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Research Article

Identification and Distribution of Helminth Species in Cattle from Çorum Province

Çorum İlindeki Sığırlarda Helmint Türlerinin Tespiti ve Yayılışının Belirlenmesi

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Abstract

Helminths are among the most prevalent parasitic infections affecting cattle worldwide, leading to substantial economic losses and, in severe cases, mortality. This study was carried out between January and June 2025 in Çorum Province, Türkiye, to assess the prevalence and distribution of helminth infections in cattle. Fecal samples were collected from 410 cattle representing different breeds, sexes, and age groups across 13 villages. Samples were examined macroscopically and analyzed using the Fülleborn flotation, Benedek sedimentation, and Baermann-Wetzel techniques to detect helminth eggs and larvae. Among the 410 cattle examined, 143 (34.9%) were found to be infected with one or more helminth species, with Trichostrongylidae being the most prevalent: 88 (21.46%), followed by *Paramphistomum* spp., 52 (12.68%), *Moniezia* spp., 14 (3.41%), *Trichuris* spp., 11 (2.68%), *Dicrocoelium* spp., 8 (1.95%), *Toxocara vitulorum*, 3 (0.73%), *Fasciola* spp., 1 (0.24%), and *Nematodirus* spp., 1 (0.24%). In cattle infected with Trichostrongylidae, egg counts were generally low (≤100 eggs per gram of feces, EPG). Statistical analysis revealed significant differences in infection rates among age groups, with the highest prevalence observed in cattle between one and two years of age ($p < 0.001$). Additionally, males exhibited significantly higher infection rates than females ($p = 0.034$).

Keywords: Cattle, Çorum, Helminths, Prevalence

Öz

Sığırlarda görülen helmint türleri, dünya genelinde hayvancılık sektöründe yaygın olarak rastlanan, ekonomik açıdan ciddi kayıplara yol açan ve zaman zaman ölümle sonuçlanabilen önemli enfeksiyonlara neden olmaktadır. Bu kapsamda, söz konusu enfeksiyonların bölgesel düzeydeki durumunu ortaya koymak amacıyla bu çalışma, Türkiye'nin Çorum ilinde Ocak 2025-Haziran 2025 tarihleri arasında yürütülmüş olup, bölgedeki sığırlarda helmint enfeksiyonlarının varlığını ve dağılımını belirlemek amacıyla gerçekleştirilmiştir. Araştırma kapsamında, Çorum iline bağlı 13 köyde farklı ırk, cinsiyet ve yaş gruplarına ait toplam 410 sığırdan dışkı örnekleri toplanmıştır. Toplanan örnekler, helmint yumurta ve larvalarının varlığını belirlemek amacıyla önce makroskobik olarak incelenmiş, ardından Fülleborn flotasyon, Benedek sedimentasyon ve Baermann-Wetzel yöntemleri uygulanmıştır. Yapılan analizler sonucunda sığırların 143'ünün (%34,9) bir ve/veya daha fazla helmint türü ile enfekte olduğu tespit edilmiştir. Tespit edilen helmintlerin dağılımı sırasıyla Trichostrongylidae 88 (%21,46), *Paramphistomum* spp. 52 (%12,68), *Moniezia* spp. 14 (%3,41), *Trichuris* spp. 11 (%2,68), *Dicrocoelium* spp. 8 (%1,95), *Toxocara vitulorum* 3 (%0,73), *Fasciola* spp. 1 (%0.24) ve *Nematodirus* spp. 1 (%0.24) şeklinde belirlenmiştir. Trichostrongylidae türleriyle enfekte olan sığırlarda gram dışkıdaki yumurta sayısının düşük oranlarda olduğu tespit edilmiştir (≤ 100 EPG=eggs per gram of feces). İstatistik analiz sonucu yaş grupları dikkate alındığında, sığırların helmint enfeksiyon oranları arasında istatistiksel olarak anlamlı farklılıklar saptanmış olup, özellikle 1–2 yaş arası sığırlarda enfeksiyon oranının yüksek olduğu belirlenmiştir ($p<0,001$). Cinsiyete göre ise, erkek sığırlarda enfeksiyon oranının dişilere kıyasla anlamlı derecede yüksek olduğu gözlenmiştir ($p = 0,034$).

