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DETERMINATION OF SEROPOSITIVITY FOR *TOXOPLASMA GONDII* IN SHEEP, GOATS AND CAMELS SLAUGHTERED FOR FOOD AND HUMAN CONSUMPTIONS IN RIYADH MUNICIPAL ABATTOIRS, SAUDI ARABIA

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Abstract

Serum samples from 891 sheep, 555 goats and 182 camels slaughtered for food and human consumption from three main municipal abattoirs in Riyadh City, Saudi Arabia were tested for antibodies to *Toxoplasma gondii* by the an indirect fluorescent antibody test (IFAT). Antibodies to *T. gondii* were found in 36.4% (325/891) sheep and 35.3% (196/555) goats and 23.6% (43/182) camels, at a dilution of 1:32 or more for goats and sheep and 1:64 or more for camels. There was no significant difference in infection between sheep, goats and camels in Riyadh City ($P>0.05$). The results indicated that *T. gondii* antibodies were wide-spread in the animal populations for human consumption and welfare, and that toxoplasmosis is a widely spread zoonotic infection in Riyadh City.

Keywords*:* Saudi Arabia, Riyadh City, *Toxoplasma gondii*, Sheep, Goats, Camels, zoonosis, IFAT.

Introduction

Toxoplasmosis is an increasing zoonosis of worldwide distribution concern hazards in both human health and veterinary medicine. The disease is caused by an obligate intracellular protozoan parasite called "*Toxoplasma gondii"* (Halonen and Weiss, 2013). Whilst the sexual life cycle of the parasite is confined to cats (the definitive host), the asexual cycle occurs in many warm blooded animals (Dubey and Beattie, 1988). The most common sources of human infection are ingestion of tissue cysts in raw meat or of food or water contaminated with oocysts shed by felids and transplacental transmission (Dubey and Joens, 2008; Dubey, 2010). *T. gondii* infections in the domestic animals are subclinical. Clinical signs, when present, are generally vague and nonspecific and may include a period of fever, anorexia, respiratory distress and sometimes diarrhea, however, the disease is major cause of abortion and perinatal mortality in the sheep and goats (Buxton and Brebner, 1998; Hill and Dubey, 2013).

In Saudi Arabia, the sheep, goats and camels populations after the Ministry of Agriculture (2011) were more than 8.5 million. Besides, more than 5 mil-

lion are imported of live sheep, goats and camels annually from several countries such as Sudan, Ethiopia, Brazil, Argentina, Romania and Turkey for meat, and animal products. In the last two or three years, there have been several storms of abortions and still-births in commercial farms in Riyadh area consistent with toxoplasmosis (Hussein *et al*, 2011).

The aim of this work was to determine *T. gondii* antibodies in edible animals from three different zones in Riyadh City, from September 2012 to June 2013 using indirect fluorescent antibody test (IFAT).

Materials and Methods

Riyadh City is the Capital with geographical position at latitude 34°-38° north and longitude 43°-46° east, about 3,024 km^2 and inhibited by approximately five million persons. Riyadh region has very hot summer up to 50°C or more with an average temperature of 45°C. Winter is cold with windy nights. The overall climate is arid, receiving very little rainfall of 21.4 mm with relative humidity ranging from 10% to 47% throughout the year. Riyadh region is also known to have many dust storms. Blood samples were withdrawn from jugular vein of sheep, goats and camels from the three governmental slaughter-houses in Southern, Western and Eastern of Riyadh city. A total of 1628 animals (891 sheep, 555 goats and 182 camels) were collected (Tab. 1). The blood samples were immediately transported to Parasitology Research Laboratory, Faculty of Science and Humanities, Shaqra University. Sera were separated by centrifuged at 4000 rpm for 10 min, and stored in a deep freeze at -20°C until assayed for *T. gondii* antibodies.

Sera thawed at 35°C immediately before testing for antibodies to *T. gondii* by IFAT (Voller and O'Neill, 1971). Positive serum samples showing a titer of 1:32 were further diluted to determine the end point. Titers of 1:32 or above were considered to be positive for sheep and goats and 1:64 or above for camels.

Statistical analysis*:* Data were computerized and statistically analysis using a Chi square test (SPSS Inc., Chicago, Illinois). *P*-value <0.05 was considered significant (Armitage, 1983).

