



Seroprevalence of *Toxoplasma gondii* in aborted goats in Kerala



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Abstract

Toxoplasmosis, is a cosmopolitan zoonotic parasitic infection prevalent throughout the world affecting all warm blooded animals and man. A total of 72 serum samples from goats belonging to the organised, unorganised and small holder farms that had aborted recently or had a history of abortion were collected from the central districts of Kerala viz., Palakkad, Thrissur and Ernakulam. The samples were subjected to indirect Enzyme Linked Immunosorbent Assay (ELISA) for the detection of IgG antibodies of Toxoplasma gondii. Factors predisposing to the prevalence of infection such as age, grazing behaviour and stage of gestation were also taken into account during the study. Out of 72 serum samples examined, 31(43 per cent) were negative, 13 (18 per cent) were weakly positive and 28 (38.88 per cent) were highly positive. A higher prevalence was noticed in goats above four years of age, in those with regular grazing behaviour and in those that had aborted in the second stage of gestation. District-wise prevalence revealed relatively higher prevalence in Ernakulam district (62.5 per cent) compared to Thrissur (56.09 per cent) and Palakkad (53.33 per cent), even though the difference was not statistically significant.

Keywords: *Toxoplasma gondii, Enzyme Linked Immunosorbent Assay, Goat, Kerala.*

Toxoplasmosis is a wide spread zoonotic protozoan parasitic infection caused by *T. gondii* capable of infecting both mammals and birds (Dubey and Beattie, 1998). Felids are the definitive host and following infection they shed oocysts in the faeces. While most of the intermediate

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hosts remain asymptomatic, toxoplasmosis is acute in sheep and goats causing resorbtion, abortion, foetal mummification and still birth (Ahmed *et al.*, 2008). Goats become infected when they feed on pastures, concentrates or drinking water contaminated with *T. gondii* oocysts. Toxoplasmosis associated abortions significantly affect the reproductive status of the goats, eventually leading to decreased production and productivity. It also poses a major threat to humans because of its zoonotic importance. Reports on the prevalence of toxoplasmosis and *Toxoplasma* associated abortions in food animals especially in goats are scarce in India, although there are a few studies on the seroprevalence of the disease in this species. Due to the significance of *T. gondii* in public health and economic points of view, there is an urgent need for early and accurate detection of the disease. This will help to map the seroprevalence among goats so that *T. gondii* contamination can be avoided. It will also help to improve the economy of farmers by containment of *T. gondii* associated abortions in goats. Therefore the present work was carried out to assess the extent of *Toxoplasma gondii* infection in aborted goats from the central districts of Kerala by ELISA.

Materials and Methods

A total of 72 serum samples from goats belonging to the organised, unorganised and small holder farms that had aborted recently or had a history of abortion were collected from the central districts of Kerala *viz.*, Palakkad, Thrissur and Ernakulam during the period from November 2019 to November 2020. Details of risk factors such as age, grazing behaviour of goats and stage of gestation were also collected to evaluate its significance on the presence of *T. gondii* antibodies. The serum samples were separated from the blood by centrifugation and stored at -20°C until further processing.

All the serum samples were subjected to indirect ELISA for the detection of IgG antibodies of *T. gondii* using a commercial ELISA kit (IDEXX Toxotest, Switzerland). ELISA results were read using spectrophotometer at 450 nm. Serum with sample to positive ratio (S/P) per cent which is equal or more than 100 per cent was considered as positive, serum with S/P per cent between 30 to 100 was considered as weakly positive and serum with less than 30 S/P per cent was considered as negative. The data was analysed statistically using Chi square test to ascertain the association of age, grazing behaviour and stage of gestation on the prevalence of *T. gondii* in goats.

Results and Discussion

Among the 72 serum samples examined, 31 (43 per cent) were found negative for the presence of *T. gondii* antibodies, whereas 13 (18 per cent) were weakly positive, and 28 (38.88 per cent) were detected to be highly positive for the presence of *T. gondii* specific antibodies (Table 1). The overall seroprevalence was determined to be 56.94 per cent. This is in accordance with the findings of Syamala and Devada (1999) who also recorded, 58.16 per cent seroprevalence in goats of Kerala.

A highly significant difference ($p < 0.01$) was noticed in the prevalence of *T. gondii* antibodies in goats above four years of age when compared to those of other age groups (Table 2). Thus it was inferred that the prevalence of *T. gondii* antibodies increased with increase in age. The ELISA results were in accordance with the study of Figueiredo *et al.* (2001), Figliuolo *et al.* (2004), Cavalcante *et al.* (2008), Kamani *et al.* (2010), Balea *et al.* (2012) and Hareendran (2017), who reported more number of animals above four years of age to be seropositive to *T. gondii* antibodies when compared to other age groups. This could be due to the continuous

Table 1. Seroprevalence of *T. gondii* in aborted goats by ELISA

Samples examined	Seronegative		Weakly seropositive		Seropositive	
	Number	Percentage	Number	Percentage	Number	Percentage
72	31	43	13	18	28	38.88

