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Prevalence and Significance of Gastrointestinal Parasites in Turkeys (*Meleagris gallopavo*) in Konya

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ABSTRACT

Gastrointestinal parasite in turkeys are important because they cause clinical infections and pose a zoonotic risk. This study aimed to determine the prevalence of gastrointestinal parasites in turkeys raised in Konya and to evaluate the obtained data from an epidemiological perspective. The study material consisted of the feces of 86 turkeys, aged 2 months (n=76) and 6 months (n=10), from an intensive farm. Descriptive information for the sampled turkeys was recorded for each animal. Freshly collected stool samples were brought to the Parasitology Department Laboratory of Selçuk University Faculty of Veterinary Medicine. Stool samples brought to the laboratory were first examined macroscopically to check for cestode segments or other adult helminths. Subsequently, in order to perform parasitic examination under appropriate conditions, all stool samples were examined for gastrointestinal parasites using the Native examination, Fulleborn Flotation with saturated NaCl solution, and Modified Ziehl-Neelsen methods. In 56.97% (49/86) of the stool samples, cysts and oocysts of gastrointestinal protozoa were observed. *Giardia* spp. cysts were found in 54.65% (47/86) of turkeys, and *Cryptosporidium* spp. oocysts were found in 4.65% (4/86). No helminth eggs were observed. Of the turkeys whose feces were examined at least one parasitic agent was found in 49, while no parasitic agents were found in 37. Fisher's exact test revealed that the difference was not statistically significant (p=1.000). When evaluating alternative production models for meeting Türkiye's animal protein requirements, turkeys hold a significant place. Considering the gastrointestinal parasites in turkeys, which can cause yield loss and mortality, it is recommended that research on these factors continue.

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INTRODUCTION

With population growth in Türkiye and globally, nutrition problems are becoming increasingly significant (Godfray et al., 2010). Nutritional deficiencies weaken the immune system, thereby increasing susceptibility to infections (Katona and Katona-Apte, 2008). Regular consumption of animal-derived foods and adequate protein intake from these sources is important for human health, particularly in children and young people, as it supports growth, cognitive function, and mental development (Ünsal, 2019).

Alternative production models for meeting Türkiye's animal protein requirements are being investigated, and poultry farming is widespread due to its compatibility with industrial production systems. While chickens are the primary species in poultry production, turkeys represent an economically valuable alternative with lower fat and cholesterol content and high protein value (Marangoni et al., 2015; Arslan and Çetin, 2022). According to the Turkish Statistical Institute's 2025 data, there are 3,192,168 turkeys nationwide, and in Konya province, where the study was conducted, this number is 27,223. The majority of these turkeys are bronze turkeys (Arslan, 2022; TÜİK, 2025).

There are numerous pathogenic and non-pathogenic factors that can lead to yield losses and mortality in turkeys (Arslan and Çetin, 2022). Among these, parasitic agents are among the main causes of production losses and mortality. Various helminth and protozoan species, particularly those residing in the gastrointestinal system, can cause clinical symptoms such as diarrhea, loss of productivity, and general malaise (McDougald, 2020). The helminths that infest the gastrointestinal system of turkeys vary widely. Nematode species such as *Ascaridia galli* and *Capillaria caudinflata* cause diarrhea and general discomfort, while less pathogenic nematodes such as *Heterakis gallinarum* are also found. However, these helminths act as vectors for more pathogenic protozoan agents such as *Histomonas meleagridis*. Along with these commonly seen helminths, less common cestode species such as *Raillietina cesticillus* and *Davainea proglottina* are also observed (Doğanay, 2018; Öge, 2018; McDougald, 2020).

Protozoan parasites such as *Giardia* spp., *Cryptosporidium* spp., and *Eimeria* spp. can be detected in the gastrointestinal systems of turkeys. These parasites can cause clinical signs such as diarrhea, loss of productivity, and general malaise (Goodwin et al., 1988; Karaer and Kar, 2010). It has also been reported that *Cryptosporidium* spp. can settle in the respiratory system in addition to the intestine (Tarwid et al., 1985).

Given the transmission risks of these parasites, periodic fecal monitoring at production facilities is essential for updating epidemiological data and establishing robust strategies for the control and prevention of parasitic infections (Muriu, 2023).

