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Research Article

Investigation of the Prevalence of Hydatid Cysts and Liver Condemnation Losses in Sheep and Goats Slaughtered in Van Province, Türkiye

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ABSTRACT

This study was conducted to determine the financial losses and distribution in internal organs caused by liver condemnation due to hydatid cysts in sheep and goats slaughtered in slaughterhouses in Van province of Türkiye. Hydatid cysts were detected in 247 out of 1200 sheep (20.58%) and 26 out of 150 goats (17.33%), totaling 273 animals (20.22%). According to organ localizations, hydatid cysts were most frequently seen in both the liver and lungs in 96 (39.52%) sheep and 9 (34.62%) goats, totaling 105 (38.46%) animals. It was determined that the prevalence of hydatid cysts in sheep and goats slaughtered in Van province was high. The high incidence of hydatid cyst infections in sheep and goats in Van province poses a risk to human and animal health in the region and causes significant financial losses. Therefore, studies should be carried out to prevent the spread of the disease and financial losses, and taking protective measures is essential.

Keywords: *Financial loss, Hydatid cyst, Van*

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INTRODUCTION

Echinococcus granulosus is a zoonotic helminth that infect various animal species and humans and widespread in Türkiye and the world. Carnivores including dogs are final hosts which while humans and animals are the intermediate hosts. While the adult form of *Echinococcus granulosus* settles in the small intestine of carnivores, the larval form settles in the internal organs of the intermediate hosts including sheep, goats, cattle, pigs as well as humans, and causes hydatid cysts, which leads to significant health problems (Almulhim and John, 2022; Toparlak and Tüzer, 2012). The life cycle of *Echinococcus granulosus* begins with the ingestion of water and food contaminated with the eggs found in the feces of infected carnivores (Toparlak and Tüzer, 2012; Ertabaklar et al., 2019). Hydatid cyst infections caused by *Echinococcus granulosus* show significant differences between developed and developing countries. In developed countries, high levels of public education and regular administration of antiparasitic drugs to dogs have significantly reduced the spread of hydatid cyst infections (Akyol, 2001). Such preventive health measures are effective for public health strategy and contribute to the control of the infection. The prevention of cystic echinococcosis relies on implementing integrated strategies aimed at disrupting the parasite's life cycle. One of the most critical steps is the regular deworming of dogs, the primary definitive hosts, with anthelmintic drugs such as praziquantel to prevent the release of parasite eggs into the environment (WHO, 2020). Additionally, preventing dogs from consuming raw offal especially livers and lungs from infected livestock is essential to stop the acquisition of the parasite (Craig et al., 2017). Ensuring proper hygiene and inspection in slaughterhouses and eliminating illegal home slaughter practices can significantly reduce environmental contamination (ECDC, 2021). From the human health perspective, especially in rural areas, public health education on hand hygiene, washing vegetables and fruits before consumption, and avoiding direct contact with stray dogs can reduce transmission risk (Torgerson & Macpherson, 2011). The implementation of surveillance programs in livestock populations is also crucial for early detection and control in endemic regions (Romig et al., 2020). The World Health Organization and the Food and Agriculture Organization advocate for a "One Health" approach, emphasizing integrated control strategies that consider the interconnectedness of human, animal, and environmental health (WHO, 2020; FAO, 2019). On the other hand, factors such as uncontrolled or illegal animal slaughter, large numbers of stray dogs, and the disposal of infected organs into the environment without destroying them facilitate the spread of hydatid cyst infections in developing countries. Inadequate hygiene conditions, limited access to health services, and lack of sufficient information in the society are also important factors in these countries. (Almulhim and John, 2022; Ertabaklar et al., 2019; Toncheva and Zhelyaskov, 1999).

Cystic echinococcosis is a zoonotic parasitic disease that causes significant public health concerns and economic losses, especially in regions where close contact with livestock is common. According to the World Health Organization (WHO), echinococcosis affects nearly one million people annually and is endemic in areas such as South America, the Middle East, North Africa, Central Asia, and parts of Europe (WHO, 2020). Prevalence rates can exceed 4% in countries like Türkiye, Iran, China, Kenya, and Peru (Torgerson et al., 2015). Economically, the disease results in billions of dollars in losses due to healthcare costs and reductions in livestock productivity. A global analysis by Torgerson et al. (2015) estimated the total annual economic burden of cystic echinococcosis including both human health and livestock production losses at approximately 3 billion USD. These losses include carcass condemnation, decreased milk and wool production, treatment expenses, and labor loss (Budke, Deplazes, & Torgerson, 2006; Torgerson et al., 2015).

This study was conducted to determine the prevalence of hydatid cysts in sheep and goats slaughtered in Van province and the financial losses resulting from liver condemnation.

