

Helminth Distribution in Cattle in Intensive Farming Systems in the Samsun Region

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ABSTRACT

Helminth infections in cattle are among the parasitic diseases that seriously affect animal health worldwide and cause significant economic losses. In this context, the present study was conducted between April 2025 and December 2025 to determine the helminth species and their distribution in intensively reared cattle in the Çarşamba, Terme, Tekkeköy, and Ayvacık districts of Samsun province and to obtain epidemiological data. In the study, fecal samples were collected during natural defecation from a total of 400 cattle, while breed, sex, and age characteristics were recorded. The fecal samples were examined using the Fülleborn saturated salt flotation, Benedek sedimentation, and Baermann-Wetzel methods. Of the 400 fecal samples examined, 61.75% were found to be infected with one or more helminth species. The prevalence rates were 39% for *Trichostrongylidae*, 7.5% for *Moniezia spp.*, 1.25% for *Nematodirus spp.*, 1% for *Bunostomum spp.*, 0.75% for *Capillaria spp.*, 0.25% for *Toxocara vitulorum*, 32% for *Paramphistomum spp.*, 3.5% for *Dicrocoelium spp.* and 2% for *Fasciola spp.*. In addition, the protozoan *Eimeria spp.* was detected at a rate of 27.5%. When age groups were considered, *Paramphistomum spp.* and *Trichostrongylidae* infection rates were significantly higher in cattle aged older than 12 months ($p < 0.001$). The prevalence of helminth infections was significantly higher in the Holstein breed compared to other breeds ($p = 0.013$). According to sex, female cattle showed a significantly higher prevalence of helminth infections ($p = 0.003$). These findings provide updated epidemiological data on helminth infections in cattle in the Samsun region and may contribute to the development of effective control and prevention strategies.

Keywords: cattle, helminth, intensive farming, Samsun

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Introduction

Livestock farming plays an important role in human life. In cattle breeding, products such as meat, milk, hide, manure, and leather are utilized, all of which are of great importance for national economies. However, helminth infections observed in cattle cause significant production losses (Hamid et al., 2023). The control of helminth infections in cattle has become a major problem worldwide, negatively

affecting farm productivity. Although gastrointestinal helminth infections in cattle generally show a subclinical course, they lead to reduced reproductive performance decreased feed conversion efficiency, lower meat and milk yields, compromised animal welfare, and, in advanced cases, may result in mortality (Charlier et al., 2024; Alkadir and Ayana, 2024). In addition, the development of resistance to

anthelmintics used in the control of helminth infections complicates the elimination of these infections from herds (Podpečan et al., 2023; Charlier et al., 2024; Gatitu et al., 2025). This situation results in the presence of untreated animals, which adversely affects herd health, leading to repeated increases in infection rates within the herd.

In Türkiye, helminth infections remain a significant issue in the livestock sector, largely due to favorable climatic conditions that facilitate the development and spread of helminths (Yıldırım et al., 2000; Afshar et al., 2023; Afşar et al., 2025). Both intensive and extensive farming systems are practiced in Türkiye, and studies have reported that helminth infections are prevalent in both systems (Celep et al., 1990; Yıldırım et al., 2000; Kozan, 2014; Afşar et al., 2025; Köse et al., 2025). Depending on differences in production systems, helminth species diversity also varies; however, it is evident that helminths cannot be eliminated in either system. Feeding and housing systems play a crucial role in the epidemiology of parasitic infections (Afşar et al., 2025). While pasture fed animals in extensive systems are continuously exposed to infective stages in grazing areas, intensive indoor systems are often mistakenly considered low risk for parasitism (Podpečan et al., 2023). In regions where intensive farming is practiced, close housing of animals and contact of barns with intermediate hosts facilitate the spread of helminth infections within the barn environment (Mennerat et al., 2010; Podpečan et al., 2023). Similarly, in extensive farming systems, cattle become more susceptible to infections due to climatic conditions and the ecosystem. This indicates the necessity of regular monitoring of parasitic infections in cattle farming. Despite the high density of intensive livestock operations in northern Türkiye, comprehensive data on the parasite fauna of intensive cattle enterprises in Samsun province remain limited.

