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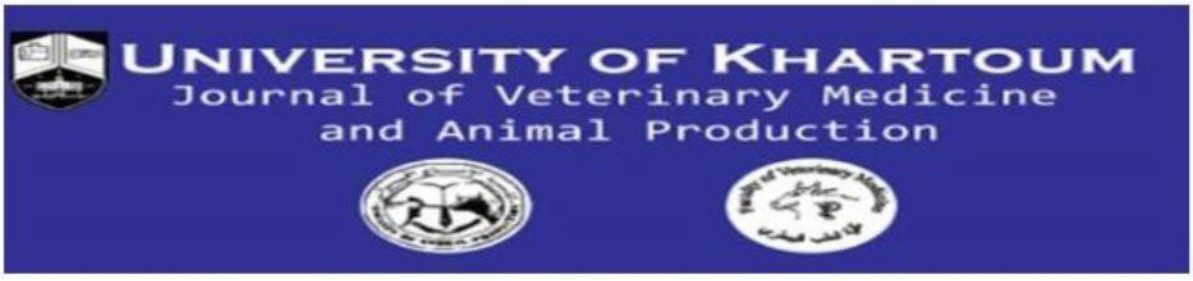

Prevalence of *Toxoplasma gondii* Antibodies in Chickens and Pigeons in Khartoum State, Sudan

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Abstract

This study was conducted to determine the prevalence of toxoplasmosis in commercial chickens, free rang chickens and pigeons in Khartoum State. Three localities in Khartoum State were chosen (Khartoum, Bahri and Omdurman). A total of 358 blood samples were collected from the poultry in houses and farms. The samples from apparently healthy birds were collected randomly from 36 free rang chickens, 22 pigeons and 300 chickens (broiler and layer). The samples were examined by using Enzyme Linked ImmunoSorbant Assay (ELISA) to determine the prevalence of *Toxoplasma gondii* antibodies for *IgG* and *IgM*. The results obtained showed that 2 (0.56%) out of 358 birds were positive as chronic infection and no bird was showed acute infection, one was detected from free rang chicken and the other from broiler chicken. The result showed that all samples examined for presence of *Toxoplasma gondii* antibodies in pigeons were negative. This study concluded that *Toxoplasmagondii* was found with low prevalence rate in chicken in Khartoum State.

Keywords: *Toxoplasma gondii, pigeons, broiler chicken, free range chicken, Layer chickens*

المستخلص

صممت هذه الدراسة لتحديد معدلإنتشار داء المقوسات في الدجاج التجاري، الدجاج البلدي والحمام في ولاية الخرطوم. تم إختيار ثلاثة محليات في ولاية الخرطوم (الخرطوم، بحري و أمدرمان). تم جمع 358 عينة دم من الدواجن من المنازل والمزارع. جمعت العينات من طيور ظاهريا سليمة عشوائيا من 36 عينة دجاج بلدي، 22 عينة حمام و 300 عينة دجاج (لاحم وبياض). تم فحص العينات بإستخدام إختبار الإليزا لتحديد معدل الأجسام المضادة للمقوسة قوندي للغلوببولين المناعي (IgG) وللغلوبيولين المناعي (IgM). أظهرت النتائج أن 2 (0.56%) من أصل 358 طائر كانت موجبة كحالة مزمنة ولم يظهر أي طائر عدوى حادة ، أحدى العينات الموجبة كشفت من الدجاج البلدي والأخري من الدجاج اللاحم. وأظهرت النتائج أن جميع العينات التي تم فحصها لوجود الأجسام المضادة للمقوسة قوندى في الحمام كانت سالبة. خلصت الدراسة إلى أن المقوسة قوندي قد وجدت بمعدل منخفض في الدجاج في ولاية الخرطوم.

كلمات مفتاحية: *المقوسة قوندى، حمام، دجاج لاحم، دجاج بلدى، دجاج بياض ، ولاية الخرطوم*

Introduction

Chickens are considered one of the most important hosts in the epidemiology of *Toxoplasma gondii* infection because they are an efficient source of infection for cats that excrete the environmentally resistant oocystes and because humans may become infected with this parasite after eating undercooked infected chicken meat (Dubey, 2010).

