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Full Length Research Paper

Seroprevalence of *Toxoplasma gondii* antibodies in farm animals (camels, cattle, and sheep) in Sudan

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Infection with *Toxoplasma gondii* in human was increased in last years in Sudan particularly, in pregnant women. The infection may lead to devastating consequences to newborns therefore, the present study, designed to study the role of domestic animals in transmission of the disease to human. Serum samples from 200 cattle, sheep, and lactating camels from Khartoum State, Sudan were researched for *T. gondii* antibodies by latex agglutination test (LAT). Out of them, 76/200 (38%) resulted positive, being 14/70 (20%) camels, 16/50 (32%) cattle and 46/80 (57.5%) sheep serum samples. The test titration results obtained as followed: 53 (26.5%), 20 (10%), and 3 (1.5%) were 1:8, 1:16, and 1:32, respectively. From the 70 sera samples collected from camels, 14 (20%) were found positive with intensity of 12 (17.1%), 2 (2.9%), and 0 (0%) by dilution of 1:8, 1:16, and 1:32 respectively. In the 50 sera samples from cattle, 16 (32%) were positive with intensity of 10 (20%), 4(8%), and 2 (4%) by dilution of 1:8, 1:16, and 1:32, respectively. Significant among these target groups were found to be highest in sheep ($p < 0.05$). This is the first serological report regarding *T. gondii* in cattle and sheep from Sudan.

Key words: *Toxoplasma*, animals, latex agglutination test (LAT), seroprevalence, Sudan.

INTRODUCTION

Toxoplasmosis is widespread in human beings and many other warm-blooded animals. *Toxoplasma gondii* is an obligate intracellular parasite. The three means by which it is mainly spread are transplacental transmission, ingestion of infective tissues, and ingestion of food or water contaminated with infective feces (Dubey and Beattie, 1988).

The vast majority of natural *T, gondii* infections in domestic animals are subclinical. Clinical signs, when present, are generally vague and non-specific and may include a period of fever, anorexia, respiratory distress and sometimes diarrhoea. Central nervous system disorders are rarely reported. *T gondii* infection, however, is the major cause of abortion and perinatal mortality in sheep and goats (Buxton and Brebner, 1998).

Abortion and neonatal mortality occur when sheep and goats suffer a primary infection during pregnancy. Coinciding with the parasitaemia, the ewe displays a febrile response which can exceed 41°C around day six or seven. The cessation of the parasitaemia coincides with the onset of an effective maternal immune response. With the exception of the gravid uterus, the infection then persists as bradyzoites within tissue cysts.

In pregnant ruminants, the gravid uterus is an immunologically privileged site. On the uterine side, maternal immunological responses are locally sup-pressed, while the ability of the fetus, with its placenta, to recognize and respond to a pathogen such as *T. gondii* commences during the first half of gestation and develops for the reminder of pregnancy, so that fetal lambs become immunocompetent by the time they are born. During maternal parasitaemia, tachyzoites are able to parasitize the carunclar septa, invade the adjacent trophoblast cells of the fetal villi, and from there the rest of the fetus, between five to ten days after the onset of parasitaemia (Buxton and Brebner, 1998).

The ocular form of toxoplasmosis in animals has been studied in experimental animals to appreciate the patho-genesis of human ocular toxoplasmosis. The presence of tissue cysts in the retinas of mice experimentally infected

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as adults, and also in mice which were congenitally infected with the parasite (Beverly, 1961) . Experimental ocular toxoplasmosis in mice has also been studied following instillation of *Toxoplasma* into conjunctival sac (Aoki et al., 1970). In Europe and in the USA, pork has generally been considered to be a major source of *T. gondii* infection in human (Dubey, 1994). This supposition is based on the fact that tissue cysts have been found in most commercial cuts of pork (Dubey et al., 1984; Dubey et al., 1986) and on estimates for prevalence of *T.. gondii* infection in pigs that were made in the 1970s or 1980s (Dubey and Beattie, 1988).

Sheep are considered important in the epidemiology of *T. gondii* infection worldwide, but especially in Europe (Cook et al., 2000; Buxton et al., 2007). Ingestion of infected lamb serves as a direct source of infection for humans. Moreover, *T. gondii* is also an important cause of abortion in sheep world- wide.

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Cattle have high natural resistance to the parasite. *Toxoplasma gondii* causes subclinical infection in cattle (Dubey and Thulliez, 1994).