Anahtar Kelimeler: Çorum, Helmintler, Sığır, Prevalans

Introduction

The breeding and management of cattle play a significant role in livestock farming activities in Türkiye (Ergün & Bayram 2021). Large ruminant husbandry is particularly important as a livelihood source in rural areas, providing both direct and indirect economic benefits to farmers. In addition to their contribution to household income, cattle serve as a crucial source of animal-derived proteins, which are essential components of a healthy and balanced diet. Meat, milk, and their derived products constitute the primary dietary sources of high-quality protein and micronutrients, and they play a critical role in ensuring food security and nutritional adequacy in both rural and urban populations (Can & Engindeniz 2025; Özbek et al. 2025).

Cattle, although economically and nutritionally important, are frequently affected by a range of infectious diseases, among which helminth infections constitute one of the most significant health concerns. Helminths are widely prevalent in cattle populations globally and are associated with substantial economic losses due to reduced growth rates, lower milk and meat yields, and decreased reproductive performance (Charlier et al. 2023). These parasites inflict a range of pathological effects, primarily on the gastrointestinal tract, as well as on the liver, lungs, and other organs, thereby compromising the host's nutrient utilization and adversely impacting its metabolic functions (Charlier et al. 2015). The clinical signs and pathological outcomes of infection depend on parasite species, infection intensity, and host immunity, frequently manifesting as growth retardation, weight loss, and diminished product quality, including lower milk fat content or poor coat quality (Strydom et al. 2023). Severe infections may be fatal and frequently lead to increased organ and carcass condemnation at slaughter, thereby directly reducing farmers' income and imposing broader economic burdens on national livestock industries (Idris et al. 2019; Charlier et al. 2020). Productivity losses are often more pronounced in young, immunologically immature, or immunocompromised animals, highlighting the importance of age and physiological status in infection dynamics (Silva et al. 2013).

In Çorum province, the prevalence and epidemiology of helminth infections in cattle have not yet been systematically investigated. This study aimed to assess the prevalence, species diversity, and infection dynamics of helminths in cattle in the region, providing valuable data to enhance disease surveillance and to inform effective control strategies for improving animal health, welfare, and productivity.

Materials and Methods

Collection of Samples

Fecal samples were collected from a total of 410 cattle across 13 villages in Çorum province (Atçalı, Pancarlık, Palabıyık, Eskiekin, Kazıklıkaya, Turgut, Karaağaç, Ahmediye, Güney, Kuşsaray, Körücek, Elmalı, Büğet) between 1 January and 9 June 2025 at the time of defecation. Each sample was placed in a plastic bag and recorded along with the animal's age, sex, breed, and the date of collection, before being transported under cold chain conditions (+4 °C) to the Parasitology Laboratory at Ankara University Faculty of Veterinary Medicine.

Analysis of Fecal Samples

Fecal samples delivered to the laboratory were initially examined macroscopically (for the presence of adult helminths, proglottids, etc.). For the detection of nematode and cestode eggs, the Fülleborn flotation technique was employed (Zajac et al. 2021). The Benedek sedimentation method was used to identify trematode eggs, which are difficult to float or may lose their morphological integrity during flotation procedures (Doğanay 2018). To investigate lungworm infections, the Baermann-Wetzel technique was applied (Hansen & Perry 1994). In fecal samples where Trichostrongylidae eggs were observed through flotation, egg counts per gram of feces (EPG) were determined to assess infection intensity (Zajac et al. 2021). The identification of helminth eggs and larvae in the fecal samples was based on the diagnostic keys provided by Doğanay (2018) and Zajac et al. (2021).

Statistical Analysis

In the study, samples were categorized based on breed, sex, and age groups to investigate differences in helminth species among the cattle. For the statistical analysis of the data, the Chi-square (χ^2) test was employed to determine differences between groups. All analyses were performed using SPSS Statistics 27 software. Thus, the distribution of helminth species across different groups in cattle was evaluated, and potential relationships between various risk factors were interpreted. Statistical significance was accepted at $p<0.05$.

