

## ***Toxoplasma gondii* Prevalence in Farm Animals in Dongola Area, Northern, Sudan**

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### **Abstract**

The incidence of toxoplasmosis in animals and the epidemiology of the disease were not widely studied in Sudan. The study was conducted in Dongola area, Northern Sudan for the first time.

The study was carried out to determine the seroprevalence of toxoplasmosis in sheep, goats and cattle in the study area and to identify the factors associated with prevalence of infection. The study was undertaken during the period April 2015 to November 2016 where a total of serum samples of sheep (480), goats (803) and cattle (433) were collected and tested using LAT. The prevalence of the disease in sheep, goats and cattle examined in the study area reached 39.1%, 40.0% and 19.1% respectively. The average prevalence was 34.6%.

The results revealed that the seroprevalence was significantly higher in younger ruminants (sheep and goats) than cattle and varied significantly with breed, sex and age. The local breed and females were more infected than males and adult animals showed higher prevalence than young. Also, animals with history of abortion had a seroprevalence of (66.4%) which was significantly higher than seroprevalence in animals with normal birth and animals managed under open system had a seroprevalence of (37.9%) which was significantly higher than animals under extensive management system. This study was done to highlight the significance against *T. gondii* in animals in the study area, in which the disease was not investigated before.

**Keywords:** *Toxoplasma gondii*; Toxoplasmosis; Sheep; Goats; Cattle

### **Introduction**

Toxoplasmosis is a zoonotic parasite causing infection in man and animals (Ayinmode., *et al.* 2012). The disease is caused by *Toxoplasma gondii*, which is recognized as one of the most important foodborne pathogens (Dubey 2010). It is an intracellular protozoan with a large number of intermediate hosts, including all warm blooded animals. It is essentially a disease of animals and most acquired toxoplasmosis on ovine, caprine and equine are subclinical and cattle have high natural resistance to the parasite (Dubey and Beattie, 1988). The disease is usually transmitted to human by consumption of undercooked meat that contains tissue cysts, while in animals, infection is mainly acquired by ingestion of food, water or soil that is contaminated with oocytes shed by cats [1]. According to Buxton., *et al.* [2] abortion and fetal death occur when sheep and goats are infected with *T. gondii* in the early stage of gestation, while infection in the late stage of pregnancy, have no clinical effects. The disease leads to great economic losses especially in small ruminants [3].

In Africa prevalence of *T. gondii* infection in sheep, goats and cattle is largely investigated [4]. However, in Sudan few studies have been conducted in man and animals.

**Objective of the Study**

The objective of present work was to determine the seroprevalence of the disease in sheep, goats and cattle in Dongola area, Northern Sudan.

**Materials and Methods**

**Study area**

This study was carried out from April 2015 to November 2016 in Dongola area (Hafeer, Dongla city and Shark-Alneel) in Northern Sudan. Dongola is a town 400kms north of Khartoum, situated by the river Nile.

**Animals**

The study focused on sheep, goats and cattle of different breeds, sex, age, history of abortion and system of rearing.

**Samples**

10 ml of blood were collected from Jugular vein. After clotting at room temperature, blood was centrifuged at 3000 rpm for 10 minutes and the sera were stored at -20°C until used. A total of 1716 sera including 480 sera of sheep, 803 sera of goats, 433 sera of cattle were collected (Table 1).