Publications are not available on the *T. gondii* in Sudanese cattle, sheep, and goats. The first study of toxoplasmosis in camels was done by El Din et al. (1985) who reported an infection rate of 54% from slaughter-camels. Bornstein and Musa (1987) accounted 22.5% by using Sabin-Feldman test. Abbas et al. (1987) reported 12% via indirect haemagglutination test. Elamin et al. (1992) in Butana plains via LAT reported 67%. Khalil et al. (2007) in three ecologically different areas reported prevalence 22.2% by using LAT. In this way, the aim of this work was to detect *T. gondii* antibodies in three different kinds of animals in Khartoum State, Sudan.

MATERIALS AND METHODS

Target animals

The main target is slaughtered animals such as sheep, all of them were males and their age is less than one year. Also cattle in slaughter house and camels from open farm round Khartoum State, Sudan.

Samples collection

A total of 200 blood samples from slaughtered animals from Kadru slaughter-house and farm around Khartoum State were collected. Blood samples of from 70 camels were collected by jugular venipuncture after they were slaughtered immediately in slaughter-houses. Separated sera and 130 slaughtered sheep and cattle were collected by jugular vein. Serum samples were stored at -20 °C.

Latex agglutination test (LAT)

Latex agglutination test Toxo-Latex ® (SPINRER EACT, S. A. Ctra. Santa coloma, Spain) was used to screen the sera basically. The TOXO-Latex reagent is a suspension of polystyrene latex particles coated with soluble *T. gondii* antigen. Latex particles allow a visual observation of the antigen-antibody reaction. If the reaction occurs, latex suspension changes and a clear agglutination becomes evident, due to the presence of *Toxoplasma* antibodies upper than 4 IU/ml.

Data statistical analysis

All data were recorded using PC computer and the statistical package for social sciences (SPSS) version 12.0 (SPSS Inc. Chicago, IL. USA) was used to analyze the data. A *p*-value less than 0.05 were considered statistically significant.

RESULTS

The total of 200 sera samples from slaughter-animals cattle, sheep, and lactating camels were collected from Khartoum State and screened using LAT, 76 (38%) were found to be positive. The test titration results obtained as followed: 53 (26.5%), 20 (10%), and 3 (1.5%) were 1:8, 1:16 and 1:32, respectively (Table 1).

An entirety of 200 sera samples from Sudanese farm animals (cattle, sheep, and lactating camels) were collected from Khartoum State and screened using latex agglutination test (LAT) . It was found that 76 (38%) sera samples were positive. The test titration results obtained as followed: 53 (26.5%), 20 (10.0%), and 3 (1.5%) were 1:8, 1:16, and 1:32, respectively (Table 1).

From the 70 sera samples collected from camels, 14 (20.0%) were found positive with intensity of 12 (17.1%) and 2 (2.9%) by dilution of 1:8, and 1:16, respectively (Table 1).

From the 70 sera samples collected from camels, 14 (20%) were found positive with intensity of 12 (17.1%), 2 (2.9%), and 0 (0%) by dilution of 1:8, 1:16 and 1:32, respectively (Table 1).

In the 50 sera samples from cattle, 16 (32%) were positive with intensity of 10 (20%), 4 (8%), and 2 (4%) by dilution of 1:8, 1:16, and 1:32, respectively (Table 1).

From the 80 sera samples from sheep, 46 (57.5%) were sero-positive with intensity of 31 (38.7%), 14 (17.5%), and 1 (1.3%) by dilution of 1:8, 1:16, and 1:32, respectively (Table 1).

In the 50 sera samples from cattle, 16 (32.0%) were positive with intensity of 10 (20.0%), 4 (8.0%), and 2 (4.0%) by dilution of 1:8, 1:16, and 1:32, respectively (Table 1).

From the 80 sera samples from sheep, 46 (57.5%) were

Table 1. The detection of antibodies to *Toxoplasma gondii* by latex agglutination test in Sudanese sheep, cattle and camels in Khartoum State.

Target group	Number of examined sera samples	Number of positive sera samples total positive (%)	Distribution of specific antibody titres to *Toxoplasma gondii* positive reaction			Number of negative samples reaction
			1:8 (%)	1:16 (%)	1:32 (%)	1:4 (%)
Sheep*	80	46 (57.5)*	31 (38.7)	14 (17.5)	1 (1.3)	34 (42.5)
Cattle	50	16 (32.0)	10 (20.0)	4 (8.0)	2 (4.0)	34 (68.0)
Camels	70	14 (20.0)	12 (17.1)	2 (2.9)14	0 (0.0)	56 (80.0)
Total	200	76 (38.0)	53 (26.5)	20 (10.0)	3 (1.5)	124 (62.0)

* Significant of the disease observed in sheep ($p < 0.05$).