MATERIAL AND METHODS

This study was conducted on a total of 1350 the internal organs of animals including1200 sheep and 150 goats slaughtered in slaughterhouses under the control of Van Metropolitan Municipality in Van province of Türkiye between February and November 2023, which constituted the study material, by visiting once a week. After slaughter, the internal organs of the animals (liver, lungs, spleen, kidney and heart) were examined in detail by inspection and palpation and evaluated for the presence of hydatid cysts. Financial losses caused by condemnation of livers due to hydatid cysts in particular, were calculated based on the 2023 liver sales price and certain parameters to calculate these losses. On average, liver weight in sheep and goats was assumed 0.5-1.26 kg and its ratio to body weight as1.45%. Accordingly, the average price per kilogram of liver in sheep

and goats was as 1$ = 26 TL (September 2023). (Table 1). Financial loss was calculated according to the formula in table 1. (Sarıözkan and Yalçın, 2009).

Table 1. *Estimating method of production losses due to CE in ruminants.*

Loss	Calculation method
Liver Loss	(Number of slaughtered animals x Cystic echinococcosis rate) x Average liver weight x Price per kg of liver]

RESULTS

Hydatid cysts were detected in 247 of 1200 sheep (20.58%) and 26 of 150 goats (17.33%) slaughtered in slaughterhouses under the control of Van Metropolitan Municipality between February and November 2023, totaling 273 (20.22%) animals (Table 2). When the organ localizations of the cysts were examined; it was determined that the presence of hydatid cysts was mostly seen in the liver and lungs in 96 (39,52%) sheep and 9 (34,62%) goats (Table 2).

Table 2. *Numerical data of sheep and goats infected and uninfected with hydatid cysts*

Type	**Hydatid cyst (+)**		**Hydatid cyst (-)**		**Total**	
	Number	%	Number	%	Number	%
Sheep	247	20,58	953	79,42	1200	88,88
Goat	26	17,33	124	82,67	150	11,12
Total	273	20,22	1077	79,78	1350	100

The detailed distribution of hydatid cysts by organs is shown in Table 3.

Table 3. *Distribution of hydatid cyst according to infected organ locations*

Organs	**Sheep**		**Goat**		**Total**	
	Number	%	Number	%	Number	%
Liver only	79	32,10	7	26,91	86	31,50
Lung only	58	23,42	8	30,77	66	24,18
Lung + liver	96	39,52	9	34,62	105	38,46
Other organs (Heart, Spleen, Kidney)	14	4,95	2	7,70	16	5,86

All 273 livers with hydatid cysts were destroyed. The unit price of an average 1 kg sheep and goat liver in 2023 has been determined as 175 TL/kg, and the total material value of liver loss due to cystic echinococcosis has been determined as 47775 TL (=1837.5$). According to the data obtained from the relevant institutions, a total of 16500 small cattle, including 14500 sheep and 2000 goats, were slaughtered in Van province in 2023. In total, the material loss incurred as a result of the condemnation of livers in sheep and goats slaughtered annually in 2023 has been determined as (16500 x %20.58) x (1 x 175) = 597247,5 TL (=22855.67$).

DISCUSSION

Hydatid cyst is one of the most important parasitic zoonoses in the world, affecting both humans and domestic animals (Toparlak and Tüzer, 1999; Soulsby, 1986; Balkaya and Şimşek, 2010). Hydatid cyst is a zoonotic parasitic disease that is common in Türkiye as well as all over the world. In Türkiye, the adult form of the *Echinococcus granulosus* parasite is found in the small intestine of carnivores, especially dogs, while the larval form is found in animals such as sheep and goats, cattle, horses, donkeys, mules and pigs (Díaz, 2017). The disease mostly settles in tissues and organs such as the lungs, liver, spleen, kidney, heart, bone marrow, eye and brain, forming fluid-filled cysts (Agudelo et al., 2016). Hydatid cysts are frequently seen especially in regions where animal husbandry is done, but they still maintain their importance due to both public health and financial losses they cause (Yazar, 2005). According to TUİK data, 18.4% of the active population in Türkiye is engaged in agriculture and animal husbandry, and *Echinococcus granulosus* is still commonly encountered