| Variable           | Species and number of animal sampled |      |        | Total |
|--------------------|--------------------------------------|------|--------|-------|
|                    | Sheep                                | Goat | Cattle |       |
| Total No           | 480                                  | 803  | 433    | 1716  |
| <b>Breed</b>       |                                      |      |        |       |
| Local              | 480                                  | 652  | 312    | 1444  |
| cross              | -                                    | 151  | 121    | 272   |
| <b>Sex</b>         |                                      |      |        |       |
| Male               | 164                                  | 157  | 115    | 436   |
| Female             | 316                                  | 646  | 318    | 1280  |
| <b>Age</b>         |                                      |      |        |       |
| 1 year-old         | 82                                   | 75   | 41     | 198   |
| 1 to 3 years-old   | 95                                   | 101  | 52     | 248   |
| > 3 years- old     | 303                                  | 627  | 340    | 1270  |
| <b>Pregnancy</b>   |                                      |      |        |       |
| Normal birth       | 451                                  | 728  | 412    | 1221  |
| Previously aborted | 29                                   | 75   | 21     | 69    |
| <b>Management</b>  |                                      |      |        |       |
| Extensive          | 142                                  | 201  | 94     | 437   |
| Intensive          | 338                                  | 602  | 339    | 1279  |

**Table 1:** Serum samples from different animal species.

**Serological tests**

All sera were tested using latex agglutination test (LAT) for detection of *T. gondii* antibodies.

**Latex agglutination test (LAT)**

Serum samples were tested for determination of *T. gondii* antibodies using the kit (Toxocell Latex, Biokit, S.A Barcelona, Spain). The test was considered positive when soluble toxoplasma antigen in the Latex reagent reacted with specific anti-toxoplasma antibodies present in sera giving whitish granules after 5 minutes of rotation of the slide.

**Statistical analysis**

The obtained data was computed and analyzed by using the software SPSS volume 18, M.S Excel, while the Chi squared test was calculated with the EPI info 6.04 software at 95% confidence interval. The differences were considered statically significant when  $P < 0,05$ .

**Results**

The results of serum samples from 480 sheep, 803 goats and 433 cattle, using LAT for detecting *T. gondii* antibodies showed seropositivity correlated with species, breed, sex, age, abortion and system of rearing were shown in table 2-5.

| Variables          | Number examined | LAT             |              |
|--------------------|-----------------|-----------------|--------------|
|                    |                 | Number positive | (%) positive |
| <b>Breed</b>       | 480             | 189             | 39.1%        |
| Local              | 480             | 189             | 39.1%        |
| cross              | -               | -               | -            |
| <b>Sex</b>         |                 |                 |              |
| Male               | 164             | 51              | 31.0%        |
| Female             | 316             | 138             | 43.6%        |
| <b>Age</b>         |                 |                 |              |
| < 1year-old        | 82              | 21              | 25.6%        |
| 1 to 3 years-old   | 95              | 35              | 36.8%        |
| > 3 years-old      | 303             | 133             | 43.8%        |
| <b>Pregnancy</b>   |                 |                 |              |
| Normal birth       | 451             | 172             | 38.1%        |
| Previously aborted | 29              | 17              | 58.6%        |
| <b>Management</b>  |                 |                 |              |
| Extensive system   | 142             | 37              | 26.0%        |
| Open system        | 338             | 152             | 44.9%        |

**Table 2:** Seroprevalence of *T. gondii* in sheep in Dongola area using LAT.

| Variables          | Number examined | LAT             |              |
|--------------------|-----------------|-----------------|--------------|
|                    |                 | Number positive | (%) positive |
| <b>Breed</b>       | 803             | 322             | 40.0%        |
| Local              | 652             | 267             | 40.9%        |
| cross              | 151             | 55              | 36.4%        |
| <b>Sex</b>         |                 |                 |              |
| Male               | 157             | 47              | 29.9%        |
| Female             | 646             | 275             | 42.5%        |
| <b>Age</b>         |                 |                 |              |
| < 1 year-old       | 75              | 25              | 33.3%        |
| 1 to 3 years-old   | 101             | 36              | 35.6%        |
| > 3 years-old      | 627             | 261             | 41.6%        |
| <b>Pregnancy</b>   |                 |                 |              |
| Normal birth       | 728             | 271             | 42.5%        |
| Previously aborted | 75              | 51              | 68.0%        |
| <b>Management</b>  |                 |                 |              |
| Extensive system   | 201             | 58              | 28.8%        |
| Open system        | 602             | 264             | 43.5%        |