MATERIAL and METHODS

Stool Samples

The material for this study consists of fecal samples from a total of 86 bronze turkeys (76 2 months old and 10 6 months old) received from an intensive farm at the Parasitology Department Laboratory of Selçuk University Faculty of Veterinary Medicine between October 2025 and December 2025.

Parasitological Examination of Stool Samples

Stool samples were primarily evaluated macroscopically for cestode proglottids and adult gastrointestinal helminths. All samples were then examined by native fecal examination; subsequently,

the Fulleborn flotation method with saturated NaCl solution was applied to investigate helminth eggs, protozoan cysts, and oocysts. In this flotation procedure, the density of the solution was standardized (specific gravity: 1.18–1.20), and diagnostic criteria included egg morphology, size, and shell characteristics. For each sample, a minimum of 10 microscopic fields were systematically examined under x10 and ×40 magnification to ensure diagnostic accuracy. Quality control procedures were implemented by re-examining 10% of randomly selected samples by a second parasitologist to confirm reproducibility of findings.

In addition, thin fecal smear preparations were made and microscopic examination was performed for *Cryptosporidium* spp. oocysts using the Modified Ziehl-Neelsen (MZN) technique. All parasitological diagnostic methods were performed following the standard protocols defined by Güçlü (2006) and Kaya (2010).

Statistical analysis

All statistical analyses were performed using IBM SPSS Statistics v27.0 (IBM Corp., Armonk, NY, USA) software package. The relationship between age groups (2 months vs. 6 months) and the presence of infection was evaluated using Fisher's exact test. A p-value <0.05 was considered statistically significant. Prevalence values are presented as n (%) with 95% exact (Clopper-Pearson) confidence intervals (CI), as detailed in Table 2.

RESULTS

In 56.97% (n=49) of the 86 stool samples examined in the study, cysts and oocysts of protozoa located in the gastrointestinal system were observed. Table 1 shows the distribution of infections in animals identified as infected with parasitic agents.

Table 1. Infection distribution in animals infected with parasitic agents. Distribution of parasitic agents in examined turkeys.

	n (%)
Mono Infection	
Giardia spp.	45 (52.32%)
Cryptosporidium spp.	2 (2.32%)
Mix Infection	
Giardia spp. + *Cryptosporidium* spp.	2 (2.32%)

In turkeys whose fecal samples were examined for parasites, *Giardia* spp. cysts were found in 54.65% and *Cryptosporidium* spp. oocysts were found in 4.65%. No helminth eggs were observed. Of the turkeys whose feces were examined, at least one parasitic agent was found in 49, while no parasitic agents were found in 37.

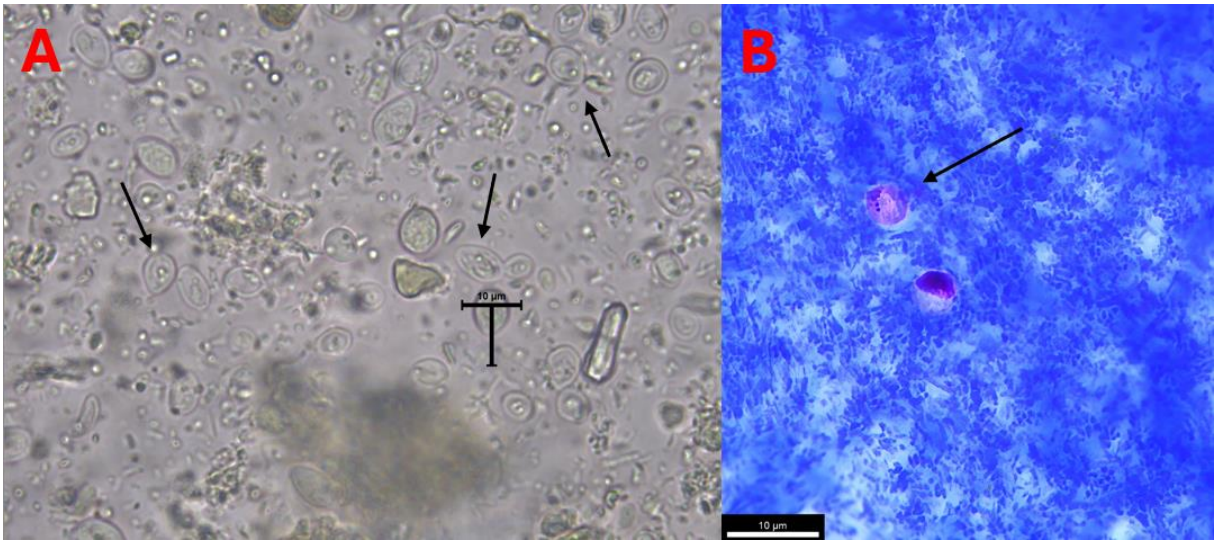
This study evaluated the relationship between the presence of parasitic infections and age groups (2 months and 6 months) in the turkeys examined. The analysis revealed that parasitic agents were detected in 56.57% (n=43/76) of 2 month old turkeys and 60% (n=6/10) of 6 month old turkeys . Fisher's exact test revealed no statistically significant difference between age groups regarding the presence of infection (p=1.000). Similarly, the distribution of *Giardia* spp. (p=1.000) and *Cryptosporidium* spp. (p =1.000) did not differ significantly between age groups. Table 2 presents the distribution and statistical data of gastrointestinal parasite prevalence in turkeys according to age groups.