Toxoplasma gondii is an obligate intracellular protozoan that infects human and a wide range of mammals and birds (Smith and Reduck, 2000). Toxoplasmosis caused parasitic disorder in mammals, birds and reptiles affecting primarily the central nervous system but some time also the reproductive system, skeletal muscles and visceral organs (Calnek *et al.*, 1977).

The clinical signs of toxoplasmosis in poultry include anorexia, emaciation, reduce eggs production, ataxia, blindness, and even mortality rate may be as high 50%, which is seldom observed (Dubey and Beattie, 1988). Although symptoms in pigeons such as diarrhea, trembling, incoordination, torticollis and severe encephalomyelitis may be observed in the acute period, *T.gondii* infections are often subclinical in pigeons (Jacobs *et al.*, 1953).

The ingestion of food or water contaminated with oocysts from cat feces or the ingestion of tissue cysts in undercooked meat are the two major ways of postnatal transmission of *T.gondii* (Karatepe *et al.*, 2011). *T.gondii* has been recovered from a wide range of food animals including sheep, goats, pigs, rabbits, and domestic poultry (Zia-Ali *et al.*,2005). Ground-feeding birds are considered important in the epidemiology of *T.gondii* because they serve as indicators of soil contamination by oocysts; cats excrete environmentally resistant oocysts after consuming tissues of infected birds (Dubey *et al.*, 1994)

In recent years, seroprevalence studies of *T.gondii* in chickens, ducks and pigeons have been conducted extensively in various parts of the world (Dubey *et al*., 2011). It has been estimated that cats prey billions of birds annually (Loss *et al*., 2013). Investigations of *T.gondii* infection in Chickens, ducks, and geese have been reported worldwide but in Sudan one study was conducted in River Nile, Khartoum and Sinar State revealed that the prevalence rate was 100% in all types of chickens (Hussien *et al.*, 2016); therefore, this study was designated to determine the prevalence of *Toxoplasma gondii* in commercial chicken, free rang chicken and pigeons in Khartoum State.

Materials and methods

Study Area

The samples were obtained from different localities in Khartoum state, which represent the capital of Sudan and consist of three main towns, Omdurman, Khartoum and Bahri.

Sources of samples

A total of 358 serum samples were collected from different age group between (1<39) weeks from (layer, broiler, pigeon, free range chicken)

during February and March 2015 (Table 1) from male and female (Table 2).

Collection of samples

Serum samples

The blood samples were collected from chicken from commercial farms, houses and pigeon from houses. Most of the specimens were collected from apparently healthy pigeon and chicken and some of them diseased chicken had nervous sings and diarrhea. Blood samples were taken from the wing and jugular vein in sterile tubes and were left to clot at room temperature. The clot was separated from the edges of the tubes and left overnight at 4°C, serum were then collected and stored at -20°C until used.

Table 1: Source and number of samples

	Area and No. of Samples Examined			Total
	Khartoum	Bahri	Omdurman	
Layer	50	50	51	161
Boiler	69	6	64	139
Pigeon	20	2	--	22
Free Rang	26	6	4	36
Total	165	74	119	358

Table 2: Sex of chickens and pigeon and number of samples

Sex	Number
Female(Chicken)	329
Male (Chicken)	7
Female (Pigeon)	14
Male (Pigeon)	8
Total	358

Diagnostic Procedure

The samples were examined by using ELISA technique, where 89 samples examined using IgG kit and 269 samples using IgM kit.

Results

Field observation

In this study random samples were collected from different farms and houses in Khartoum state, most of the m have a good health and some of them showed clinical signs. The clinical signs were diarrhea, nasal discharge, dormancy, lice and fall of feather.

Prevalence of *T. gondii* according to study area

The prevalence of the *T.gondii* was found 0.28% in Omdurman and 0.28 % in Khartoum which was not significant (P-value= 0. 734) and there was no antibodies detected in Bahri (Table 3).

Prevalence of *T .gondii* according to sex

The prevalence of *T. gondii* in female chickens was found 0.56% and all samples from male were found negative. There were no positive cases recorded male and female of pigeons

(Table 4). The different was not significant (P-value=0.981).

Prevalence of *T.gondii* according to type of test

Serum samples from 269 birds were tested for presence of *T.gondii* antibodies using the ELISA test for type IgM and showed negative in all the samples. While, 89 samples were tested by using the ELISA test for type IgG, showed 2 samples positive (2.24%) and 87 samples were negative (97.75%) (Table 5).