today due to the uncontrolled slaughter of animals, especially in rural areas, and the feeding of cystic organs to stray dogs (Demir and Mor, 2011; TUİK, 2011; Hakverdi et al., 2008). Many studies have been conducted in different countries of the world to determine the prevalence of hydatid cysts in farm animals. According to recent studies; hydatid cysts in sheep have been reported at a rate of 65.6% in Romania (Mitrea et al., 2014), 61.9% in Moldova (Chihai et al., 2016), 18.1% in Algeria (Ouchene et al., 2014), 2.9% in Iran (Borji et al., 2012), 10.6% in Ethiopia (Kebede et al., 2009) and 3.5% in China (Guo et al., 2019). In studies conducted in various slaughterhouses in Türkiye; The prevalence of cystic echinococcosis in Afyon is 29.5% (Köse, 2008), 9.8% in Ankara (Öge, 1998), 3.2% in Antakya (Hakverdi et al., 2008), 13.5% in Burdur (Umur, 2003), 34.3-46.4% in Erzurum (Arslan and Umur, 1997; Balkaya and Şimşek, 2001), 31.3% in Kars (Gıcık et al., 2004), 3% in Kayseri (Düzlü et al., 2010), 14.2% in Kırıkkale (Yıldız and Tuncer, 2005), 9.4% in Konya (Dik et al., 1992), 21.1% in Samsun (Celep et al., 1990), and 4.5-35.7% in Sivas (Acıöz et al., 2008) reported that it was 37.8% in Van (Değer et al., 2001). In this study, the cystic echinococcosis rate determined in sheep and goats was determined as 20.22%. The findings obtained in this study are parallel to the previous studies conducted in Afyon, Erzurum, Kars, Samsun, Sivas and Van provinces. We suggest that the reason for these high rates may be pasture-based animal husbandry, the continuous walking of dogs with sheep and cattle in the pastures during the day, their sleeping in barns at night and uncontrolled slaughtering of animals.

Although no significant clinical symptoms are observed in animals due to cystic echinococcosis, significant economic losses occur due to decrease in meat and milk yield, increase in infertility rate, and disposal of offal, especially liver and lungs, after slaughter (Balkaya and Şimşek, 2010; Düzlü et al., 2010; Sarıözkan and Yalçın, 2009; Umur, 2003; Köroğlu and Şimşek, 2004). In a study conducted throughout Türkiye, it was estimated that there is an annual economic loss of 32,400,000$ (26,200,000$-39,100,000$) due to carcass, milk yield, birth and offal loss (Sarıözkan and Yalçın, 2009). In studies conducted worldwide, it has been reported that the annual economic loss due to hydatid cyst is 232.3$ million in Iran (Fasihi Harandi et al., 2012), 212.35$ million in India (Singh et al., 2014), 141,605,195$ in the USA (Budke et al., 2006), and $58,114.62 in Ethiopia (Guduro and Desta, 2019). In a study conducted in a slaughterhouse in Southwestern Ethiopia, the annual economic loss was calculated as 12,758.21$ (Mesay et al., 2017). In a study conducted in Erzurum, the economic loss due to liver condemnation due to hydatid cyst has been estimated as 3,320 TL (Balkaya and Şimşek, 2010). In a study covering three slaughterhouses in Kayseri, the economic loss due to hydatid cyst was determined to be 31,372$ (Düzlü et al., 2010). In Kars province, the annual economic loss due to liver condemnation alone was reported as 12,180 TL (Demir and Mor, 2011). In Bursa, the total loss due to hydatid cyst was calculated as 12,321$ (Yibar et al., 2015). In a study covering all of Türkiye, the economic loss due to hydatid cyst was reported as 36.3% for cattle, 60.7% for sheep and 3.0% for goats (Sariözkan and Yalçin, 2009). In a study, it was reported that direct and indirect economic losses in Türkiye could be 98,558$ and 466,891$, respectively. It was also reported that the total monetary loss due to Hydatidosis in Türkiye in 2020 could be an estimated $565,448. (Acıöz and Bozkaya., 2022).

CONCLUSION

In this study, it was calculated that the liver condemnation caused by cystic echinococcosis determined in sheep and goats was 47775 TL (=1837.5$). The financial loss arising as a result of the condemnation of livers in sheep and goats slaughtered annually in Van province in 2023 was determined as (=22855.67$). However, when indirect yield losses due to cystic echinococcosis are calculated, it can be said that this value will be even higher. As a result, it can be argued that the high frequency of cystic echinococcosis in sheep and goats in Van province poses a risk to human and animal health in the region and leads to significant financial losses. It is thought that informing breeders about the transmission routes and protection measures regarding hydatid cyst, one of the important zoonoses, taking the necessary precautions for stray dogs, preventing uncontrolled and illegal slaughtering and ensuring that cystic organs are destroyed under appropriate conditions will be an effective eradication program in reducing the prevalence of the disease.

COMPLIANCE WITH ETHICAL STANDARDS

This research study complies with research and publication ethics. The scientific and legal responsibility of the articles published in MJAVL belongs to the author(s).

CONFLICT OF INTEREST

There is no conflict of interest between the authors in this section.

AUTHOR CONTRIBUTION

V.D: 50%, A.S.K: 50% contributed.

ETHICS APPROVAL

This study does not require ethics committee approval.

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