Results

Flotation and sedimentation analyses of fecal samples collected from 410 cattle revealed that 143 animals (34.9%) were infected with one or more helminth species. In the positive samples, eggs of eight different helminths were detected, including three trematodes (Fasciola spp., Dicrocoelium spp., Paramphistomum spp.), one cestode (Moniezia spp.), and four nematodes (Trichostrongylidae, Toxocara vitulorum, Nematodirus spp., Trichuris spp.). Among the infected cattle, 61 (42.65%) had trematodes, 14 (9.8%) had cestodes, and 104 (72.72%) had nematodes. Additionally, 1 (0.7%) was co-infected with both cestodes and trematodes; 9 (6.3%) were co-infected with cestodes and nematodes; 14 (9.8%) were co-infected with trematodes and nematodes; and 2 (1.4%) were co-infected with trematode, cestode, and nematode species simultaneously. No larvae were observed in any of the fecal samples examined using the Baermann–Wetzel technique for the detection of lungworm infection. In cattle infected with Trichostrongylidae eggs, the number of eggs per gram of feces (EPG) was found to be low (≤ 100).

The distribution of helminth species according to breed (Simmental, Holstein, Anatolian Black, Brown Swiss, Charolais, and Blonde) and sex is presented in Table 1, with the highest infection rate recorded in Simmental cattle. However, this difference among breeds was not statistically significant ($p = 0.208$).

Table 1. Distribution of species responsible for infections in cattle according to sex and breed

Helminth species	Simmental (n:298)		Holstein (n:77)		Anatolian Black (n:17)	
	Female (n:249)	Male (n:49)	Female (n:57)	Male (n:20)	Female (n:3)	Male (n:14)
***Fasciola* spp.**	1	-	-	-	-	-
***Dicrocoelium* spp.**	6	-	1	-	-	-
***Paramphistomum* spp.**	41	3	6	-	-	1
***Moniezia* spp.**	7	5	2	-	-	-
Trichostrongylidea	36	22	15	10	-	1
Toxocara vitulorum	2	-	1	-	-	-
***Nematodirus* spp.**	1	-	-	-	-	-
***Trichuris* spp.**	10	1	-	-	-	-

Table 2 (continued). Distribution of species responsible for infections in cattle according to sex and breed

Helminth species	Brown Swiss (n:12)		Charolais (n:2)	Blonde (n:4)	
	Female (n:6)	Male (n:6)	Male (n:2)	Female (n:2)	Male (n:2)
***Fasciola* spp.**	-	-	-	-	-
***Dicrocoelium* spp.**	1	-	-	-	-
***Paramphistomum* spp.**	1	-	-	-	-
***Moniezia* spp.**	-	-	-	-	-
Trichostrongylidea	-	3	1	-	-
Toxocara vitulorum	-	-	-	-	-
***Nematodirus* spp.**	-	-	-	-	-
***Trichuris* spp.**	-	-	-	-	-

The age-related distribution of helminths is shown in Figure 1. Fecal samples were examined from 100 cattle aged ≤1 year, 205 cattle aged 1–2 years (including 2 years), and 105 cattle older than 2 years. The overall prevalence of helminth species was notably higher in cattle aged 1–2 years, and the differences among age groups were statistically significant ($p < 0.001$).

