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RESEARCH ARTICLE

Seroprevalence of *Toxoplasma gondii* antibodies in sheep from Libya

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Abstract

Toxoplasmosis is a worldwide contagious disease of humans and other warm-blooded animals including birds caused by coccidian parasite *Toxoplasma gondii*. This survey was carried out to show the prevalence of antibodies of *T. gondii*in sheep by latex agglutination test (LAT) in different geographical areas in Libya (western area, central area, eastern area, and southern area). The results of this survey are showed that the overall seroprevalence of antibody of *Toxoplasma* is 71%. There was significant differences in infection to *Toxoplasma gondii* in the age group of sheep (P = 0.00). The prevalence of anti-*Toxoplasma* antibody in sheep in the <1 years old was higher than >1 years old sheep. The results showed that there was a significant relation between the seropositivity and presence of abortion in sheep (P = 0.000). Also a significant differences was observed between rate of infection and management system (Extensive and Intensive) of sheep (P =0.022). In total the results of this study together with the previously recorded show high seroprevalence in sheep in Libya and other countries support the impression that Toxoplasmosis is widespread cause for abortion and a latent infection in sheep. Furthermore sheep are suitable host for *Toxoplasma gondii*.

Introduction

Toxoplasmosis is a worldwide contagious disease of humans and other warm-blooded animals including birds. Clinically it is manifested chiefly by abortion and stillbirths in ewes, and in all species by encephalitis, pneumonia and neonatal mortality (Arthur et al., 1992; Khan et al., 2006; Radostitis, 1994).

Infection by the protozoan parasite *T. gondii* is widely prevalent in sheep throughout the world. Clinically, ovine toxoplasmosis does not cause any symptoms, but in non-immune ewes an infection acquired during pregnancy may spread to the placenta and fetus and cause abortion, stillbirth or delivery of weak, infected lambs. In non-pregnant ewes the parasites develop cysts containing dormant organisms in the central nervous system and muscle. These cysts could transmit the disease to humans by ingestion of raw or undercooked meat containing tissue cysts (Marca et al., 1996). The seroprevalence of toxoplasmosis in sheep has been reported in several parts around the world. The prevalence rates have been varied among countries and diagnostic methods from 25% to 65% (Babur et al., 1997; Dubeyand Beattie 1988).

The only documented study on *T. gondii* seroprevalence in sheep in Libya was in Tripoli (EL-Gomatiet al., 2008) who reported seroprevavlence rates of 40.71 % in adult in Tripoli- Libya, using the Latex agglutination test. The purpose of the present study was to determine the prevalence of *T. gondii* infection in adult sheep from different agro-ecological zones (Natural regions) of Libya.

Material and Methods

We divided Libya into four geographical areas (western area, central area, eastern area, and southern area).A total of 5806 blood samples were obtained from the jugular vein of sheep. These samples were collected randomly from four different geographical areas.

The blood samples were collected by veterinarians and veterinary assistants in tubes without anticoagulant directly from the jugular. The samples were transported to the research laboratory in (Libyan National Center for Diseases Control) **LNCDC** as soon as possible in an ice keeper tanks. Upon arrival, the sera were separated into micro tubes after centrifugation at 4000 rpm for 10 min. Then the micro tubes were stored at -20˚C until analysis. The sera obtained were screened for *anti-T. gondii* antibodies using the Latex agglutination test (Toxocell Latex, Biokit, Spain).

Data analysis was performed with computer software SPSS (Statistical Package for Social Science), version 15. SPSS Inc., Chicago, IL).Statistical significance was taken at P- value of ≤ 0.05.

Result

Seropositivity according to blood samples collection areas (Table 1)**:** A total of 3302, 1082, 1368 and 54 blood samples which were collected from the western, central, eastern and southern area a total of 2530 (76.6%), 554 (51.2%), 1007 (73.6%) and 29 (53.7%) were found to be seropositive for *T. gondii* infection respectively. The results showed that there was a significant relation between the seropositivity and areas of collection in sheep (P-value = 0.000).

Seropositivity according to gender of sheep (Table 2)**:** Out of 1042 male and 4764 female blood samples which were collected from the four areas of the study a total of 707 (67.9%) and 3413 (71.6%) respectively were found to be seropositive for *T. gondii* infection. The results showed that there was a significant relation between the seropositivity and gender of sheep (P- value = 0.015).

Seropositivity according to animal age (Table 3)**:** Out of 956 (<1 year), 3213 (1-3 years), 1637 3 years blood samples which were collected from the four areas of the study a total of 398(41.6%), 2572(80%), 1150(70.3%) and were found to be seropositive for *T. gondii* infection, respectively. The results showed that there was a significant relation between the seropositivity and age of sheep (P- value = 0.000).

