confinement likely result from environmental exposure to *T. gondii* oocysts. Oocyst contamination of the environment is widespread as a result of fecal contamination of soil and ground water by an estimated 140 million domestic and feral cats in the US, each of which can deposit hundreds of millions of oocysts in feces during infection [5,7,8]. While its prevalence has been reported in pigs and goats [9,10] in Mississippi, a literature review shows that to date, it has not been reported in chickens.

Chickens are considered one of the most important hosts in the epidemiology of *T. gondii* infection. This is because they are an efficient source of infection for cats that excrete the environmentally resistant oocysts and because humans may become infected with this parasite after eating undercooked infected chicken meat [5]. Chicken is of economic importance in Mississippi. Poultry is reported to be the most consumed meat in Mississippi and is the state's largest agricultural industry. Mississippi poultry industry is a major contributor to the State's economy [11].

While there is no previous report on *T. gondii* infection in chickens in Mississippi, some have been reported in the US [5,12-15]. The Public Health concern or importance of toxoplasmosis was discussed [9]. The public health importance of *T. gondii* in chickens cannot be overemphasized. The objectives of this study are to determine whether *T. gondii* occurs in chickens from Mississippi and to compare its frequency of occurrence with those in pigs and goats. It is also to portray (bring out) its economic and public health importance with respect to Mississippi and to the need to carry out this kind of study in chickens in Mississippi in the future.

Materials and Methods

During the month of October 2010, blood samples were collected with anticoagulant bottles from chickens while they were being slaughtered at Wayne-Sanderson Farms Processing Plant in McComb, Pike County, Mississippi (see figure 1). These were commercially raised indoor chickens [16]. The blood samples were taken to the Alcorn State University Laboratory for processing. They were centrifuged and the sera were put in vials, labeled and stored in the freezer at -20 degrees centigrade until tested for *T. gondii* antibodies. The modified agglutination tests (MAT) were performed [17] at serial dilutions of 1:25, 1:50 and 1:500. A titer of 1:25 was considered to be seropositive.

Results and Discussion

Of a total of 612 chicken blood samples tested, 68 (11.1%) were seropositive. The seroprevalence was lower than reported in pigs (16%) and slightly lower than in goats (12.5%) from Mississippi. But these are average results from several locations surveyed. In this study, the blood samples were collected from commercial indoor farm chickens from one location (McComb in Pike County). This may be a factor in the frequency of occurrence of *T. gondii* in the chickens surveyed. Also, previous reports show that the prevalence



Figure 1: Map of Mississippi showing the county where the study was conducted.

of *T. gondii* is usually low in commercial indoor chicken farms [18-21]. So the result obtained is in consonance with some previous studies. It is necessary that this kind of study be carried out in the future and in different locations in Mississippi as was done for pigs and goats [9,10] and that free-range chickens (i.e. those that have access to the outdoors) be surveyed as they feed from the ground and are likely to ingest oocysts shed in the feces of infected cats and also to see if there is much of a difference in the *T. gondii* rate of infection between them and backyard chickens in Mississippi. This is also considered important as they (free-range chickens) are one of the best indicators for soil contamination with *T. gondii* oocysts. They are one of the most important hosts in the epidemiology of *Toxoplasma gondii* infection in many countries because they are an efficient source of infection for cats that excrete the environmentally resistant oocysts and because humans may become infected with this parasite after eating undercooked infected chicken meat [22]. Chickens are conduits to human infection.

Public Health Importance/Impact of *Toxoplasma gondii* Infection

Toxoplasma gondii infection in chickens is of public health importance in Mississippi as it is in the US and elsewhere. This lies in their role as environmental sentinels and potential vectors of human infection. This has been discussed by several previous investigators [5-7,20,21] Emphasis was made on the public health significance of infected poultry in human toxoplasmosis. An author [23] observed that toxoplasmosis continues to be of a significant public health problem in the United States. It is estimated that 1,075,242 persons are infected with *Toxoplasma gondii* and approximately 2,839 persons develop symptomatic ocular disease annually. Some publications have linked suicide and schizophrenia to *Toxoplasma* infection [24,25].

Economic Importance of Chickens to Mississippi

As observed earlier [11], chicken is of economic importance to Mississippi. This is further buttressed by reports on the impacts of poultry industry in Mississippi [26-28].

There are many poultry farms in Mississippi spread in different counties and ranging from small family farms to large commercial operations [29]. Based on available slaughterhouse and meat processing facility listings, there are many counties in Mississippi that have slaughterhouses or processing plants [30]. These facilities range from large commercial slaughterhouses to small custom or mobile processing units, serving both commercial and local markets. For the chickens to continue to be revenue earners in Mississippi, they need a conducive and risk-free environment.

Besides congenital infection, humans become infected with *T. gondii* by ingesting food or water contaminated with sporulated oocysts from infected cat feces or through ingestion of tissue cysts in undercooked or uncooked meat. Food animals (pigs, chickens, lambs and goats) become infected by the same routes, resulting in meat products containing tissue cysts which can then infect consumers. *Toxoplasma* infection is common in food animals in the United States [22]. In Mississippi, management factors such as biosecure confinement housing could be employed (if not already done) to reduce the levels of *Toxoplasma gondii* infection in animals being processed for human consumption. *Toxoplasma gondii* infection in chickens surveillance needs to be done for public health and control strategies.

Conclusion

Serological surveys for *Toxoplasma* prevalence have been conducted frequently in the US over the last 30 years. Of the major meat animal species investigated thus far, pigs and chickens are the only species shown to frequently harbor the parasite [22]. Since there are many poultry farms and slaughterhouses in Mississippi and poultry industry is of economic importance, it is necessary and is recommended that this kind of study be carried out in several other counties in Mississippi especially those that have poultry farms and slaughterhouses. Chicken is a host record for *T. gondii* infection in Mississippi.

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