**Table 3:** Seroprevalence of *T. gondii* in goats in Dongola area using LAT.

| Variables          | Number examined | LAT             |              |
|--------------------|-----------------|-----------------|--------------|
|                    |                 | Number positive | (%) positive |
| <b>Breed</b>       | 433             | 83              | 19.1%        |
| Local              | 312             | 63              | 20.1%        |
| cross              | 121             | 20              | 16.5%        |
| <b>Sex</b>         |                 |                 |              |
| Male               | 115             | 21              | 18.2%        |
| Female             | 318             | 62              | 19.4%        |
| <b>Age</b>         |                 |                 |              |
| < 1 year-old       | 41              | 5               | 12.1%        |
| 1 to 3 years-old   | 52              | 8               | 15.3%        |
| > 3 years-old      | 340             | 70              | 20.5%        |
| <b>Pregnancy</b>   |                 |                 |              |
| Normal birth       | 412             | 68              | 16.5%        |
| Previously aborted | 21              | 15              | 71.4%        |
| <b>Management</b>  |                 |                 |              |
| Extensive system   | 94              | 14              | 14.8%        |
| Open system        | 339             | 69              | 20.3%        |

**Table 4:** Seroprevalence of *T. gondii* in cattle in Dongola area using LAT.

| Risk factors | Variables          | Number examined | Number positive | (%) Positive | 95%CI | P-Value |
|--------------|--------------------|-----------------|-----------------|--------------|-------|---------|
| Species      | Sheep              | 480             | 189             | 39.1%        | 0.77  | 0.24    |
|              | Goats              | 803             | 322             | 40.1%        |       |         |
|              | Cattle             | 433             | 83              | 19.1%        |       |         |
|              | Total              | 1716            | 594             | 34.6%        |       |         |
| Breed        | Local              | 1444            | 519             | 35.9%        | 0.64  | 0.07    |
|              | Cross              | 272             | 75              | 27.5%        |       |         |
| Sex          | Male               | 436             | 119             | 27.2%        | 0.68  | 0.27    |
|              | Female             | 1280            | 475             | 37.1%        |       |         |
| Age          | < 1 year old       | 198             | 51              | 25.7%        | 0.24  | 0.78    |
|              | 1 to 3 year old    | 248             | 79              | 31.8%        |       |         |
|              | > 3 year old       | 1270            | 464             | 36.5%        |       |         |
| Pregnancy    | Normal birth       | 1221            | 511             | 41.8%        | 0.86  | 0.47    |
|              | Previously aborted | 125             | 83              | 66.4%        |       |         |
| Management   | Extensive system   | 437             | 109             | 24.9%        | 0.73  | 0.05    |
|              | Open system        | 1279            | 485             | 37.9%        |       |         |

**Table 5:** Risk factors related to Toxoplasmosis in sheep, goats and cattle.

## Discussion

*Toxoplasma gondii* infection in small ruminants and cattle is widely distributed in most tropical countries (Hannond, *et al.* 2014).

In the present study, the prevalence of toxoplasmosis in sheep, goats and cattle was found to be (39.1%, 40.0% and 19.1%) respectively. Our finding confirm previous studies stating that, seroprevalence of *T. gondii* was higher in small ruminants than cattle. The differences seem to be due to differences in susceptibility to infection according to species.

In sheep, seroprevalence of toxoplasmosis was found to be (39%), which is lower than that found in Khartoum, Sudan (57.5%) reported by Khalil, *et al.* [5] in Egypt (62.2%) reported by Younis, *et al.* [6], in Tanzania (67.9%) reported by Hove, *et al.* [7], in Turkey (90.9%) reported by Mor, *et al.* [8] and in Brazil (51.1%) reported by Romanelli, *et al.* [9]. Our results were similar to those obtained by Dubey, *et al.* [10] in Ghana (38.2%), Lahmar, *et al.* [11] in Tunisia (37.0%) and Davoust, *et al.* [12] in Senegal (35.3%).