Seropositivity according to presence of abortion (Table 4)**:** Out of 606 and 2964 blood samples which were collected from the four areas of the study with a history of abortion a total of 511(84.3%) and without a history of abortion a total of 2068(69.8%) were found to be seropositive for *T. gondii*infection. Out of 2236 blood samples which were collected from the slaughter houses of the four areas of the study a total of 1541(68.9%) were found to be seropositive for *T. gondii*infection. The results showed that there was a significant relation between the seropositivity and presence of abortion in sheep (P- value=0.000).

Seropositivity according to management system (Figure 1)**:**

Extensive management system: Out of 2257 blood samples which were collected from open areas management system of the four areas of the study a total of 1486 (65.8%) were found to be seropositive for *T. gondii* infection.

Intensive management system: Out of 1313 blood samples which were collected from herds kept outside as well as in housing of the four areas of the study a total of 1093 (83.2%) were found to be seropositive for *T. gondii* infection.

Slaughter houses: Out of 2236 blood samples which were collected from slaughter house of the four areas of the study a total of 1541 (68.9%) were found to be seropositive for *T. gondii* infection.

The results showed that there was a significant relation between the seropositivity and management system of sheep (P value = 0.022).

Table 1. Distribution of sheep seropositivity among blood samples collection areas**.**

Area of sample	The result		Total
	Positive	Negative	
Western area	2530 (76.6%)	772 (23.4%)	3302 (100.0%)

Central area	554 (51.2%)	528 (48.8%)	1082 (100.0%)
Eastern area	1007 (73.6%)	361 (26.4%)	1368 (100.0%)
Southern area	29 (53.7%)	25 (46.3%)	54 (100.0%)
Total	4120 (71.0%)	1686 (29.0%)	5806 (100.0%)

Table 2. Relation between seropositivity and gender of sheep.

Animal gender	**The result**		**Total**
	Positive	Negative	
Male	707 (67.9%)	335 (32.1%)	1042 (100.0%)
Female	3413 (71.6%)	1351 (28.4%)	4764 (100.0%)
Total	4120 (71.0%)	1686 (29.0%)	5806 (100.0%)

Table 3. Relation between seropositivity and age of sheep.

Animal age (year)	**The result**		**Total**
	Positive	Negative	
<1	398 (41.6%)	558 (58.4%)	956 (100.0%)
1-3	2572 (80.0%)	641 (20.0%)	3213 (100.0%)
>3	1150 (70.3%(	487 (29.7%)	1637 (100.0%)
Total	4120 (71.0%)	1686 (29.0%)	5806 (100.0%)

Table 4. Relationship between seropositivity and presence of abortion in sheep.

Presence of abortion	**The result**		**Total**
	Positive	Negative	
Positive	511 (84.3%)	95 (15.7%)	606 (100.0%)
Negative	2068 (69.8%)	896 (30.2%)	2964 (100.0%)
Unknown	1541 (68.9%)	695 (31.1%)	2236 (100.0%)

Total	4120 (71.0%)	1686 (29.0%)	5806 (100.0%)