Prevalence of *T.gondii* according to age

The prevalence of *T. gondii* in serum samples of birds in age between 1-6 weeks was (0.70%). In age between 7-14 weeks 36 samples were tested and all of them were negative. In age between 15-39 weeks 91 samples were tested and all of them were negative. In age above 39 weeks were tested one (1.20%) out of 84 samples was positiveand 83 samples were negative (Fig.1).

Prevalence of *T.gondii* according to the breed

There were no positive cases observed for Lehman. The prevalence of *T. gondii*in Hisex breed was (0.28%). The same prevalence of T. gondii in local breed was recorded (0.28%). The different was not significant (P-value=4.100) (Table 6).

Prevalence of *T.gondii* according to the type of production

The prevalence of *T.gondii* in broiler was (0.28%). The prevalence of *T.gondii* in layer was (0.28%). The different was not significant (P-value=0.974) (Table 7).

Prevalence of *T.gondii* according to the health status

The prevalence of *T.gondii* in birds with had a normal health status was (0.56%).Twelve samples from sick birds all of them were negative. The different was not significant $\chi 2$ =0.792, P-value=0.070 (Table 8).

Prevalence of *T.gondii* according to the environment

The prevalence of *T.gondii* in birds with good environment was (0.56%). 77 samples were collected from birds with bad environment and all of them were negative. The different was not significant (P-value=0.458) (Table 9).

Prevalence of T .gondii according to the contact with other animals

The prevalence of *T. gondii* in birds from farms free from other animals was 0.28%.The prevalence of *T. gondii* in farms and houses with presence of other animals was 0.28%.The different was not significant (P-value=1.257) (Table 10).

Table 3: Prevalence of *T .gondii* according to Area

Source	No. examined	No. positive (Prevalence %)	$\chi 2$	p-value
Khartoum	161	1 (0.28%)	0.619	0.734
Bahri	78	0 (0.00%)		
Omdurman	119	1 (0.28%)		
Total	358	2 (0.56%)		

Table 4: Prevalence of *T .gondii* according to sex

Sex	Negative	Positive	$\chi 2$	p-value
Female (Chicken)	327 91.34%	2 0.56%	0.177	0.981
Male (Chicken)	7 1.96%	0 0.00%		
Female (Pigeon)	14 3.91%	0 0.00%		
Male (Pigeon)	8 2.24%	0 0.00%		
Total	356 99.44%	2 0.56%		

Table 5: Prevalence of *T .gondii* according to type of test

Type of test	Result		Total
	Negative	Positive	
IgM	269 100.00%	0 0.00%	269 100.00%
IgG	87 97.75%	2 2.24%	89 100.00%