Regarding goats, the study showed, for the first time, the prevalence of *T. gondii* in Sudanese goats (40.0%). This result is in close agreement with reports from Egypt (49.4%) reported by Younis, *et al.* [6], from Tunisia (35.0%) reported by Lahmar, *et al.* [11] and from Ethiopia (45.4%) reported by Negash and Tilahun [13].

Seropositivity to *T. gondii* in cattle in current study was (19.1%) which was similar to that reported in Nigeria (22.8%) by Onyich, *et al.* [14], in South Africa (20.8%) reported by Ndou, *et al.* [15] and in Zimbabwe (14.0%) reported by Schoonman, *et al.* [16].

However, it was higher when compared to those reported in cattle in Tunis (12.0%), in Tanzania (12.8%) and in Egypt (10.7%) [17]. With regard to the breed, *T. gondii* infection was significantly higher in local breed than cross breed (40.9% to 36.4%) in goats and (20.1% to 16.5%) in cattle. This result was in agreement with Van Depiujé, *et al.* [18] and Lahmar, *et al.* [11] that showed a significance difference between breeds.

This study showed that female animals were more likely to be seropositive than males (43.6% to 31.0%) in sheep, (42.5% to 29.9%) in goats and (19.4% to 18.2%) in cattle these were in agreement with those reports from Almabruk., *et al.* [19], Dubey., *et al.* [20] and Younis., *et al* [6].

We also found higher infection rates in adult animals than younger ones in sheep, goats and cattle (age > 3 years higher than of < 1 year).

This is probably due to the exposure of old animals to *T. gondii* oocysts for long period. The study showed also there were apparently increase in aborted sheep (58.6%), goats (68.0%) and cattle (71.4%) than those with normal birth (38.1%), (42.5%) and (16.5%) respectively. These results were in agreement with those of Aktas., *et al.* [21], Sevince., *et al.* [22], Hissein., *et al.* [23] and Younis., *et al* [6]. Moreover, *T. gondii* infection was significantly ( $P < 0.05$ ) higher in sheep, goats and cattle which raised under open system (44.9%, 43.5% and 20.3%) respectively than those raised in extensive system (26.0%, 28.8% and 14.8%) respectively. This result was in agreement with those obtained by Romanelli., *et al.* [9], Tzandakis., *et al.* [24] and Al-Mabruk., *et al* [19,25-30].

### Conclusion

In conclusion, the present study showed that toxoplasmosis is prevalent in sheep, goats and cattle in Northern Sudan for the first time. Breed, sex, age, abortion and management farming system play an important role in prevalence of *T. gondii* infection. Therefore, human population may stand at a greater risk of acquiring the disease.

### Research Summary

1716 blood samples were collected for this study as follows: (480) specimens from lamb (803) specimens from goats and (433) specimens from cows to detect the presence of antibodies to toxoplasmosis in the period from April 2015 to November 2016 in the northern state of Sudan for the first time. All samples were examined by Latex Agglutination Test. The results showed that the disease prevalence in animals examined in the region was (34.6%), where the disease prevalence in sheep (39.1%), in goats (40.0%) and in cows (19.1%). The study showed some factors related to the disease, as the incidence of the disease in sheep and goats is higher compared to the disease in cows and with regard to sex, the infection rate of the disease was higher in females (37.1%) than in males (27.2%) and the infection rate was also high in animals The elderly (36.5%) compared to the younger ones (less than one year 25.7%) The study also showed that the infection rate is high in aborted animals (66.4%) compared to natural birth animals (41.8%) and the incidence of this disease is higher in animals under The open breeding system (37.9%) compared to animals under the intensive breeding system (24.9%).

The study recommended that an effort be made to know the epidemiology of the disease in the region and that there is an urgent need to clarify the role of other pets in transmitting the disease to humans.

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