Table 2. Age-wise seroprevalence of *T. gondii*

Age(in years)	No. of samples examined	Seronegative		Weakly Seropositive		Seropositive		p value
		No.	%	No.	%	No.	%	
<2 year	20	18	90	1	5	1	5	0.000*
2-4 years	28	8	28.57	9	32.14	11	39.28	
>4 years	24	5	20.83	3	12.5	16	66.66	
Total	72	31	43	13	18	28	38.88	

*Highly significant ($p < 0.01$)**Table 3. Seroprevalence of *T. gondii* in goats related to grazing**

Grazing behaviour	No. of samples examined	Seronegative		Weakly seropositive		Seropositive		p value
		No.	%	No.	%	No.	%	
Regular grazing animals	58	21	36.20	11	18.96	26	44.82	0.046*
Non grazing animals	14	10	71.42	2	14.28	2	14.28	
Total	72	31	43	13	18	28	38.88	

*Significant difference ($p < 0.05$)**Table 4. Seroprevalence of *T. gondii* based on the stage of gestation**

Stage of gestation	No. of samples examined	Seronegative		Weakly seropositive		Seropositive		p value
		No.	%	No.	%	No.	%	
First stage (<2months)	22	8	36.36	6	27.27	8	36.36	0.000*
Second stage (2 to 3 months)	28	4	14.28	4	14.28	20	71.42	
Third stage (4 months and still birth)	22	19	86.36	3	13.63	0	0	
Total	72	31	43.05	13	18.05	28	38.88	

* Highly significant ($p < 0.01$)**Table 5. District - wise seroprevalence of toxoplasmosis**

District	No. tested	No. positive	% positive	p value
Thrissur	41	23	56.09	0.9*(ns)
Palakkad	15	8	53.33	
Ernakulam	16	10	62.5	

(Not significant - $p > 0.05$)

and prolonged exposure of aged animals to oocysts of *T. gondii* in the environment over the years. Repeated exposure from soil, feed and fodder results in the development of antibodies in the serum with high titres. Sharif *et al.* (2006) opined that the prevalence of toxoplasmosis in aged animals could be due to the browsing behaviour of goats. Goats generally browse the top of the grass and shrubs rather than taking the lower parts of the plants.

During the present study, positive correlation was observed between the prevalence of *T. gondii* antibodies in the serum samples of goats and their grazing habits. Out of 58 regular grazing animals, 44.82 per cent (26/58) were highly positive for *T. gondii* antibodies. Significant difference ($p < 0.05$) was noticed between the animals that were let out for grazing than those that were staged indoors (Table 3). This finding corroborated

with that of Skjerve *et al.* (1998), where higher seroprevalence was noted in Norwegian lambs that were let out for grazing regularly. Similarly, Lahmar *et al.* (2015) noted a higher seroprevalence in Southern Tunisia sheep and goats that were let out for grazing.

Regular grazing makes the animals to come in close contact with the oocyst contaminated environment, which results in accidental ingestion. Repeated exposure to oocysts leads to infection and further development of serum antibodies. It is also worth mentioning that Kerala owing to its high humid weather, oocysts are protected against dessication thereby enabling their survival and sporulation.

A highly significant difference ($p < 0.01$) was noticed in the prevalence of *T. gondii* antibodies in goats that had aborted in the second stage when compared to the other stages (Table 4). Among the three stages of gestation, 71.42 per cent animals that had undergone abortion in the second stage of gestation were seropositive for *T. gondii*. According to Ahmed *et al.* (2008), foetal death was found to be caused by the multiplication of *T. gondii* in the placenta, rather than invasion of foetus by the parasite. The continuous multiplication of the parasite in the placenta and foetus could be enhanced by the local suppression of immune mechanism in the maternal placenta and immaturity of the foetal immune system. Moreover, it has been found that the inflammatory reactions induced in the placenta by *T. gondii* are capable of stimulating synthesis and release of prostaglandin F₂α which has a leuteolytic action leading to decreased progesterone level and subsequent abortion.

A relatively higher seroprevalence of toxoplasmosis was noticed in goats from Ernakulam district (62.5 per cent) followed by Thrissur (56.09 per cent) and Palakkad (53.33 per cent). Statistically, no significant difference could be noticed between the different districts and the positive results obtained (Table 5). The higher prevalence rate observed in Ernakulam could be due to the relatively less number of samples examined (16). Besides, the samples collected from Ernakulam were from goats

reared in households and unorganised farms and were let out for grazing regularly. The presence of cat population in the premises of these houses and farms could also contribute to the results obtained. This finding corroborated with that of Figliuolo *et al.* (2004), where higher prevalence was noted in the household goats.

A high seroprevalence of 56.94 per cent was detected in recently aborted goats or those that had a history of abortion. This indicates that infection of *T. gondii* is widespread in this area. Hence, it is imperative to carry out a mapping of seroprevalence in goats in a wider geographical region in the state of Kerala to contain *T. gondii* contamination in the food chain to control zoonotic transmission. Adequate awareness must be created among goat farmers on the managerial aspects in order to control toxoplasmosis in goats.

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