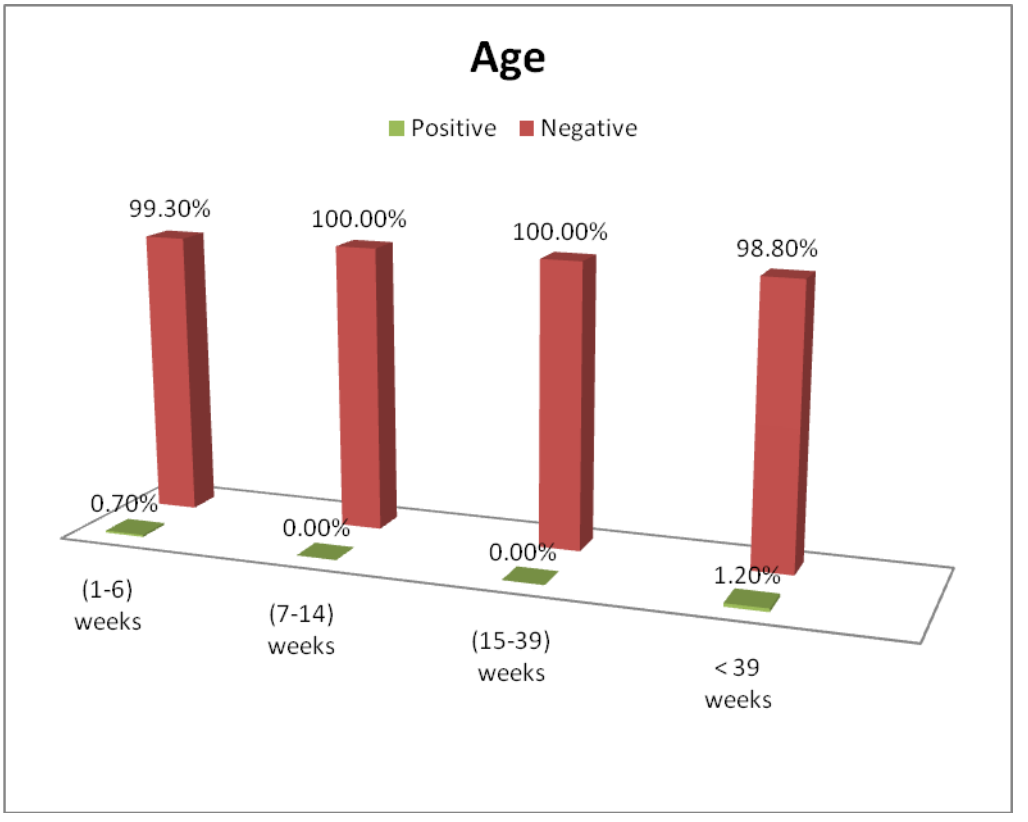

Fig. 1 Prevalence of *T .gondii* according to age

Table 6: Prevalence of *T .gondii* according to breed

Breed	No. examined	Prevalence%	χ^2	p-value
Lehman	161	0 0.00%	4.100	0.129
Hisex	161	1 0.28%		
Local	36	1 0.28%		
Total	358	2 0.56%		

Table 7: Prevalence of *T .gondii* according to type of production

Type of production	No. examined	Prevalence %	χ^2	p-value
layer	161	1 0.28%	0.052	0.974
Broiler	161	1 0.28%		
Free rangechicken	36	1 (0.28%)		
Total	353	2 0.56		

Table 8: Prevalence of *T .gondii* according to health status

Health status	No. examined	Prevalence %	χ^2	p-value
Normal	346	2 0.56%	0. 792	0. 070
Sick	12	0 0.00%		
Total	358	2 0.56		

Table 9: Prevalence of *T .gondii* according to environment

Environment	No. examined	Prevalence %	χ^2	p-value
Good	281	2 0.56%	0.458	0. 551
Bad	77	0 0.00%		
Total	358	2 0.56		

Table 10: Prevalence of *T .gondii* according to contact with other animals

Contact with other animals	No. examined	Prevalence %	$\chi 2$	p-value
No	280	1 0.28%	1.257	0. 262
Yes	78	1 0.28%		
Total	358	2 0.56		

Discussion

Toxoplasma gondii is a parasitic protozoon whose life cycle includes a definite and an intermediate host, besides a wide range of mammals also birds are suitable intermediate hosts (Bangoura *et al.,* 2011). Various species of domestic and wild poultry, including chickens (*Gallus domesticus*) are infected with toxoplasmosis (Dubey *et al*., 2007).

This study aimed to detected *Toxoplasma gondii* antibodies in chickens (Layer and boiler), free rang chickens and pigeons at Khartoum State by using ELISA test, the prevalence rate of infection in this investigation was 0.56% which was lower than that observed by Hussien *et al.*, (2016) who found that the prevalence rate was 100% in all types of chickens in Sudan, also this investigation was lower than that observed in other countries and that agree with Literk and Hejlcek (1993) who found a total of 1120 chickens from a commercial farm was tested and antibodies were found in 0.01% of them in the Czech Republic. Zhou *et al.,* (2012) found the prevalence rate of *T. gondii* in chickens were 7.26% among 30 chickens tested in China. The result was disagreed with Massry *et al.*, (2000) who found the prevalence of *T. gondii* antibodies chickens was 47.2% in Egypt. Also Galat (2015) found that the results of investigations seroprevalence of chicken's toxoplasmosis were 21, 95 % in Kyiv region, Ukraine. The prevalence rate was found 0.28% in broiler chicken which was disagreed with aboelhadid *et al*., (2013) who stated that *T. gondii* was detected at a rate of 9.6% in farmed chickens in Beni Suef, Egypt. Shaapan *et al.,* (2012) found that the prevalence rates of *T. gondii* in commercial farming Chickens were 68.5% in some Egyptians Governorates.