This study was conducted to determine the presence and prevalence of helminth infections in cattle raised under intensive farming systems in Samsun province. The identified helminth species were evaluated according to age, sex, and breed to assess their distribution among different host-related factors and provide actionable epidemiological data for establishing targeted herd health and parasite control strategies.

Materials and Methods

Collection of Fecal Samples

Fecal samples were collected from a total of 400 cattle during natural defecation from cattle farms practicing intensive production systems in four major livestock dense districts (Çarşamba, Terme, Tekkeköy, and Ayvacık) of Samsun province. These specific districts were selected due to their high concentration of intensive cattle enterprises and agricultural importance in the region. The sample size ($n = 400$) was established based on farm accessibility, voluntary farmer participation, and herd size constraints across the selected enterprises using a convenience sampling approach. Among the sampled cattle, 147 were females and 253 were males. The samples were placed into plastic bags, labeled, and numbered. Information regarding the age, sex, and breed of each animal was recorded. The collected fecal samples were preserved under a cold chain ($+4^{\circ}\text{C}$) and transported to the Parasitology Laboratory of the Faculty of Veterinary Medicine, Ankara University, for examination.

Macroscopic and Microscopic Examination of Feces

Upon arrival at the laboratory, fecal samples were first examined macroscopically for the presence of adult helminths and proglottids. Subsequently, the Fülleborn saturated salt flotation technique was applied for the detection of cestode and nematode eggs (Doğanay, 2018). The Benedek sedimentation method was used for the identification of trematode eggs (Tagesu, 2018). The Baermann–Wetzel technique was employed to detect lungworm infections (Hansen and Perry, 1994). Helminth eggs and larvae detected in fecal samples were identified based on morphological characteristics using standard parasitological keys from the literature (Taylor et al., 2016).

Statistical Analysis

To evaluate the distribution of helminth infections in cattle according to breed, sex, and age groups and to determine differences between these groups, the Chi-square (χ^2) test was used. Statistical analyses were performed using SPSS Statistics version 30 software.

Results

Fecal samples obtained from a total of 400 cattle reared under intensive farming conditions in the Samsun region were examined using flotation,

sedimentation, and Baermann–Wetzel methods. As a result of these examinations, 61.75% (247/400) of the cattle were found to be infected with one or more helminth species. Based on flotation and sedimentation analyses, the prevalence rates were determined as follows: *Trichostrongylidae* 39% (156/400), *Moniezia* spp. 7.5% (30/400), *Nematodirus* spp. 1.25% (5/400), *Bunostomum* spp. 1% (4/400), *Capillaria* spp. 0.75% (3/400), *Toxocara vitulorum* 0.25% (1/400), *Paramphistomum* spp. 32% (128/400), *Dicrocoelium* spp. 3.5% (14/400) and *Fasciola* spp. 2% (8/400). Although the primary focus of this study was helminth fauna, oocysts of *Eimeria* spp. were concurrently detected in 27.5% (110/400) of the examined samples during routine coprological examination. (Figure 1) Following the Baermann–Wetzel examination for lungworms, all 400 animals were found to be negative for *Dictyocaulus* spp. (0/400).

Mixed gastrointestinal helminth infections were detected in 87 of the examined animals. The most common co-infection was the simultaneous presence of *Paramphistomum* spp. and *Trichostrongylidae*, observed in 48 samples. Other notable mixed infections included the dual combination of *Moniezia* spp. and *Trichostrongylidae* ($n = 7$), as well as triple infections involving *Fasciola* spp., *Paramphistomum* spp., and *Trichostrongylidae* ($n = 4$), and *Moniezia* spp., *Paramphistomum* spp., and *Trichostrongylidae*

($n = 4$). In addition, several other dual, triple, and quadruple helminth combinations were detected at lower frequencies.

