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The Prevalence and Economic Importance of Hydatidosis in Slaughtered Cattle in the Afyonkarahisar Province of Türkiye

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Abstract

This study aimed to determine the prevalence of hydatid cysts, an infection caused by Echinococcus granulosus, in cattle and estimate the economic losses caused by this infection. The material of the study (weight values of 2,813 cattle livers) was obtained from a private slaughterhouse in Afyonkarahisar between January and June 2018. Cattle livers were first weighed as a whole. As a result of the macroscopic examination, the liver parts with infection were cut, and their weight (kg) was determined. Hydatid cysts were found in a total of 614 (21.83%) cattle livers. The total weight of cattle liver that was examined in the study was 20,357.8 kg, and the total weight of infected cattle liver was 2,064.8 kg (10.14%). The economic loss due to infected livers was calculated as 79,556.74 TRY ($13,981.85). Considering the 2019 cattle slaughter data in Türkiye, the total amount of economic loss due to infected livers was estimated as 102,742,642.10 TRY ($18,056,703.36).

Keywords: Cattle, Hydatidosis, Economic Loss, Afyonkarahisar

1. Introduction

Farm animals play a critical role in human nutrition and socio-economic development. Livestock products such as meat, milk, eggs, and offal are sources of protein, energy, calcium, and micronutrients (FAO, 2011). Due to the rapid growth of population worldwide, the need for basic nutrients has increased all over the world, whereby the necessary investments and livestock activities to meet this need have gained importance. In recent years, cattle breeding have played an important role in livestock activities (Bagdatlıoglu, 2019). In addition to its importance in human nutrition, red meat also reveals the level of development in countries through its social and economic functions. In Türkiye, the red meat sector is important for the national economy as it creates both consumption and large production areas (Saygın & Demirbas, 2017). Türkiye has important potential for animal husbandry thanks to its geographical features. In the past, meat breeds for livestock used to be bred extensively in large pasture areas with the production of cheap feed raw materials. Today, red meat is produced from dairy or combined productive breeds by using intensive breeding methods (DPT, 2014).

In addition to its main problems such as increased production costs, rural-to-urban migration, and increased red meat prices due to supply-demand imbalance, the red meat sector suffers from loss of productivity due to animal diseases. Among such diseases, parasitic ones can cause serious economic losses, and zoonotic ones can spread to people and cause illness (Bagdatlıoglu, 2019). The Taeniidae family has a large place among the tapeworm species that cause diseases in cattle. There are two species with significant implications for cattle in the family Taeniidae, namely Taenia and Echinococcus. The disease Taenia causes (depending on the species) is called cysticercosis and coenurosis, while the disease Echinococcus causes is called hydatidosis or cystic echinococcosis (Bagdatlıoglu, 2019). Cystic echinococcosis (CE) is a zoonosis caused by the larval form of *Echinococcus granulosus* in its intermediate hosts, and this larval form can settle in any part of the body, especially in the lungs and liver. CE is common both in Türkiye and across the world, but it is more common in countries with less developed animal husbandry sectors and uninspected procedures after animal slaughtering (Unat & Altas, 1995; Kesik et al., 2021). Moreover, risk factors for the spread of the disease are within the context of factors associated with health such as social, political, economic instabilities, uncontrolled livestock systems, lack of awareness about CE, exposure to dog faeces, and the consumption of contaminated food/water (Khan et al., 2021). In addition to being a significant health problem in humans and animals, it is a major economic problem for the livestock sector (Unat & Altas, 1995; Cebi & Kaplan, 2001). In the end-of-slaughter examinations of butchery animals, some lesions caused by parasitic factors are observed in most cattle livers; therefore, significant economic losses occur due to the complete or partial destruction of lesioned cattle livers (Caya, 2012).

This study was conducted to determine the prevalence of hydatid cysts in slaughtered cattle in a private slaughterhouse in Afyonkarahisar, Türkiye and estimate the economic loss caused by infected liver tissue that is destroyed after slaughter.

2. Materials and Methods

Material: The material of the study (weight values of 2,813 cattle livers) was obtained from a private slaughterhouse in Afyonkarahisar, Türkiye between January and June 2018. The study used data from the Turkish Statistical Institute (TURKSTAT), the Ministry of Agriculture and Forestry, the Ministry of Health, the Food and Agriculture Data (FAOSTAT), the World Health Organization (WHO), and domestic and foreign literature.

Method: First of all, a preliminary interview was made with the owners of slaughterhouses in Afyonkarahisar, and they were informed about the study. In those of which owners agreed to participate in the study, a proper work environment and equipment were prepared so that the study could proceed in a healthy way.

The following formula was used to determine the sample size:

n=N t2 pq/d2(N-1)+t2pq

N: Target population size

n: Sample size

p: Frequency of occurrence of the investigated event (probability of occurrence)

q: Frequency of non-occurrence of the investigated event (probability of non-occurrence)

t: Theoretical value found in t-table at a certain level of significance d: Accepted ± sampling error according to the frequency of occurrence of the event.

