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Research article

Prevalence of Toxoplasma Gondii in Sheep and Goats in Multan (Punjab), Pakistan

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Abstract

Toxoplasmosis, a protozoan illness caused by Toxoplasma (T.) gondii, is prevalent in humans and other animals, having been observed in a variety of nations and climates. There is no data on this element of food animals in Pakistan. The goal of this study was to find out how common T. gondii infection is in sheep and goats. A total of n = 300 serum samples from sheep (n =230) and goats (n = 170) were collected and tested for Toxoplasmosis using a commercial latex agglutination kit (Eiken Chemical Co., Ltd. Japan) in the Multan. Toxoplasmosis prevalence was 20.33% overall. Goats had a substantially greater P<0.01 prevalence 22.94% than sheep 16.92%, and females 30.55% had a significantly higher P<0.01 prevalence than males 16.92% for both species. Male sheep and goats were shown to be less seropositive to T. gondii in this investigation than female sheep and goats. Adult sheep had a considerably higher prevalence P<0.01 than younger animals. In both sheep and goats, the group aged 1–2 years is strongly seropositive compared to the group aged less than one year, followed by the group aged 2–3 years, and the group aged more than three years is least seropositive.

Keywords: Toxoplasma gondii; Sheep; Goat; Prevalence; Multan; Punjab

Introduction

Toxoplasmosis, an infection caused by the Apicomplexa protozoan Toxoplasma (T. gondii), is common in humans and other animals.

The disease has been documented in a wide range of countries and climates. Ingestion of sporulated oocysts, cyst-contaminated meats, especially from pig and sheep contact with free tachyzoites, or congenitally by trans placental transit infect intermediate hosts of the parasite [1]. Sheep and goats are more commonly infected with T. gondii in livestock, while infection in cattle has also been observed. This parasite is a leading cause of abortion in small ruminant breeders, resulting in large financial losses; infection does not normally cause clinical signs in cattle. Furthermore, goats infected with T. gondii are a major source of human infection due to the consumption of infected animals' meat and milk [2]. Because goat milk consumption is higher among children with cow/buffalo milk allergies in certain rural parts of Pakistan, this information is vitally relevant for disease control and, more importantly, public health. According to recent research, only a small percentage of people infected with T. gondii obtain it through their uterus, while the majority get it from undercooked or raw meat harboring tissue cysts, oocysts shed by infected cats, or contaminated drinking water or fresh vegetables [3]. In many countries, T. gondii has been found in mutton and beef [4,5]. In Pakistan, there is no information on the prevalence of Toxoplasma infection in food animals. As a result, ensuring the presence of this parasite in animal species designated

for human consumption is very beneficial. The purpose of this study is to determine the prevalence of T. gondii in sheep and goats in Multan; the findings may aid in the development of effective anti-Toxoplasmosis treatments for humans.

Methods and Materials

T. gondi had not been reported in Multan. In this study, n= 300 blood samples were obtained from mixed local breeds of sheep (n=130) and goats (n=170) in the urban region of Multan (Punjab), Pakistan, using a simple random sampling procedure between July 2020 and June 2021. Sera were extracted from 5 mL venous blood samples using a centrifuge at 2000g for 10 minutes and stored at -20 °C until needed. Sera were separated and tested for latex particle agglutination using a commercial kit (Eiken Chemical Co., Ltd., Japan) following the manufacturer's protocol. In a U-shaped 96 well microtitration plate, latex agglutination buffer (25 µl) was applied to each well. In each well, 25 µl of diluted sera (1:8) was introduced and thoroughly mixed. Then, in each well, 25 µl of T. gondii-antigen-coated latex beads were added. After a gentle shake, the plate was incubated at room temperature overnight. In comparison to the positive control, the agglutination pattern was examined (provided in the commercial kit). The information gathered was statistically examined [6].