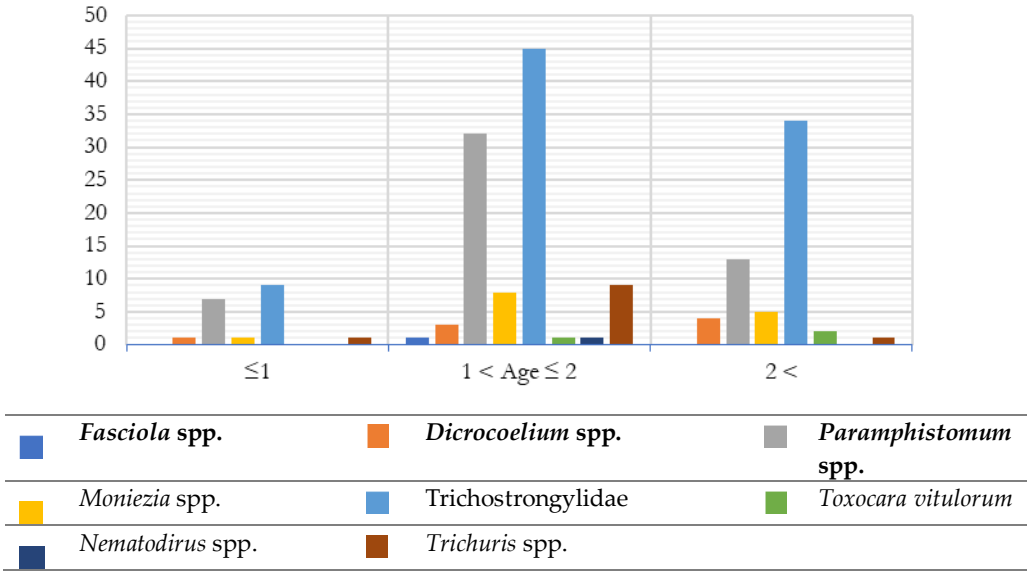

Figure 1. Distribution of helminths according to age

The distribution of helminth species across villages is presented in Figure 2. Trichostrongylidae were detected in all villages except Güney, and helminths belonging to this family were identified as the most prevalent. These were followed by *Paramphistomum* spp., and subsequently *Moniezia* spp. The highest helminth burden was observed in Pancarlık village. In contrast, in Güney village, only a protozoan, *Eimeria* spp., was detected, with no developmental stages or larvae of any helminth species identified.

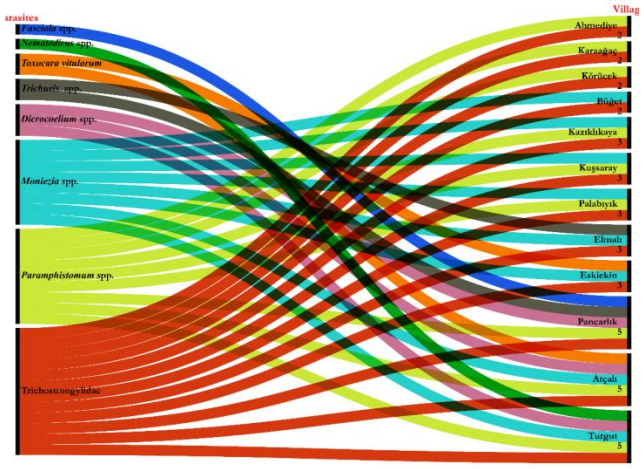

Figure 2. Distribution of parasite species detected in cattle across villages using an Alluvial diagram. This figure was created with Rawgraphs.

Discussion

Cattle bred in Türkiye play an important role both economically (as a source of meat, milk production, and livelihood) and ecologically, while helminth infections observed in ruminants, particularly in cattle, are considered a major factor limiting livestock productivity (Yıldırım et al. 2000; Kozan 2014; Idris et al. 2019). Often subclinical in nature, these infections lead to economic losses due to mortality, reduced production,

and decreased reproductive performance in affected animals (Silva et al. 2013; Idris et al. 2019; Charlier et al. 2023). In this study, the presence of helminths in cattle populations raised in the central villages of Çorum Province was investigated, providing the first region-specific parasitological data for the area. Age, sex, and breed were evaluated in relation to helminth infection rates, and a total of eight different helminth species infecting cattle were identified. Gastrointestinal nematodes were the most frequently detected helminth group, followed by trematodes and cestodes.

It has been reported that nematodes constitute the most prevalent phylum of helminths infecting cattle worldwide (Thanasuwan et al. 2021; Nouri et al. 2022; Frias et al. 2023; Tiele et al. 2023; Su et al. 2024). Among the nematodes detected in cattle, species belonging to the family Trichostrongylidae, a major group of gastrointestinal nematodes, are considered the most important. Studies conducted in Türkiye have demonstrated that the prevalence of Trichostrongylidae species exhibits regional variation. Reported prevalence rates range between 1–65% in the Black Sea Region (Celep et al. 1990; Kozan 2014), 0.5–35% in Central Anatolia (Yıldırım et al. 2000; Sevimli et al. 2007; Şen et al. 2011; Kozan et al. 2021), 22% in the Marmara Region (Senlik et al. 2010), 0.2–6% in the Mediterranean Region (Köse et al. 2025), and 1–35% in Eastern Anatolia (Goz et al. 2006; Aydın et al. 2006; Arslan et al. 2008; Avcıoğlu & Balkaya 2011; Afshar et al. 2023; Afşar et al. 2025).