The result of this study showed that the prevalence rate was 0.28% in free range chickens which disagreed with Aboelhadid *et al*., (2013) who stated that *T. gondii* was detected at a rate of

20% in free range chickens and Fathollah and Garedaghi (2016) who revealed that 18% of free ranging chickens positive by ELISA. Also Tilahun *et al*.,(2013) from Addis Ababa, Ethiopia, Ayinmode and Dubey (2012) from Oyo State, Nigeria and Shaapan *et al*., (2012) from some Egyptians Governorates were found that prevalence rates were higher in free range chickens 38.4%, 66% and 69.5% of *T. gondii* in free range chickens respectively.

In this study, seroprevalence of *T. gondii* was found to be 0.00% in pigeons and this disagree with Karatepe *et al.,* (2011) who found that seroprevalence of *T. gondii* was 0.95% in domestic pigeons and 0.90% in wild pigeons from Niğde in Turkey. Zhou *et al.,* (2012) found the prevalence rate of *T. gondii* in pigeons were 11.68% among 37 pigeons in China. Also Chao *et al.,* (2010) found prevalence rate of *T. gondii* in pigeons were 8.7% in Guangdong province of Southern China.

In this study, the positive samples were detected in Khartoum and Omdurman and all samples of *T. gondii* in Bahri were negative.

The distribution of *T. gondii* in birds especially free rang chickens may be related to the cats that disseminated the oocysts in the soil. Therefore *T. gondii* infection in birds is epidemiologically significant and people have the habit of eating uncooked chicken meat should be aware of the risk of encountering *T. gondii* infection. In commercial chickens, the prevalence of toxoplasmosis depends on many factors, but the important one is bad management practices especially, the access of cats to poultry farms and feeding.

Conclusion

The results revealed that *Toxoplasmagondii* was found with low prevalence in chicken in Khartoum State, Sudan. The occurrence of *Toxoplasmagondii* in chicken in chronic state highlights the presence of zoonotic *Toxoplasmagondii* in Sudanese chickens.

Recommendation

Further research on *Toxoplasmagondii in* chickens in Sudan are needed to clarify the epidemiology of the disease.

References

Aboelhadid, S. M., Ab del-Ghany, A. E., Ibrahim, M. A. and Mahran, H. A. (2013). Seroprevalence of *Toxoplasma gondii* Infection in Chickens and Humans in Beni Suef, Egypt. Glob. Vet., 11 (2): 139-144.

Ayinmode, A. B. and Dubey, J. P. (2012). *Toxoplasma gondii* infection in free-range chicken:Mini-review and seroprevalence studyin Oyo state, Nigeria.Afr. J. Biomed. Res., 15(3):145-148.

Bangoura, B., Zoller, B. and Daugschies, A. (2011). Prevalence and relevance of avian *Toxoplasma gondii* infections in Europe, Tierarztl. Wochenschr., 124(11-12): 96-485.

Calnek, B. W., Barnes H. J. B., Eard C. W., Medoughlad, L. P. and Saif, Y. M. (1977). Diseases of poultry 10thed. Editorial board for Amme Association Avian Pathologist, 907-911.

Chao Yan, C. L., Yue, S. B., Qiu. Xing Quan Zhu. (2010). Seroprevalence of *Toxoplasma gondii* infection in domestic pigeon (*Columba livia*) in Guangdong Province of southern China, Vet. Parasitol., 177(3-4):371-3.

Dubey, J. P. (2010). *Toxoplasma gondii* infections in chickens (*Gallus domesticus*): prevalence, clinical disease, diagnosis and public health significance. Zoonoses Public Health, 57:60–73.

Dubey, J. P. and Beattie C. P. (1988). Taxoplasmosis of animal and man. CRC Press, Boca Raton, Fl: 1-220.

Dubey, J. P., Goodwin, M. A., Ruff, M. D., Kwok, O. C. H.; Shen, S. K.; Wilkins, G. C. and Thulliez, P.(1994). Experimental toxoplasmosis in Japanese quail. Vet. Diagn. Invest., 6:216-221.