The distribution of helminth species according to breed and sex is presented in Table 1. Among the breeds with adequate sample sizes, higher than expected numbers of infected animals were observed primarily in Holstein cattle, followed by the Jersey and Simmental breeds ($p = 0.013$).

The distribution of helminths according to age groups is presented in Table 2. In this study, cattle were categorized into three age groups: 0–6 months (including 6 months), 6–12 months (including 12 months), and older than 12 months. Especially, *Paramphistomum* spp. and *Trichostrongylidae* infections were higher in cattle older than 12 months ($p < 0.001$). Helminth infection rates were also observed to be higher in female cattle ($p = 0.003$).

Table 2. Number of helminth positive animals by age

Age	Total number of animals	Number of helminth-positive animals
0-6 months (including 6 months)	35	22
6-12 months (including 12 months)	39	22
12 months +	326	203

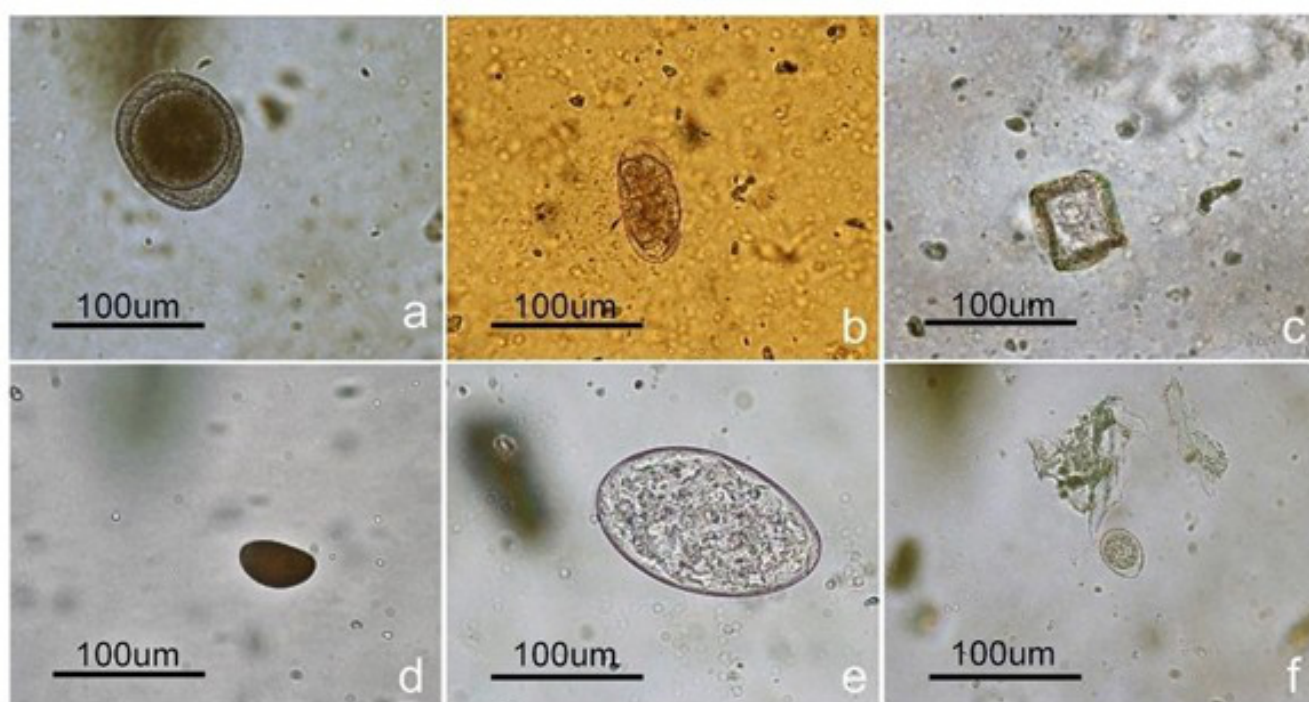


Figure 1. (a) *Toxocara vitulorum*, (b) *Trichostrongylidae*, (c) *Moniezia* spp., (d) *Dicrocoelium* spp., (e) *Paramphistomum* spp. and (f) *Eimeria* spp. All images were captured using a 40× objective.