This study was conducted in Çorum Province, located in the northern part of Central Anatolia and the inland zone of the Central Black Sea Region, and similar to previous research carried out in Türkiye, a notably high prevalence (21.46%) of Trichostrongylidae infection was recorded. In addition to Trichostrongylidae, other gastrointestinal nematodes such as *Toxocara vitulorum* and *Trichuris* spp. have also been reported in cattle in Türkiye, although at lower prevalence rates. The prevalence of *T. vitulorum* infection in Türkiye has been documented to range between 0.5–35% (Yıldırım et al. 2000; Goz et al. 2006; Aydın et al. 2006; Arslan et al. 2008; Şen et al. 2011; Avcıoğlu & Balkaya 2011; Kozan 2014; Kozan et al. 2021; Afshar et al. 2023; Afşar et al. 2025), while *Trichuris* spp. infections have been reported at levels of 1–3.4% (Kozan 2014; Afşar et al. 2025). In the present study, *Trichuris* spp. and *T. vitulorum* were detected at rates of 2.68% and 0.73%, respectively. Gastrointestinal nematodes, primarily species belonging to the Trichostrongylidae family, are consistently identified as the most prevalent helminth group infecting cattle. Evidence from both global and national studies supports this finding. Although the diversity of species and the magnitude of infection vary with climatic conditions, husbandry practices, and regional characteristics, Trichostrongylidae species remain dominant across different cattle production systems. Their widespread occurrence is generally attributed to their direct life cycles, which do not involve an intermediate host and therefore facilitate efficient transmission under suitable environmental conditions.

Global research shows that trematode prevalence and distribution vary geographically. In particular, *Fasciola* spp. and *Paramphistomum* spp. have been reported as highly prevalent in tropical areas (Opio et al. 2021; Thanasuwan et al. 2021; Hernández-Hernández et al. 2023; Hecker et al. 2024). Research carried out in Türkiye similarly demonstrates that trematodes are widespread across nearly all regions of the country, with prevalence influenced by environmental and management-related factors such as regional climate, grazing practices, the presence of wetlands, and farm management systems. Investigations conducted in the Central Anatolia and Black Sea regions, where the present study was also carried out, show that *Fasciola* spp., *Paramphistomum* spp., and *Dicrocoelium* spp. infections occur in ruminants within a broad

prevalence range. In the Black Sea Region, the prevalence of *Fasciola* spp. infections has been reported to range between 16–25% (Celep et al. 1990; Kozan 2014), whereas in Central Anatolia, prevalence exhibits a much wider variation, ranging from 2–69% (Yıldırım et al. 2000; Sevimli et al. 2005; Yavuz et al. 2007; Şen et al. 2011). With respect to *Paramphistomum* spp., prevalence has been documented as 41.34% in the Black Sea Region (Kozan 2014) and 13.6–65% in Central Anatolia (Yıldırım et al. 2000; Sevimli et al. 2005; Yıldırım et al. 2007). *Dicrocoelium* spp. infections have been reported to range between 6.73–74.6% in the Black Sea Region (Celep et al. 1990; Kozan 2014) and 9–15.3% in Central Anatolia (Yıldırım et al. 2000; Sevimli et al. 2005).

In this study, *Paramphistomum* spp., *Fasciola* spp., and *Dicrocoelium* spp. were identified among trematodes, with *Paramphistomum* spp. showing the highest prevalence at 12.68%. The comparatively higher occurrence of *Paramphistomum* spp. in Çorum Province may be associated with the presence of freshwater snails, intermediate hosts in the life cycle of this parasite, and ecological conditions favoring water dependent habitats. Factors such as interactions between pastures and wetlands, irrigation and drainage practices, seasonal precipitation patterns, and soil water dynamics can influence the distribution and density of intermediate hosts, thereby increasing the risk of *Paramphistomum* spp. transmission.

The most frequently reported cestodes infecting cattle are *Moniezia* spp. of the family Anoplocephalidae. Recent investigations into the global prevalence of *Moniezia* spp. indicate detection rates ranging from 1.5% to 21% across diverse geographical regions, including Ethiopia, Peru, and Germany (Tiele et al. 2023; Rojas-Moncada et al. 2025; Rehbein & Hamel 2025). Epidemiological studies conducted in Türkiye similarly document *Moniezia* spp. at a prevalences of 24.03% in the Black Sea Region (Kozan 2014), 1% in Central Anatolia (Yıldırım et al. 2000; Şen et al. 2011), and 0.17% in the Mediterranean Region (Köse et al. 2025). In the present study, *Moniezia* spp. was identified as the sole cestode species, with a prevalence of 3.41%, a result that aligns with previously reported findings from Türkiye. No other cestode species were identified.