Results

The seroprevalence of *T. gondii* antibodies in sheep, goats and camels within the Riyadh city was found to be 36.4%, 35.3% & 23.6%, respectively. This difference was statistically not significant according to the chi-square test ($P > 0.05$). No significant differences were indicated in seroprevalence for sheep, goats and camels from different areas of Riyadh city ($P > 0.05$).

The details are shown in table (2).

Table 1: Samples collected from three municipal abattoirs in Riyadh City.

Animal	South (Al-Azizia abattoir)	East (Al-Sa'adah abattoir)	West (Abattoir)	Total
Sheep	313	287	291	891
Goat	201	198	156	555
Camel	65	71	46	182
Total	579	556	493	1628

Table 2: IFAT-*T. gondii* antibodies in sheep, goats and camels in Riyadh City.

Abattoir location	Sheep		Goat		Camel	
	No. examined	No. +ve (%)	No. examined	No. +ve (%)	No. examined	No. +ve (%)
South	313	113 (36%)	201	86 (42.8%)	65	13 (20%)
East	287	88 (30.6%)	198	63 (31.8%)	71	19 (26.7%)
West	291	124 (42.6%)	156	47 (30.1%)	46	11 (23.9%)
Total	891	325 (36.4%)	555	196 (35.3%)	182	43 (23.6%)

Discussion

Three infectious stages of *T. gondii* were identified; tachyzoites (groups or clones), bradyzoites (tissue cysts) and sporozoites (oocysts) linked in a complex life cycle (Elsheikha *et al*, 2008).

The present results can be compared with previous studies from different provinces of Saudi Arabia. For example, the rate of *T. gondii* infection in Jeddah Municipal abattoir western of Saudi Arabia using IHAT was found to be 39% in sheep and 28% in goats (Amin and Morsy, 1997) and 52.2% in sheep and 51.7% in goats from Tabouk official abattoir north of Saudi Arabia by IFAT (Sanad and Ghabban, 2007). Al-Mohammed (2011) reported that ELISA-antibodies against *T. gondii* were 22% in sheep and 12 % in goats from Al-Ahasa District. The antibodies against *T. gondii* in camels ranged between 2% to 16% (Hussein *et al*, 1988; El-Metenawy, 2000; Al-Mohammed, 2011; Alanazi, 2011).

In the present study, IFAT was used due to highest sensitivity and specificity. Sanad and Ghabban (2007) reported 100% and 96.7%, specificity 97.1% and 96.1% and diagnostic accuracy 98.5% and 96.9% in sheep and goats respectively, as compared with LAT and IHAT. Mendonça *et al*. (2013) stated that *Toxoplasma*-IFAT-IgG with a a cutoff point of 1:64 proved highly specific and sensitive for sheep.

T. gondii infection in slaughter sheep and goats varied in many countries, the previous studies indicates that prevalence of infection among sheep was higher than that for goats (Hossain *et al*, 1987; Chantal *et al,* 1994; Zaki, 1995; Mirdha *et al,* 1995: Skjerve *et al,* 1996; Hashemi-Fresharki, 1996; Iskandar, 1998; van der Puije *et al*, 2000; Khalil and Elraya, 2011). These variations of *T. gondii* infection among sheep and goats may be due to the samples size of different studies or to the different serological methods used, also may be due to variations in sheep and goats feeding different methods of management and according to species immunity.

In the present study, the seropositivity of *T. gondii* in camel was not so high when compared with results from more or less similar environmental conditions (Rifaat *et al*, 1979). Abroad, the prevalence was 17.4% of Egyptian camels (Hilali *et al*, 1998). Khalil and Elraya (2011) found 20% of slaughter camels from Khartoum State, Sudan.

Nevertheless, the prevalence of *T. gondii* infection in the present study was lower than that (48%) reported

from Iraqi camels (Saleem and Fatohi, 1993).