The results were considered to include 5% sampling error (d=0.05) in a 95% confidence interval (a=0.05). As a result, the required sample size was calculated as 2,813.

During the 6-month field study, the slaughterhouse was visited two days a week. Before the slaughterhouse visits, working papers, slaughterhouse information slips, and follow-up forms were prepared to obtain the relevant data. During the visits, the slaughters were observed, the number of animals that were slaughtered was recorded, and the organs of the animals with cystic echinococcosis were identified by macroscopic examinations. During the examinations, the microscopic cysts inside the organ were detected by palpation, paying attention to not miss any hydatid cysts by making proper incisions. In the organs with hydatid cysts, the healthy and infected parts were separated and weighed separately using an electronic scale. During the weighing processes, both the contamination of the work environment and the contact of the infected tissues with the healthy ones and the carcass were prevented. If there were no diseases in the organ, only the healthy liver tissue was weighed. During the weighing and transportation of the organs, as much attention was paid as possible to not interrupt the operations of the slaughterhouse. When deemed necessary, butchers in the slaughterhouse were employed in the study, informing them to comply with hygiene rules. After the organs with hydatid cysts were placed in bags, they were taken to the laboratory of the Parasitology Department at the Faculty of Veterinary Medicine at Afyon Kocatepe University by giving a protocol number and kept at 4 ℃. After the pre-slaughter mean live weight of the slaughtered cattle was determined, the percentage of the infected organs to be destroyed in the live weight

was considered. The current market price of the infected organs was used in the calculation of total economic losses.

3. Results and Discussion

Hydatid cysts were detected in a total of 614 (21.83%) out of 2,813 cattle slaughtered in a private slaughterhouse in Afyonkarahisar, Türkiye between January and June 2018 (Table 1). Additionally, 41 (11.17%) of 367 female cattle and 573 (23.43%) of 2446 male cattle were infected with hydatid cysts.

Table 1. Numbers of Cattle with Hydatid Cysts by Sex

Sex	Hydatid cyst (Positive)		Hydatid cyst (Negative)		Total	
	Number	%	Number	%	Number	%
Female	41	11.17	326	88.83	367	13.05
Male	573	23.43	1873	76.57	2446	86.95
Total	614	21.83	2199	78.17	2813	100

Hydatid cysts were detected in the cattle in every month throughout the study period, but they most commonly found in January (23.29%), followed by May (19.06%) and February (15.96%) (Table 2). Table 3 presents the numbers of slaughtered animals and the weights of healthy and infected liver tissue by months during the study.

Table 2. Numbers of Cattle with Hydatid Cysts by Months

Months	Frequency	%
January	143	23.29
February	98	15.96
March	86	14.00
April	81	13.19
May	117	19.06
June	89	14.50
Total	614	100

Table 3. Numbers of Slaughtered Animals and the Weights of Healthy and Infected Tissue by Months

	January	February	March	April	May	June	Total
Number of Slaughtered Animals	679	397	478	426	459	374	2813
Healthy liver (Kg)	4510	2619	2894	2524	3046	2700	18293
Infected liver (Kg)	466.4	387.2	315.3	556.1	87	252.8	2064.8
Total liver (Kg)	4976.4	3006.2	3209.3	3080.1	3133	2952.8	20357.8

The total weight of liver tissue measured in this study was 20,357.8 kg, and the total weight of infected liver tissue was 2,064.8 kg (10.14%). The economic loss caused by the infected liver tissues was calculated as 79,556.74 TRY ($13,981.85) based on the unit price of 2019. Considering the 2019 cattle slaughter data in Türkiye, the total liver loss due to infection was estimated as 102,742,642.10 TRY ($18,056,703.36) (according to the CBRT Exchange Rates in 2019; 1 Dollar = 5.69 Turkish Liras).

The global demand for food is rising each passing day due to the increase in human population. Therefore, food production and supply must double with little or no loss to meet this demand. Any loss at any point in the farm-to-fork chain hinders the stability of food security on the home and country levels (Jaja et al., 2018).

Parasitic infections negatively affect various physiological events such as food intake and digestion in animals, causing several problems such as premature deaths, loss of yield, decrease in live weight gain, decrease in milk quality and quantity, and loss of fertility. All these factors also lower animal production and have negative effects on human nutrition (Koroğlu & Simsek, 2004). Cystic echinococcosis is one of the most significant parasitic zoonoses in the world, affecting both humans and domestic animals (Toparlak & Tuzer, 1999; Soulsby, 1986; Balkaya & Simsek, 2010). This disease, which is caused by the larval form of Echinococcus granulosus, is seen especially in livestock areas, but it still maintains its significance due to both public health and economic loss impacts (Yazar, 2005). According to the TURKSTAT data, echinococcosis is still common today, as 18.2% of the active population in Türkiye is employed in agriculture and animal husbandry. It is also common in Türkiye due to uncontrolled butchery especially in rural areas, the high number of stray dogs, and the ineffectiveness of infection control programs (Yazar, 2005; Altıntas, 2003; Hakverdi, 2008).