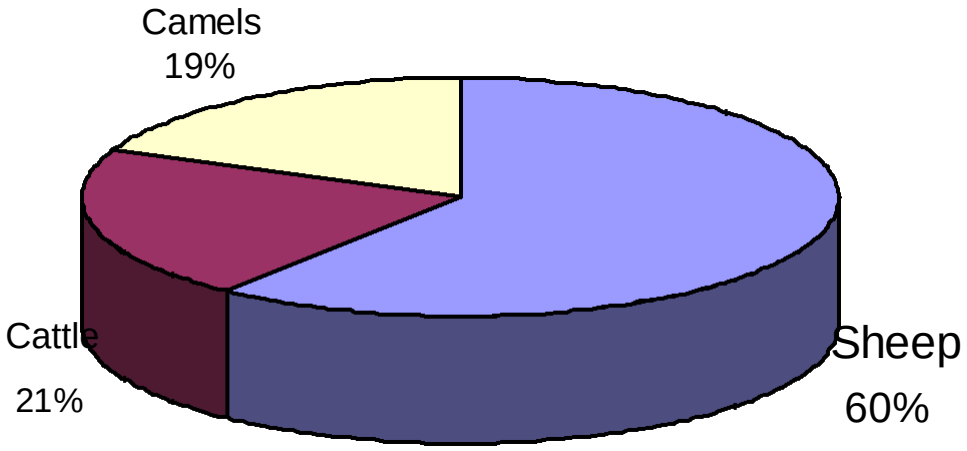

Figure 1. Sero-positivity of *T. gondii* among animal target group using LAT.

sero-positive with intensity of 31 (38.7%), 14 (17.5%), and 1 (1.3%) by dilution of 1:8, 1:16, and 1:32, respectively (Table 1).

According to results obtained, sheep in Sudan have high susceptibility to infection by *T. gondii* and the results confirm that. significant among these target groups were found to be highest in sheep as shown in ($p < 0.05$) Figure 1.

DISCUSSION

Animal species for this study were chosen according to their role in human life in Khartoum State, Sudan. Cattle were the main source of meat, sheep was exported but their viscera were common protein particularly among those who eat raw meat or to the deprived people. Cameline unboiled milk or raw liver are consume by nomads around Khartoum State. People in Khartoum State are not recognized as consumer of goats' meat, few people consume the goats' milk after boiling, and therefore, the goats were excluded from this study.

The differences in prevalence of toxoplasmosis in different animal species may be explained by differences in susceptibility to infection (Dubey and Frenkel, 1976; Fayer, 1981). This is of present particular importance, because tissue cysts have been established in many edible parts of sheep (Dubey and Kirkbride, 1989; Lunden and Uggla, 1992). The difference of prevalence rates around the world might be due to serological methods used or difference of breed or difference of sex. The toxoplasmosis in camels was studied in India by dye test (DT), indirect heamoagglutination test (IHAT) and reported 11.1 and 10.8% (Gill and Prakash, 1969), respectively . In Egypt, reported 27.9% (Michael et al., 1977). In Saudi Arabia, reported 16% by using IHAT (Hussein et al., 1988) all of the aforementioned results was matched with the results obtained in this study, this matching may be due to the similar environment conditions and the small different in figures may be due to different tests used.

In Arab area, the prevalence was 2% in Saudi Arabia using IHAT (EL-Metenawy, 2000) to 48% in Iraq where used complement fixation test CFT (Saleem and Fatohi, 1993). In Egypt using IHAT in 1990 and obtained 21%, the later on (1997) prevalence reached 49% by the same technique (EL Ridi et al., 1990; Ibrahim et al., 1997) the variation of the results may be due to the samples

size of different studies also, the different methodology used.

The prevalence of *T. gondii* in slaughter sheep were studied in many countries, the percent were range between 3% in Pakistan using LAT (Zaki, 1995) to highest percent in Indonesia (60%) by using IHAT (Iskandar, 1998) . In Norway using ELISA recorded 18% (Skjerve et al., 1996). In Saudi Arabia, Egypt, and Djibouti where using IHAT, the prevalence 39% in Saudi Arabia (Amin and Morsy, 1997), in Egypt 29% (EL Ridi et al., 1990), and 10% in Djibouti (Chantal et al., 1994).

This variation of infection among different species may be according to immunity of different species. The study gives preliminary information about the disease in different species of domestic animals in Sudan.

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