Table 2. Prevalence of gastrointestinal parasites and comparasion between age groups in turkeys and statistical data.

	Positive n (%)	**Negative n (%)**	***Giardia* spp. n (%)**	***Cryptosporidium* spp. n (%)**	**Total number of animals n**
Age					
2 month	43 (56.57%) (95% CI: 44.71%-67.92%)	33 (43.42%)	41 (53.94%) (95% CI: 42.13%-65.45%)	4 (5.26%) (95% CI: 1.45%-12.93%)	76
6 month	6 (60.00%) (95% CI: 26.24%-87.84%)	4 (40.00%)	6 (60.00%) (95% CI: 26.24%-87.84%)	0 (0.00%) (95% CI: 0.00%-30.85%)	10
Total	49 (56.97%) (95% CI: 45.85%-67.61%)	37 (43.02%)	47 (54.65%) (95% CI: 43.55%-65.42%)	4 (4.65%) (95% CI: 1.28%-11.48%)	86
***p* value**	p=1.000		p=1.000	p=1.000	

Abbreviations: CI = Confidence Interval. Prevalence values are presented as n (%) with 95% exact (Clopper-Pearson) confidence intervals. Statistical comparisons between age groups were performed using Fisher's exact test. p values ≥ 0.05 indicate no statistically significant difference in parasite prevalence between the 2-month and 6-month age groups.

Figure 1. A: *Giardia* spp. cysts 100x, B: *Cryptosporodium* spp. oocysts 100x in the preparation stained with MZN staining



DISCUSSION

A study conducted in Konya on turkeys regarding gastrointestinal parasites, based on fecal examination, reported a prevalence of 24.66%. In this study, the parasitemia rate was found to be 56.97% (Sevinç et al., 2000). This data is significantly higher than the rates reported in the literature. This difference is thought to stem from variations in sampling strategies, diagnostic methods, and the time period in which the study was conducted.

Numerous helminth species have been reported in previous studies conducted on birds (Güçlü, 1992; Yardibi, 2004; Gürler et al., 2012). However, no helminth infection was found in this study. This situation is thought to be related to the fact that the samples were obtained from an intensive operation. Helminths, particularly trematodes and cestodes, require contact with an intermediate host

to complete their life cycles. In intensive farming systems, turkeys have limited contact with intermediate hosts and soil, which prevents helminth infections caused by environmental contamination. Conversely, the high prevalence rate observed in the study can be explained by the non-intermediate host life cycles and direct transmission of the protozoan agents encountered, as well as the inadequate hygiene practices in the establishments (Caccio et al., 2005; Toparlak and Tüzer, 2012).