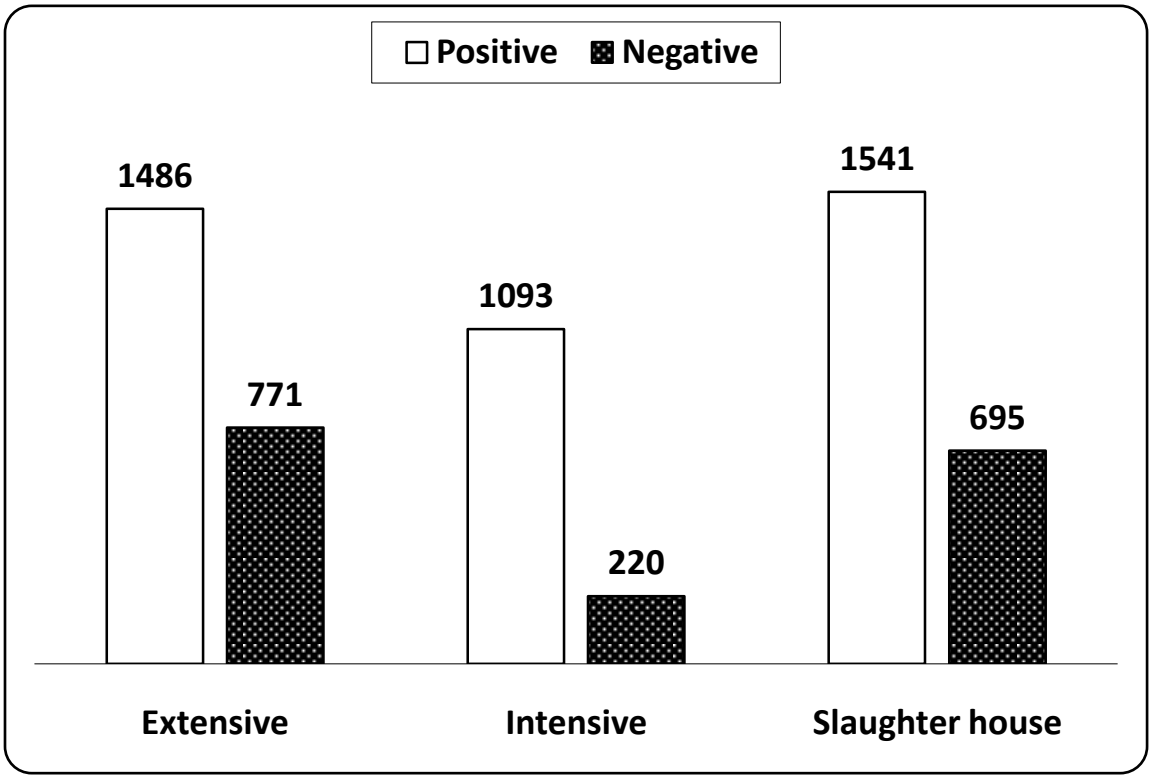

Figure 1. Showed relationship between seropositivity and management system of sheep.

Discussion

In Libya there is only one studies done which concern with the prevalence of toxoplasmosis in sheep, these study was done in Tripoli region and the results was 40.7% (El-Gomati et al., 2008).

The prevalence of *T. gondii* antibodies in sheep (71.0%) found in this study is lower than those found in USA (73.8%) which done by Dubey and Welcome (1988), In Italy the prevalence was 78% (Gaffuri et al., 2006). Also the prevalence was high as 84.5% (Klun et al., 2006), 95.7% (Mor and Arslan 2007) and 72.6% (Hamidinejat et al., 2008) in Serbia, Turkey and Iran respectively.

On the other hand our results were found to be higher than those found in Jordon (20.6%) by Harps (1993)., Djibouti and Senegal (Deconinck et al.,1996), Brazil (Gondim et al., 1999), Ghana (Van der Puije et al., 2000), Zimbabwe (Hove et al., 2001), Iran (Sharif et al., 2007), Spain (Mainar-Jaime et al., 2007), Egypt (Shaapan et al., 2008), Mexico (Alvarado-Esquive et al., 2013).

Our study showed that the western area contained the highest seroprevalence (76.6%), where the central area contained the lowest seroprevalence (51.2%). The fluctuation of the seroprevalence results might be due to the presence or absence of cats in the areas of blood collection. The climate also plays a role in *Toxoplasma* prevalence because the prevalence is higher in warm, moist weather as compared to cold, dry weather. This is due to the longer viability of *T. gondii* oocysts in moist or humid environment (Dubey 1994).

Among the 71.0% seropositivity of sheep obtained in our study, 71.6% seropositivity was found to be among females, where males had a lower seropositivity of 67.9%. This finding is similar to those found in Maroc

(Benkirane et al. 1990), Saudi Arabia (Sanad and Al-Ghabban 2007) and differs from that found in Mexico (Caballero-Ortega 2008), who observed no differences in seroprevalence between male and female sheep.

Since seroprevalence was shown to increase with age, and most sheep acquired infection before 4 years of age (Dubey and Kirkbride1989) and since most of sheep in Libya are males slaughtered at age of less than 2 years. This explains the reason for the higher seropositivity among females than among males.

Our study also showed a significantly higher seropositivity in ewes >3 years (70.3%) than that in lambs < 1 year (41.6%), this result is logical since age is a factor in seropositivity. This finding is similar to that found in Sweden (Lunde´ n et al., 1994), Chile (Gorman et al., 1999), Brazil (Figliuolo et al., 2004; Ragozo et al., 2008), France (Rozette et al., 2005; Dume` tre et al., 2007) and in Libya (El-Gomati et al., 2008)

The answers to the questions enlisted in our questionnaire showed a significant relation between the prevalence of toxoplasmosis and abortion. This finding is similar to that found in USA (Dubey and Kirkbride 1989). Germany (Steuber et al., 1995), Italy (Masala et al., 2003, 2007) and Spain (Hurtado et al., 2001). In other studies *T. gondii* has been suspected as a cause of ovine abortion in Morocco (Benkiraneet al., 1990), Egypt (Hassanain et al., 1992), Turkey (Oncel et al., 2005) and in Uruguay (Freyre et al., 1997, Savio, and Nieto 1995) based on serological tests.

The above mentioned significant association between toxoplasmosis and abortion does not mean that toxoplasmosis is the main or the only cause of abortion among sheep, there might be other causes that must be excluded, this requires further studies to be performed in Libya.

The seroprevalence of Toxoplasmosis in this study is higher in intensive management system than in extensive management system, this result is similar with that found in Uruguay (Savio, and Nieto 1995), South Africa (Abu Samra et al., 2007), Brazil (Ragozo et al., 2007; Romanelli et al.2008)

This similarity of the results is explained by the fact that in intensive management system, sheep are more exposed to the oocyst shed by cats where in extensive management system the contact with cats is more unlikely.

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