Research conducted on cattle populations in Türkiye, using either necropsy findings or fecal examinations, indicates that helminth infection rates as well as the genera and species involved exhibit substantial variation between regions, provinces, and even distinct local settlements within the same province. These findings highlight the pivotal role of environmental and management factors, including climatic conditions, grazing practices, hygiene levels, and inconsistencies in anthelmintic treatments, in shaping the distribution and dynamics of these parasitic infections.

The presence and distribution of helminth infections in livestock can vary depending on age and physiological status (Miller & Horohov 2006). Several studies have demonstrated that gastrointestinal nematode infections, in particular, occur at higher rates in young cattle (Wills et al. 2020; Kalacho & Kunta 2024; Wangboon et al. 2024). Some studies conducted in Türkiye have also reported a higher helminth prevalence in young cattle compared to adults, suggesting that the initial exposure of young animals to pasture and their underdeveloped immune systems increase the infection risk. Furthermore, when young and older animals share the same pasture, it has been noted that older animals contribute to pasture contamination with infective larvae, which can lead to a gradual increase in infection rates throughout the first grazing season in young animals, peaking towards the end of the season (Sevimli et al. 2007; Kozan 2014). The findings of the current study align with the literature, showing that the incidence of helminth

infections was significantly higher ($p < 0.001$) in cattle aged 1–2 years compared to other age groups. This result is likely attributable to young animals' initial introduction to pasture in the study area, increased stress levels due to hormonal changes, the resulting decline in immune capacity, and increased exposure to the source of infection from sharing the same pasture with other age groups.

Helminth infections are reported to occur at higher rates in male cattle in various geographic regions (Ola-Fadunsin et al. 2020; Zalizar et al. 2023). Studies conducted in Türkiye have similarly observed higher infection rates in males compared to females in some cases (Sevimli et al. 2005; Kozan 2014). In the present study, helminth infection rates were also significantly higher in male cattle than in females ($p = 0.034$). This pattern is potentially due to irregular anthelmintic treatments, differences in housing conditions, and the immunosuppressive effects of some hormones.

Research performed within Türkiye suggests that the prevalence of helminth infections may differ among breeds. Higher prevalence has been reported in Simmental cattle compared to other breeds (Yavuz et al. 2007; Kozan 2014). In native Black cattle, a greater number of helminth eggs have been detected (Afşar et al. 2025), while Brown Swiss cattle have shown higher gastrointestinal parasite prevalence relative to other breeds (Köse et al. 2025). In Holstein cattle, infections have also been reported (Şen et al. 2011). In the present study, although infection rates did not differ significantly between breeds, a comparatively higher prevalence was observed in Simmental cattle.

The helminth infections observed in this study reflect the multifactorial influences of regional, ecological, and management-related variables, thereby contributing to a more detailed understanding of parasite dynamics within cattle populations.

Conclusion

This study represents the first detailed investigation into the helminth fauna of cattle reared in Çorum province, providing a comprehensive overview of parasitic prevalence and diversity in the region. The findings indicate that pasture contamination is widespread and that polyparasitism is common among the cattle population, while the presence of zoonotic parasites underscores the potential risks posed to both animal and human health. These observations reveal that current control practices are insufficient and highlight the urgent necessity for the development and implementation of targeted, sustainable strategies aimed at managing helminth infections effectively. It is important to recognize that helminth infections not only compromise animal welfare and reduce productivity but also contribute to significant economic losses and increase food safety risks, emphasizing their broader implications for livestock production systems.

Consequently, regular parasitological monitoring, the consistent application of evidence-based antiparasitic programs, and the promotion of public health awareness emerge as critical components for safeguarding both animal and human health. By integrating epidemiological insights with practical management interventions, the findings of this study provide valuable guidance for regional livestock authorities and stakeholders, supporting informed decision-making and the development of sustainable, context-specific approaches that can enhance cattle health, productivity, and overall farm resilience over time.

Conflict of Interest: The authors have no conflicts of interest to declare.

Author Contributions: EM: Conceptualization, Methodology, Writing – original draft, review & editing.BG: Conceptualization, Methodology, Writing – review & editing, Formal analysis.

Ethics Approval Statement: This study was approved by the Ankara University Local Ethics Committee for Animal Experiments (Approval No: 2025-02-10, Date: 22 January 2025).

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