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

Race	<i>Fasciola</i> spp.		<i>Dicrocoelium</i> spp.		<i>Paramphistomum</i> spp.		<i>Moniezia</i> spp.		<i>Trichostrongylidae</i>		<i>Nematodirus</i> spp.		<i>Bunostomum</i> spp.		<i>Toxocara vitulorum</i>		<i>Capillaria</i> spp.	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Anatolian Black	1	1	3	1	12	8	2	1	18	3	1	-	-	-	-	-	-	-
Anatolian Red	-	1	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-
Angus	-	-	1	-	-	2	-	1	3	3	2	1	-	-	-	-	-	-
Belgian Blue	-	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-	-
Brown Swiss	-	1	3	-	15	1	6	1	19	2	-	-	-	1	-	-	-	-
Charolais	-	-	-	-	-	2	-	-	-	1	-	-	-	-	-	-	-	-
Holstein	-	1	-	1	4	13	-	3	9	5	-	-	-	-	-	1	-	-
Simmental	1	1	2	1	17	24	8	5	34	17	-	-	1	-	1	1	1	1
Jersey	-	1	1	1	6	23	2	1	20	19	1	-	1	-	-	-	-	-
Total Number of Positive Animals	8 (2%)		14 (3.5%)		128 (32%)		30 (7.5%)		156 (39%)		5 (1.25%)		4 (1%)		1 (0.25%)		3 (0.75%)	
n(%)																		

Discussion

Intensive cattle farming is widely practiced in Türkiye today. Depending on the conditions of intensive husbandry, helminth infections to which animals are exposed and the associated productivity losses are of considerable epidemiological importance (Yılmaz et al., 2022). In this production system, if timely and rational control measures are not implemented, helminth infections that emerge will continue to pose a significant threat to both herd health and increasing treatment costs (Hamid et al., 2023; Charlier et al., 2024).

Epidemiological studies on helminths of cattle raised in the Black Sea region of Türkiye indicate considerable diversity, and cattle are reported to harbor a wide range of helminth fauna (Celep et al., 1990; Kozan, 2014; Umur et al., 2018). These epidemiological studies mainly include cattle raised under pasture-based or semi-intensive systems, as well as animals grazing outdoors, and data obtained from necropsy-based investigations. Accordingly, the present study was conducted on cattle raised under intensive husbandry systems in different districts of Samsun province, located in the Black Sea region of Türkiye. This study represents the first epidemiological investigation carried out in intensively managed cattle farms in Samsun province. As a result of the examinations, a total of nine different helminth species were detected. Among the identified helminths, gastrointestinal parasites belonging to the family *Trichostrongylidae* were the most prevalent, followed by trematodes (*Paramphistomum spp.*) and cestodes (*Moniezia spp.*), respectively.

Nematodes constitute the main helminth groups infecting cattle, a fact that has been confirmed by numerous studies conducted worldwide (Pfukenyi and Mukaratirwa, 2013; Nouri et al., 2022; Sharma et al., 2023). Among these nematodes, species belonging to the family *Trichostrongylidae*, which are localized in the gastrointestinal tract, are epidemiologically the most important. Literature reviews indicate that the prevalence of *Trichostrongylidae* species ranges widely from 14.5% to 83% (Wills et al., 2020; Zalazar et al., 2023). In studies conducted in Türkiye, regional variations have been reported, with prevalence rates ranging from 1% to 65% in the Black Sea region (Celep et al., 1990; Kozan, 2014). In the present study conducted in Samsun province, consistent with previous findings,