Dubey, J. P., Nagel-Kohl U., Thoms, B., Bötcher, L., Kühne, M. andSchares, G. (2011). Serological survey and risk factors for *Toxoplasma gondii* in domesticducks and geese in Lower Saxony, Germany. Vet. Parasitol., 182:140–149.

Dubey, J. P., Webb, D. M., Sundar, N., Velmurugan, G.V., Bandini, L. A. and Kwork, O. C. (2007). Endemic avian toxoplasmosis on a farm in Illinois: Clinical disease, diagnosis, biologic and genetic characteristics of *Toxoplasma gondii* isolates from chickens (*Gallus domesticus*), and a goose (*Anser anser*). Vet. Parasitol., 148:207-212.

Fathollah, Z. M. and Garedaghi, Y. (2016). Seroprevalence of Toxoplasmosis in Free Range chickens in Tabriz area of Iran by using ELISA test. NaturalScience and Discovery, 2(1): 20-23.

Galat, M. (2015). The main aspects of spreading of the *Toxoplasma gondii* agent among chickens in Kyiv region are presented in this article. National University of Life and Environmental Sciences of Ukraine, 18(6):151.

Hussien, M. O., Alfaki, S. H. and El Hussein, A. M. (2016). *Toxoplasma gondii* infection in chickens (*Gallus domesticus*) of Sudan. Int. J. infect. In press: e40312.

Jacobs, L., Melton, M. L. and Cook, M. (1953). Experimental toxoplasmosis in pigeons. Exp. Parasitol., 2: 403-416.

Karatepe, M., Kılıç, S., Karatepe, B. and Babü, B. (2011). Prevalence of *Toxoplasma gondii* Antibodies in Domestic (*Columba livia domestica*) and Wild (*Columba livia livia*) Pigeons in Niğde region, Turkey. Turkiye Parazitol. Derg,35: 23-26.

Literak, I. and Hejlíček, K. (1993). Incidence of *Toxoplasma gondii* in population of domestic birds in the Czech Republic. Avian Pathol., 22(2): 275-281.

Loss, S. R., Will, T. and Marra, P. P. (2013). The impact of free-ranging domestic cats on wildlife of the United States. Nat. Commun., 4:1396.

Massry, A., El-Mahdy., Ghaysh, A. E. l. and Dubey J. P. (2000). Prevalence of *Toxoplasma gondii* Antibodies in Sera of Turkeys, Chickens, and Ducks from Egypt. J. Parasitol., 86(3): 627-628.

Shaapan, R., Barakat, A., Salem, L., El-Newishy, A. and El-Mahllaw, E. (2012). Zoonotic Chicken Toxoplasmosis in Some Egyptians Governorates. Pak. J. Biol. Sci.,15(17): 821-826.

Smith, J. E. and Reduck, N. R. (2000). *Toxoplasma gondii* strain variation and pathogenicity. In: Cary, J. W., Linz, Bhatnagar, B. CEDs, Microbial food borne diseases: Mechanisms of pathogenesis and toxin synthesis. Technnomic publishing, Lancaster, PA: 405-431

Tilahun, G., Tiao, N., Ferreira, L. R.;Choudhary, S., Oliveira S., Verma, S. K., Kwok, O. C., Molla, B., Saville, W. J., Medhin, G., Kassa, T., Aleme, H., Gebreyes, W. A., Su, C. and Dubey, J. P. (2013). Prevalence of *Toxoplasma gondii* from free-range chickens (Gallus domesticus) from Addis Ababa, Ethiopia. J. Parasitol., 99(4):740-1.

Zhou, D. H., Cong, W., Si-Yang Huang1, S. Y., Jun Xu1, M., Wu1, S. M., Yan, C., Zhao, Q., Hui-Qun Song1, H. Q., and Xing-Quan Zhu1, X. Q. (2012), First report of *Toxoplasma gondii* infection in market-sold adult chickens, ducks and pigeons in northwest China. Cong et al. Parasites & Vectors, 5:110.

Zia-Ali, N., Keshavarz-Valian, H., Rezaian, M., Khorramizadeh, M. R., Kazemi, B., Fazaeli, A. and Darde, M. (2005). Molecular characterization of *Toxoplasma gondii* from bird hosts. Iranian J. Publ. Health, 34(3): 27-30.