

# The First Report on Sero-Prevalence of *Toxoplasma gondii* in Working Horses and Donkeys in the Sudan

Shadia Mohamed Ahmed<sup>1</sup>, Abdalla Mohamed Ibrahim<sup>1</sup>, Nabaa Kamal Alshafie<sup>1</sup>, Rabab Haroun Mohammed<sup>1</sup>, Ahmed Ali Ismail<sup>2</sup> and Tamador Elkhansa Elnour Angara<sup>3</sup>

1. College of Veterinary Medicine, University of Bahri, Khartoum 11111, Sudan

2. College of Veterinary Medicine, Sudan University of Science and Technology (SUST), Khartoum 11111, Sudan

3. College of Science and Technology of Animal Production, Sudan University of Science and Technology (SUST), Khartoum 11111, Sudan

Received: September 1, 2013 / Accepted: November 6, 2013 / Published: December 30, 2013.

**Abstract:** A serological survey of *Toxoplasma gondii* was conducted using LAT (Latex Agglutination Test) on 205 sera collected from working horses and donkeys in Khartoum State, Sudan. The overall sero-prevalence of the investigated equines was 32.7%. Antibodies to *T. gondii* were found in 38% of 100 horses and 27.6% of 105 donkeys. The titers were 1:2 (4 heads), 1:4 (11 heads), 1:8 (13 heads), 1:16 (17 heads), 1:32 (5 heads), 1:64 (10 donkeys) and 1:128 (7 donkeys). Neither the area nor animal species showed significant differences between the investigated groups. However, age was reported to show significant ( $P < 0.05$ ) effect on equine toxoplasmosis in the Sudan. This is the first report on equine toxoplasmosis in the Sudan.

**Key words:** *Toxoplasma gondii*, equines, sero-prevalence, latex agglutination test, Sudan.

## 1. Introduction

The zoonotic protozoan parasite, *Toxoplasma gondii* are widely prevalent in humans and animals on all continents including equines [1-3]. However, very few data is available about the prevalence of toxoplasmosis in Sudanese man [4] and animals [5-8] where equines are not included. The present paper is a part of research project on animal toxoplasmosis in the Sudan as the main source of human toxoplasmosis [6]. The aim of this work is to raise up the awareness of Sudanese on the socio-economic and the public health importance of pets, food and working animals in the epidemiology of human toxoplasmosis which lack data in the country.

Equines in the Sudan are mainly horses and donkeys. Horses accounts to 784.5 thousand and donkeys are approximately 7.5 million head.

---

**Corresponding author:** Abdalla Mohamed Ibrahim, M.Sc., lecturer, research field: veterinary medicine. E-mail: abdallami79772@gmail.com.

Infections due to *Toxoplasma gondii* have been reported worldwide in many mammalian species including horses and donkeys [1, 9, 10]. There are no reports of *T. gondii* infection in equids in the Sudan. The main goal of the present work is to study the seroprevalence of *Toxoplasma gondii* antibodies in working equines in the Sudan for the first time. This may increase the importance of scientific research for more epidemiological data on human toxoplasmosis in the Sudan.

## 2. Materials and Methods

**Area:** The study area was the three districts of the Khartoum State including Khartoum, Omdurman and Khartoum North.

**Animals:** The study population encompassed 205 equines including 100 heads of horses and 105 heads of donkeys. All of the investigated animals were male adult working animals with age ranging from 3 to 26 years.

Samples: Blood samples were obtained from the jugular vein of 100 horses and 105 working donkeys in the Khartoum State, Sudan between January and July, 2013. Blood was transported to Parasitology Laboratory, College of Veterinary Medicine, University of Bahri. For each sample, serum was removed from clotted blood and stored at -20 °C until tested. Initially sera were examined for anti-*T. gondii* qualitatively in the LAT based on the manufacture (Spinreact, S.A./S.A.U, Spain) instructions. Sera with positive or doubtful reactions were then diluted twofold serially (1:2 up to 1:128).

Data analysis: Data was analyzed using the statistical package for social sciences (SPSS) version 17.0. A *P*-value less than 0.05 were considered statistically significant.

### 3. Results

The overall sero-prevalence of *T. gondii* in equines:

Antibodies to *T. gondii* were found in 67 heads out of 205 (32.7%) animals with titration ranging from 1:2 (3 horses and 1 donkeys), 1:4 (7 horses and 4 donkeys), 1:8 (9 horses and 4 donkeys), 1:16 (16 horses and 1 donkey), 1:32 (3 horses and 2 donkeys), 1:64 (10 donkeys) and 1:128 (7 donkeys). There was no significant difference (*P* > 0.05) between the two groups of the investigated animals (Table 1).

As shown in Table 2, the prevalence of toxoplasmosis was found to be more in the younger (3-10 years) animals (*P* < 0.05) compare to oldest animal groups (11-18 or 19-27 year old). However, there were no significant differences (*P* > 0.05) between the three districts of the investigated area (Table 3) or between the two animal groups (Table 1).