In Türkiye, the prevalence of cystic echinococcosis in cattle was found as 46.41% in Erzurum (Arslan & Umur, 1997), 39.7% (Özcelik & Saygı, 1990) and 35.7% in Sivas (Acıoz, 2008), 33.9% in Erzurum (Balkaya & Simsek, 2010), 29.47% in Afyonkarahisar (Kose & Sevimli, 2008), 14.16% in Kırıkkale (Yıldız & Tuncer, 2005), 13.5% in Burdur (Umur, 2003) % in Thrace (Esatgil & Tuzer, 2007), 9.4% in Ankara (Öge et al., 1998), 8.96% in Manisa (Cenet & Tascı, 1994), 7% in Malatya (Kara et al., 2009), 5.6% in Konya (Civi et al., 1995), and 3% in Kayseri (Bagdatlıoglu, 2019; Duzlu, 2010), whereas hydatid cysts were found in 2.09% (240) of male and 14.31% (247) of female cattle out of 13,191 cattle slaughtered in the province of Aydın. Another study found this rate as 31.25% in the province of Kars (Gıcık, 2004). Cystic echinococcosis was detected in 5.3% (n=203) of 3846 cattle slaughtered in the municipal abattoir of the province of Kars (Demir & Mor, 2011). The authors reported a total economic loss of 12,180 TRY caused by livers discarded due to the presence of hydatid cysts. The rate of hydatid cysts in cattle slaughtered in two private slaughterhouses in the Bursa province of Türkiye was reported as 3.06%, and the costs of the destroyed internal organs due to fasciolosis and hydatidosis in cattle were estimated to be $4,042 and $12,321, respectively (Yibar et al., 2015). In Muğla, twenty-one out of 9,985 (0.21%) cattle were found to have been infected with hydatid cysts in 2019. Cumulatively, the direct and indirect economic loss created by hydatid cyst infections in the province of Muğla was 134,451 TL ($22,296) (Acıoz

et al., 2021). In Konya, the livers of 810 (1.97%) sheep were found to be infected with hydatid cysts throughout the period of a study. The total economic loss incurred due to the discarded livers was estimated as 36,450 TL ($6,417) (Uslu et al., 2021).

The prevalence of hydatid cysts was lower in the Afyonkarahisar province (21.83%) than in some other provinces in Türkiye such as Erzurum, Kars, and Sivas, where pasture activities are intense. Animal husbandry in these provinces is mostly based on pastures, and the herds are intertwined with dogs, increasing the prevalence of hydatid cysts. The present study revealed that the prevalence of cystic echinococcosis was higher in male cattle than in female ones. This may be because cattle breeding operations are carried out more intensely than the dairy cattle farming activities in Afyonkarahisar.

Although there is no significant clinical symptom in animals due to hydatid cysts, significant economic loss occurs due to decreased meat and milk yield, increased sterility rates, and disposal of offal such as livers and lungs after slaughter (Koroglu & Simsek, 2004; Balkaya & Simsek, 2010; Umur, 2003; Duzlu et al., 2010; Sarıözkan & Yalcın, 2009). Studies have reported 2.5-5% loss in carcass weight, 2.5-10% loss in milk yield (Torgerson, 2000), and 11% decrease in pregnancy rates in calves due to hydatid cysts (Budke et al., 2005). One study conducted in the Burdur province of Türkiye found a mean decrease of $7.5 per cattle in carcass value due to cystic echinococcosis (Umur, 2003). Another study conducted throughout Türkiye estimated an annual economic loss of $32.4 million ($26.2 million-$39.1 million) due to carcass, milk yield, birth, and offal loss (Sarıözkan & Yalcın, 2009).

In the present study, the rate of hydatid cysts in cattle was 21.83%, causing an economic loss of 79,556.74 TRY ($13,981.85) due to liver disposal alone. Considering indirect yield losses due to cystic echinococcosis, this value will be even higher. From this point of view, considering the 2019 cattle slaughter data in Türkiye, the total liver disposal-related loss due to infections was estimated as 102,742,642.10 TRY ($18,056,703.36).

4. Conclusions

As hydatid cysts pose a significant risk on human and animal health and leads to various yield losses and liver disposal requirements, one can conceive how big the economic loss it causes is. The presence of this infection in approximately 22 out of every 100 cattle is worrisome considering both detectable and undetectable yield losses that it causes. It is more possible for dogs to reach cystic organs, especially in areas other than slaughterhouses, threatening public health to a serious extent. Further studies on this topic will help not only in preventing yield losses in animals but also in eliminating the damage caused by this significant form of zoonosis. In addition to the institutional control measures to prevent this infection, producers should be informed about implementing their individual protection measures. By conducting further studies on zoonotic diseases such as hydatid cysts, these diseases can be eradicated by providing alternative means of struggle to administrative units in the decision-making mechanism against such diseases.

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