Results and Discussion

Toxoplasmosis prevalence varies around the world, with rates ranging from 0% to 100% in different nations [7,8] depending on local customs, traditions, residents' lifestyles, weather conditions, animal age, and husbandry practices [9]. Apart from that, the presence of cats that deposit oocysts, which after sporulation become infectious to humans and animals, may be linked to the prevalence rate [10]. Toxoplasmosis prevalence was 20.33% overall. It's worth noting that the sampled area is Pakistan's semi-arid zone, where fodder is scarce throughout the year and animals frequently become nutritionally deficient, increasing their vulnerability to infections. T. gondii is far less common in sheep than it is in goats. The increased prevalence rate in goats compared to sheep may be due to the goat population's greater sensitivity to T. gondii infection. Previous research in Pakistan's south-west region found that 2.5 percent of sheep and none of the goats tested positive for Toxoplasma antibodies [11]. The prevalence rate of 28.9 to 92% in Brazil [12,13] 42% in Germany [14], 59.8% in Bulgaria [15], and 80.61% in the Van region of Turkey [16] is lower than that observed by several authors in goats from various parts of the world. On the other hand, the current study's prevalence rate was higher than the 19.3% infection rate observed in Iran [17] and the 5.9% prevalence rate found in the Lara State region of Venezuela [17]. [18,19] reported a prevalence rate of 23.7 percent in Iran and 3.2 percent in India [20] both lower than the prevalence rate established in the current study.

Because goats are commonly employed in rural parts of Pakistan, the current study's high prevalence of Toxoplasmosis in goats is critically important for public health. T. gondii tachyzoites have been found in the milk of naturally infected goats [21], and a statistically significant link has been shown in the literature between positive T. gondii serology in humans and goat milk consumption [22]. The prevalence of Toxoplasmosis detected in sheep in this study was lower than that seen in other regions of Iran 22.5–35%, Turkey 33.2–55.6%, Ghana 33.2%, Greece 23%, Morocco 27.6%, Ethiopia 22.9%, Italy 28.4%, India 30%, and Canada 57.6% [17,19,23-31]. Various disparities in positivity between nations suggest that animals reared in these areas were exposed to varied levels of T. gondii oocyst contamination. It could also be related to the different procedures employed to monitor the T. gondii antibodies in each investigation. Contrary to our findings, sheep have a higher prevalence of Toxoplasmosis than goats in various parts of the world [17,23, 27, 30-33] the variation could be due to breed differences as the animals sampled were mixed local Female animals have been found to be more sensitive to protozoan infections than male animals [27,34]. Male sheep and goats were shown to have lower T. gondii positivity than female sheep and goats in this investigation (Table 1).

Table 1: Sex wise distribution of Toxoplasma gondii antibodies in sheep and goats

Sex	Animals Examined		No of Positive (%)	
	Sheep	Goats	Sheep	Goats
Male	52	98	6 (11.53%)	17 (17.34%)
Females	78	72	16 (20.51%)	22 (30.55%)
Total	130	170	22 (16.92%)	39 (22.94)

Table 2: Age wise distribution of Toxoplasma gondii antibodies in sheep and goats.

Age Group	Animals Examined		No of Positive (%)	
	Sheep	Goats	Sheep	Goats
< 1 Years	22	30	0 (00)	9 (30%)
1-2 Years	40	48	5 (12.5%)	19 (39.58%)
2-3 Years	46	58	7 (15.21%)	8 (13.79%)
> 3 years	22	34	10 (45.45%)	3 (8.82%)
Total	130	170	22 (16.92%)	39 (22.94)

These findings are in line with those of a number of earlier investigations [26,35]. It is widely assumed that animals acquired Toxoplasma infection as they grew older by ingesting infective oocysts from the environment [27,36-37], as the chance for T. gondii exposure is seemingly abundant. The likelihood of an animal becoming exposed increases as it ages. As a result, animal age is thought to be a key factor in influencing the prevalence rate of Toxplasmosis in animals [38]. In both sheep and goats, the older are highly seropositive when compared to the groups of less than one year of age, 2–3 years of age, and 1–2 years of age, but the group of more than three years of age is least seropositive (Table 2).

It's worth noting that all of the animals sampled were older than seven months and hence lacked maternal passive immunity. In the current investigation, no link was discovered between sheep and goats' health and T. gondii infection positivity [39-41]. The majority of the animals identified positive appeared to be in good health and appeared to be normal. Furthermore, no link was discovered between T. gondii positive sheep and goats and companion animals such as dogs and cats. Cats undoubtedly play a key part in the transmission of Toxoplasmosis to humans, but food animals could potentially constitute a link in the chain of disease transmission to humans via raw milk and meat [2]. The significant seroprevalence of T. gondii antibodies reported in this study revealed that sheep in general, and goats in particular, had been exposed widely in District Multan. More research is needed to check food animals across the country [41-43].

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Conflict of interests

The authors declare no conflict of interest for this research work.

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