Detection of antibodies against *T. gondii* in horses:

Antibodies to *T. gondii* were found in 38 heads out of 100 (38%) horses. The titers were 1:2 (3 horses),

**Table 1** Detection of antibodies to *Toxoplasma gondii* using latex agglutination test in Sudanese working horses and donkeys in Khartoum State, Sudan.

Animals	Tested samples	Positive (%)	Distribution of specific antibody titres to <i>Toxoplasma gondii</i> positive reaction (%)							Negative (%)
			1:2	1:4	1:8	1:16	1:32	1:64	1:128	
Horses	100	38 (38)	3 (7.9)	7 (18.4)	9 (23.7)	16 (42.1)	3 (7.9)	0 (0.0)	0 (0.0)	62 (62)
Donkeys	105	29 (27.6)	1 (3.4)	4 (13.8)	4 (13.8)	1 (3.4)	2 (6.9)	10 (34.5)	7 (24.1)	76 (72.38)
Total	205	67 (32.7)	4 (6)	11 (16.4)	13 (19.4)	17 (25.4)	5 (7.5)	10 (14.9)	7 (10.4)	138 (67.3)

Not significant at *P* < 0.05.

**Table 2** The effect of age on equine toxoplasmosis in the Khartoum State, Sudan.

Age/Year	Tested	Positive (%)	Distribution of specific antibody titres to <i>Toxoplasma gondii</i> positive reaction (%)							Negative (%)
			1:2	1:4	1:8	1:16	1:32	1:64	1:128	
3-10*	162	50 (30.9)*	3 (6.0)	8 (16.0)	10 (20.0)	12 (24.0)	4 (8.0)	8 (16.0)	5 (10.0)	112 (69.1)
11-18*	36	17 (47.2)*	1 (5.9)	3 (17.6)	3 (17.6)	5 (29.4)	1 (5.9)	2 (11.8)	2 (11.8)	19 (52.8)
19-27*	7	0 (0.0)*	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	7 (100)
Total	205	67 (32.7)	4 (6.0)	11 (16.4)	13 (19.4)	17 (25.4)	5 (7.5)	10 (14.9)	7 (10.4)	138 (67.3)

\* Significant at *P* < 0.05.

**Table 3** Sero-prevalence of equine toxoplasmosis in the three districts of the Khartoum State using latex agglutination test.

District	Tested	Positive (%)	Distribution of specific antibody titres to <i>Toxoplasma gondii</i> positive reaction (%)							Negative (%)
			1:2	1:4	1:8	1:16	1:32	1:64	1:128	
Khartoum	63	21 (33.3)	2 (9.5)	4 (19.1)	5 (23.8)	6 (28.6)	2 (9.5)	1 (4.8)	1 (4.8)	42 (66.7)
Omdurman	70	23 (32.9)	1 (4.3)	3 (13.0)	1 (4.3)	7 (30.4)	2 (8.7)	9 (39.1)	0 (0.0)	47 (67.1)
Khartoum North	72	23 (31.9)	1 (4.3)	4 (17.4)	7 (30.4)	4 (17.4)	1 (4.3)	0 (0.0)	6 (26.1)	49 (68.1)
Total	205	67 (32.7)	4 (6.0)	11 (16.4)	13 (19.4)	17 (25.4)	5 (7.5)	10 (14.9)	7 (10.4)	138 (67.3)

Not significant at *P* < 0.05.

1:4 (7 horses), 1:8 (9 horses), 1:16 (16 horses) and 1:32 (3 horses).

Detection of antibodies against *T. gondii* in donkeys:

Antibodies to *T. gondii* were found in 29 heads out of 105 (27.6%) donkeys with titration ranging from 1:2 (1 donkey), 1:4 (4 donkeys), 1:8 (4 donkeys), 1:16 (1 donkey), 1:32 (2 donkeys), 1:64 (10 donkeys) and 1:128 (7 donkeys). As presented in Table 1, the donkey showed higher titration (1:128) than horses (1:32).

#### 4. Discussion

In the present study Latex agglutination test was used to detect the seroprevalence of *Toxoplasma gondii* in Sudanese equines. The uses of different serological tests for *Toxoplasma gondii* in equines have been made in several countries with prevalence rate ranging from 6.9% to 65.6% [1, 9, 10]. The prevalence rate in this study was 32.7%. The result of horses (38%) in our work is consistent with the findings of Egyptian (38.1%) horses [7] and higher than the American (6.9%) one [9]. However, the prevalence in Sudanese donkeys (27.6%) was lower than that reported in Egypt (65.6%) by Ref. [6]. That is may be due to different serological tools used. In the present study, donkeys showed lower prevalence (27.6%) than horses (38%), however, their sera recorded higher antibody titration (up to 1:128 (24.1%)), while 1:32 was the highest titration recorded from only 3 horse (7.9%) sera. The higher titration reported in our investigated donkeys compare to investigated horses may reflect that horses are more resistant to toxoplasmosis [11, 12].