Trichostrongylidae species were detected at a rate of 39%. In addition to *Trichostrongylidae* species, other nematodes reported in previous studies conducted in the Black Sea region and also detected in the present study include *Nematodirus spp.* (2.1–9.7%), *Bunostomum spp.* (4.2–15.5%), and *Toxocara vitulorum* (2.8%) (Celep et al., 1990; Kozan, 2014). The prevalence rates observed in the present study were generally consistent with those reported in earlier regional studies. Although detected at lower rates, species such as *Bunostomum spp.* (1%) carry critical clinical and economic importance in intensive operations; as hookworms, they cause direct mucosal damage, microcytic anemia, severe hypoproteinemia, and weight loss via blood-feeding, which can significantly depress feed efficiency even in subclinical cases (Taylor et al., 2016). In the present study, *Capillaria spp.*, which has not been reported in previous studies conducted in the Black Sea region, was identified at a prevalence rate of 0.75%. This finding may be attributed to the low egg shedding intensity characteristic of *Capillaria* infections, which may have been overlooked in earlier regional surveys, or to the introduction of animals and feedstuffs sourced from different geographical regions into intensive feedlots.

When epidemiological studies conducted worldwide and in Türkiye on cattle helminths are evaluated together with the findings of the present study, it is observed that the prevalence of gastrointestinal nematodes varies depending on factors such as husbandry and feeding conditions, environmental and regional differences, and climatic conditions (Charlier et al., 2020). The frequent occurrence of *Trichostrongylidae* species suggests that management-related factors associated with intensive cattle production play an important role in the development and transmission of these parasites. In particular, under intensive fattening systems, large quantities of forage harvested from potentially contaminated pastures may facilitate the introduction of infective third-stage larvae (L3) into the barn environment, where cattle can ingest them through feed. This practice may therefore contribute significantly to the maintenance and spread of *Trichostrongylidae* infections even in confined housing systems (Bowman, 2020). In this study, cattle aged 12 months and older were more frequently infected with *Trichostrongylidae* species, and this finding is thought to be related to prolonged

exposure to contaminated feed and the cumulative effect of infection over time.

Among cestode infections observed in cattle, *Moniezia spp.* are frequently reported helminth species (Terfa et al., 2023). Due to their life cycle, these cestodes require intermediate hosts, and the involvement of oribatid mites as intermediate hosts makes the infection dependent on environmental factors (Taylor et al., 2016; Almeida-Caicedo et al., 2023). Worldwide studies report that the prevalence of *Moniezia spp.* in cattle ranges from 0.97% (León et al., 2019) to 46.9% (Khedr et al., 2025). In a study conducted in the Black Sea region of Türkiye, the prevalence rate was reported as 24.03% (Kozan, 2014), whereas in the present study, it was found to be 7.5%. This difference may be related to variations in study design and husbandry systems, as many epidemiological studies conducted in Türkiye are based on cattle raised under pasture-based conditions and are often supported by necropsy findings. These results indicate that intensive housing systems do not completely prevent the presence of intermediate hosts. It is considered that oribatid mites may be introduced into intensive systems through ventilation systems, bales stored outdoors, and contaminated feed.

The global distribution of trematodes varies according to climatic conditions (Nzalawahe et al., 2014). Studies conducted in Türkiye demonstrate that trematodes are present in almost all regions, although their prevalence varies depending on climatic factors (Saltan and Taşçı, 2020). In the Black Sea region, studies largely based on cattle raised under pasture-based systems and on animals examined at slaughterhouses or through necropsy have reported prevalence rates ranging between 16–25% for *Fasciola spp.*, 41.34% for *Paramphistomum spp.*, and 6.73–74.6% for *Dicrocoelium spp.* (Celep et al., 1990; Kozan, 2014). In line with these findings, *Fasciola spp.*, *Paramphistomum spp.*, and *Dicrocoelium spp.* were also detected in the present study; however, the prevalence rates were markedly lower for *Fasciola spp.* (2%) and *Dicrocoelium spp.* (3.5%), whereas *Paramphistomum spp.* remained the most prevalent trematode species, with a prevalence of 32%. This marked reduction in *Fasciola* and *Dicrocoelium* prevalence is directly supported by the strict confinement in intensive barns, which prevents direct grazing in snail- and ant-infested pastures, while