Cryptosporidium spp., a major cause of diarrhea worldwide, is a zoonotic agent affecting both humans and farm animals. This disease is a life-threatening parasitic agent that causes severe diarrhea, particularly in infants and young animals whose immune systems are not yet fully developed, as well as in the elderly or individuals with weakened resistance due to illness, stress, or other reasons (Thompson et al., 2005; Fletcher et al., 2012; Checkley et al., 2015). To date, studies conducted in Türkiye have not detected *Cryptosporidium* spp. oocysts in turkeys; however, the presence of *Cryptosporidium* spp. is known in studies conducted worldwide (Slavin, 1955; Hoerr et al., 1978; Tarwid et al., 1985). These findings from the study represent one of the first epidemiological data regarding the presence of *Cryptosporidium* spp. in turkeys in Türkiye. In the study, *Cryptosporidium* spp., oocysts were detected in 5.26% (4/76) of 2 month old turkeys, while no infection (0/10) was observed in the 6 month old group. Despite the absence of infection in the older group, Fisher's exact test confirmed that this difference was not statistically significant (p =1.000). This is thought to be related to the age related immune response to infection. In older animals, immunity to *Cryptosporidium* spp. leads to decreased oocyst shedding, which can result in the pathogen not being detectable microscopically in stool preparations (Checkley et al., 2015).

Due to its wide host range and high environmental resistance, *Giardia* spp., a zoonotic parasite, increases the risk of infection and prevalence in farm environments. This pathogen, which can be transmitted through contaminated water, feed, and bedding, can lead to clinical signs such as diarrhea, loss of productivity, and general malaise in infected individuals (Karaer and Kar, 2010). Given the multispecies housing conditions at the study site, these animals are thought to play a carrier role in the dissemination of *Giardia* spp., a parasite characterized by low host specificity (Karaer and Kar, 2010; Adam, 2021). Although the presence of *Giardia* spp. in turkeys has not been reported in Türkiye in previous years, studies conducted in different parts of the world have reported the presence of this pathogen (Reboredo-Fernandez et al., 2015; Talazadeh et al., 2024). Parasitic agents were detected in 56.57% (43/76) of 2 month old turkeys and 60% (6/10) of 6 month old turkeys. Statistical analysis using Fisher's exact test showed no significant relationship between age groups and the general presence of infection (p=1.000). This finding is consistent with results reported in the literature, showing that age is not a determining factor in the spread of *Giardia* spp. (Alegre et al., 2021; Ussenbayev et al., 2025).

There are no historical reports of *Giardia* spp. presence in turkeys in Türkiye. However, studies conducted in different parts of the world have reported the presence of this pathogen in turkeys (Reboredo-Fernandez et al., 2015; Talazadeh et al., 2024). These findings represent one of the first epidemiological data regarding the presence of *Giardia* spp. in turkeys in Türkiye.

In this study, parasitic findings obtained from turkeys in Konya are based solely on microscopic examination. However, factors such as irregular excretion of parasites in feces, morphological similarities, and low cyst and oocyst density can limit the sensitivity of microscopic examination. Studies in the literature on different animal species show that molecular and serological methods are superior in identifying low-level infections that cannot be detected by microscopy. Therefore, supporting these findings with advanced diagnostic methods is crucial for fully determining the parasitic load and zoonotic risks in the region (Checkley et al., 2015; Çelik et al., 2023).

CONCLUSION

In a general assessment, the fundamental problems of turkey farming enterprises in Konya include insufficient technical support, infrastructure deficiencies, and a lack of adequate education and knowledge among the personnel (Arslan et al., 2020). The findings indicate that the potential risk of parasitic infections in turkeys cannot be ignored. Therefore, enhancing biosecurity measures in turkey farming, ensuring litter and feed hygiene, preventing the movement of free-ranging animals, and conducting regular parasitological screenings are of critical importance for both animal health and the mitigation of zoonotic risks (Permin and Hansen, 1998; Ryan and Hijjawi, 2015).

Ethics Approval

27/03/2026 dated 2026/48 and numbered was given by Selçuk University, SÜVDAMEK ethics committee.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Author Contributions

Research Design (CRediT 1) Author 5 (%60) – Author 1 (%40)

Data Collection (CRediT 2) Author 1 (%40) – Author 3 (%30)- Author 4 (%30)

Research - Data analysis - Validation (CRediT 3-4-6-11) Author 1 (%100)

Writing the Article (CRediT 12-13) Author 1 (%60) – Author 2 (%40)

Revision and Improvement of the Text (CRediT 14) Author 5 (%70) – Author 2 (%30)

Sustainable Development Goals (SDG)

Goal 2: Zero Hunger

Goal 3: Good Health and Well-Being

Goal 15: Life on Land

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