Younger (3-10 years old) animals were found to be more susceptible significantly ( $P = 0.028$ ) to toxoplasmosis in this study. This may be just because (79%) of the working donkeys and horses tested in this work were within this age. Moreover, age effect was rarely reported in seroprevalence of human and other animal toxoplasmosis [13-15].

#### 4. Conclusion and Recommendations

It was concluded that, similar to other livestock [5-8], equines in the Sudan are widely infected with *T. gondii*. Additional study using various serological tests is recommended for accurate assessment of equine toxoplasmosis in the Sudan. Moreover, clinical cases of equine toxoplasmosis are recommended to be investigated as well as the role of equines in the epidemiology of human toxoplasmosis in the country.

#### Acknowledgment

The authors would like to thank Miss Reem Moaz for unlimited laboratory work assistance.

#### References

- [1] A. El-Ghaysh, Seroprevalence of *Toxoplasma gondii* in Egyptian donkeys using ELISA, *Veterinary Parasitology* 80 (1998) 71-73.
- [2] E.A. Innes, Neosporosis and toxoplasmosis in farmed livestock: Options for control, in: *Proceedings of European Buiatrics Forum, Palias de Faro, Marseille, France, November 16-18, 2011.*
- [3] R.M. Shaapan, A.M. Fathia Khalil, Evaluation of different *Toxoplasma gondii* isolates as antigens used in modified agglutination test for detection of toxoplasmosis in camels and donkeys, *American Eoropean J. Agric. & Environ. Sci.* 3 (6) (2008) 837-841.
- [4] A.B. Siddig, Study on toxoplasmosis in humans and cats in the Red Sea State, Sudan, M.Sc. Thesis, SUST, 2010.
- [5] E.A. Elamin, S. Elias, A. Dausgies, M. Rommel, Prevalence of *Toxoplasma gondii* antibodies in pastoral camels (*Camelus dromedarius*) in the Butana plains, mid-Eastern Sudan, *Veterinary Parasitology* 43 (3-4) (1992) 171-175.
- [6] A.M. Ibrahim, A.A. Ismail, Tamador E.E. Angara, M.O. Osman, Sero-prevalence of *Toxoplasma gondii* in farm animals in Khartoum state, Sudan, in: *Proceedings of ICOPHAI Conference, Brazil, August 14-17, 2013.*
- [7] M.K. Khalil, I.E. Elrayah, Seroprevalence of *Toxoplasma gondii* antibodies in farm animals (camels, cattle and sheep) in Sudan, *Journal of Medicine and Animal Health* 3 (3) (2011) 36-39.
- [8] E.A. Zain Eldin, S.E. Elkhawad, H.S.M. Kheir, A serological survey for *Toxoplasma* antibodies in cattle, sheep, goats and camels (*Camelus dromedaries*) in the Sudan, *Rev. Elv. Med. Vet. Pays Trop.* 38 (3) (1985) 247-249.

- [9] J.P. Dubey, P. Thulliez, S. Romand, O.C. Kwok, S.K. Shen, H.R. Gamble, Serological prevalence of *Toxoplasma gondii* in horses slaughtered for food in North America, *Veterinary Parasitology* 86 (4) (1999) 235-238.
- [10] A.A. Ghazy, R.M. Shaapan, E.H. Abdel-Rahman, Comparative serological diagnosis of toxoplasmosis in horses using locally isolated *Toxoplasma gondii*, *Veterinary Parasitology* 145 (2007) 31-36.
- [11] J.P. Dubey, C.E. Kerber, D.E. Granstrom, Serologic prevalence of *Sarcocystis neurona*, *Toxoplasma gondii*, and *Neospora caninum* in horses in Brazil, *Journal of the American Veterinary Medical Association* 215 (7) (1999) 970-972.
- [12] J.P. Dubey, M.C. Venturini, L. Venturini, J. McKinney, M. Pecoraro, Prevalence of antibodies to *Sarcocystis neurona*, *Toxoplasma gondii*, and *Neospora caninum* in horses from Argentina, *Veterinary Parasitology* 86 (1) (1999) 59-62.
- [13] E. Petersen, R.B. Eaton, Control of congenital infection with *Toxoplasma gondii* by neonatal screening based on detection of specific immunoglobulin M antibodies eluted from phenylketonuria filter-paper blood spot samples, *Acta Paediatrica* 88 (432) (Supplement) (1999) 36-39.
- [14] L. Baril, T. Ancelle, V. Goulet, P. Thulliez, V. Tirard-Fleury, B. Carne, Risk factors for *Toxoplasma* infection in pregnancy: A case-control study in France, Scandinavian, *Journal of Infectious Diseases* 31 (3) (1999) 305-309.
- [15] T. Gorman, J.P. Arancibia, M. Lorca, D. Hird, H. Alcaino, Seroprevalence of *Toxoplasma gondii* in sheep and alpacas (*Llama pacos*) in Chile, *Preventive Veterinary Medicine* 40 (3-4) (1999) 143-149.