Paramphistomum persistence is largely maintained via metacercariae-contaminated freshly cut forage or hay harvested from wet lowlands. The widespread infection with *Paramphistomum spp.*, which use freshwater snails as intermediate hosts, highlights the importance of regular cleaning of watering areas (Rafiq et al., 2022). Field observations during sampling revealed that open water troughs were frequently exposed to stagnant water accumulation and organic debris, and that some enterprises utilized surface water or unmanaged local streams for barn operations, which could serve as potential vectors for snail intermediate hosts and encysted metacercariae. The findings suggest that intensive husbandry cannot completely prevent trematode infections and that many helminths are considered to be introduced into production systems through contaminated water and feed. When age and physiological status are considered, the presence and distribution of helminth infections vary. Several studies have reported higher rates of gastrointestinal nematode infections, particularly in young cattle (Zvinorova et al., 2016). Some studies conducted in Türkiye have shown that helminth prevalence is higher compared to adult cattle, which is attributed to the co-housing of animals from different age groups and the contribution of older animals to environmental contamination, thereby facilitating infection of younger animals (Sevimli et al., 2006; Kozan, 2014). The data of the present study are consistent with these findings, with higher *Paramphistomum spp.* and *Trichostrongylidae* infection rates observed particularly in cattle aged 12 months ($p < 0.001$). In cattle older than 12 months, prolonged exposure to parasites, housing conditions, accumulation of infection burden, and continuous environmental contamination in barns may contribute to higher infection rates.

Several coprological surveys have reported higher gastrointestinal helminth infection rates in female cattle, often with statistically significant differences (Nouri et al., 2022). This pattern is primarily attributed to reproductive and physiological stress associated with pregnancy, parturition, and lactation, which can lead to a temporary relaxation of immunity and increased susceptibility to parasitic infections (Ashraf et al., 2017; Nouri et al., 2022). Consequently, higher helminth burdens observed in female cattle are largely explained by the combined effects of hormone-related immunosuppression. Similarly, in

the present study, helminth infection rates were found to be higher in female cattle.

Overall, this study presents up-to-date data on helminths of cattle raised under intensive husbandry in Samsun province. Despite the widespread use of intensive systems in Türkiye and the absence of grazing, gastrointestinal nematodes, as well as trematodes and cestodes, persist, and infections caused by these helminths continue to occur. These persistent subclinical infections exert direct economic tolls on intensive livestock enterprises through impaired feed conversion ratios, reduced daily weight gains, suppressed milk yields, and unnecessary anthelmintic expenditures. Therefore, this study provides a scientific basis for the necessity of planning and implementing targeted biosecurity, water hygiene, and strategic helminth control strategies in intensive cattle farming enterprises.

Conclusion

This study demonstrated that helminth infections in cattle raised under intensive husbandry in Samsun province remain prevalent at a considerable level, primarily driven by the introduction of infective stages via contaminated roughage and water sources, high indoor stocking densities, and microclimatic barn conditions favoring parasite survival. The findings clearly indicate the necessity of improving hygiene conditions in cattle farms in this region, ensuring proper control of feed and water sources, implementing appropriate and effective treatment protocols, and housing animals of different age groups separately. Overall, these results underscore the importance of implementing effective prevention and control programs against helminth infections promptly, raising awareness among individuals involved in livestock production, and conducting more comprehensive studies in the region to mitigate the negative impacts of these infections on both animal health and the national economy.

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