In Saudi Arabia, particularly in the rural areas people are daily in direct contact with their livestock. No doubt, one of the major consequences of pregnant women becoming infected by *T. gondii* is vertical transmission to the fetus (Elsheikha and Morsy, 2009). The present results might give an explanation of the high prevalence of human infection that ranged between 21% and 49.3%. Saudi pregnant woman with miscarriage or congenital toxoplasmosis were reported by so many authors as (Shoura *et al*, 1073; Morsy and El Dasouki, 1973; 1974; 1977; Kandil *et al,* 1980; El-Hady, 1991; Abdalla *et al,* 1994; Al Ghazi *et al*, 2004; Alharthi *et al,* 2006; Al-Harthi *et al*, 2006; Tonkal, 2008; Mohammed *et al,* 2011) and even among Saudi blood donors (Sarwat *et al*, 1973; Al-Amari, 1994; Yanaza and Kumari, 1994; Makki and Abdel-Tawab, 2010**)**. Moreover, Tabbara (1990) reported ocular toxoplasmosis, which can be congenital or acquired with a variety of clinical manifestations that ranges from a subclinical course to a generalized infection with fatal outcome. On the other hand, Soliman *et al*. (1985) reported that the only avaiable drug at that time pyrimethamine had toxic effects of in albino rats.

Apart from man, El-Sebai (1991) in Qassem detected anti-*Toxoplasma* antibodies among wild rodents. Morsy *et al*. (1994) reported IHAT-antibodies against *Toxoplasma* in sera of different of rodents' species. Positivity ranged between 12.5% in the house mouse (*Mus musculus*) and 41.7% in the Norwegian rodent (*Rattus norvegicus*). The overall rate of infection was 35.6%. Al Dakhil and Morsy (1996) in the Eastern Region of the Kingdom 4/6 grey mongoose were IHAT-positive for *T. gondii* and parasites were successfully isolated by mice I.P. inoculation from one of them. Morsy *et al*. (2001) in Najran District examined 25 *Meriones rex* or king jird reported *Xeno-psylla astia, Ctenocephalides arabicus, Ornithonyssus bacoti* and tick nymphs with indices of 0.6, 1.6, 0.64 and 0.24 respectively. The ectoparasites were more on females than on males with indices of 3.8 and 2.0 respectively. The IHAT-anti *Toxoplsama* and anti-*Leishmania* antibodies showed positive reactions in 5 (20.0%) and 2 (8.0%) jirds respectively. However, neither the skin lesion nor protozoa parasites were detected in tissue smears of liver and spleen. Even more anti-*Toxoplasma* antibodies were reported in lizards (Al Sadoon and El Bahrawy, 1998).

Apart from meat, Chiari and Neves (1984) reported acute toxoplasmosis in three family members due to drinking unpasteurized goat's milk from one of five goats. Dogs in the same house showed no symptoms of toxoplasmosis but low antibody titers. Turner and Savya (1990) reported *T. gondii* in an equine placenta.

Hiramoto *et al.* (2001) found that the infectivity of cysts of the ME-49 strain of *T. gondii* was maintained in milk even after storage for 20 days at refrigerators. Cysts also survived the process of homemade cheese and storage for up to 10 days in the same conditions. They

added that milk and dairy products proved an important source in human contamination, reinforcing importance of pasteurization before processing. Santos *et al*. (2009) among 2000 female dairy cattle in 50 farms found positive IFAT in 1420 (71%) cattle, 54 (88.5%) dogs and 113 (97.4%) far-mers.

Moreover, Haridy *et al*. (2010) reported ELISA-*T. gondii* positive in the milk from 7/15 pregnant females donkeys. They added that donkey's and goat's milks have been used as good alternatives to human and bovine milk in various clinical conditions as allergy, atopy and inflammatory diseases since these type of milks possess immune-modulating capacities and release nitric oxide, a potent vasodilator endowed with antiatherogenic properties. Equine meat and milk is not accepted many countries, but accepted in others.

Conclusion

Toxoplasmosis is a common infection of man and animals with worldwide zoological and geographical distribution including Saudi Arabia. The outcome results showed that the *T. gondii* specific antibodies against sheep and goats was high and low for camels, and consequent risk of acquiring toxoplasmosis by consumption of sheep and goat meat and milk more than camels. Besides, acquired human toxoplasmosis is due to the contaminated sources such as fresh milk, home prepared cheese/sausage.

So, the health authorities must consider the integrated strategies, including efficient management measures for prevention and control *T. gondii* infection in these edible animals.

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