



**Prevalence of Cystic Echinococcosis in Cattle Slaughtered in Kastamonu Slaughterhouse and Its Importance in Turkish Economy\***

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**Abstract:** This study was carried out to determine the prevalence of cystic echinococcosis (CE) in cattle slaughtered in the slaughterhouse of Kastamonu Municipality, where cattle breeding is common and to determine the economic loss in the country's economy due to this disease. A total of 5511 bovine livers were examined postmortem for CE between January and December 2021. Of the 5511 cattle, 3872 are male and 1639 are female. In the postmortem examination, the livers of the animals were examined and the number of animals with CE was calculated to be 524 and the prevalence of the disease was 9.51%. In animals, the highest monthly prevalence was observed in July with 14.85% and the lowest prevalence in December with 3.94%. CE was the lowest with 4.94% in winter and the highest with 13.68% in summer. CE was found to be the lowest in male animals with 4.44% in winter and the highest prevalence in summer with 12.70%. The prevalence of the disease in female animals was 6.79% in winter and 21.32% in summer. Livers with CE were destroyed regardless of infection intensity. As a result of this study, with the destruction of 524 livers, 136240 TL (13859 USD) was lost to the Turkish economy. It has been stated that CE is common in Kastamonu as in Turkey and causes great economic losses.

**Keywords:** Cattle, echinococcosis, economic loss, Kastamonu, zoonosis

**Kastamonu Mezbanesinde Kesilen Sığırlarda Cystic Echinococcosis'in Prevalansı ve Türkiye Ekonomisindeki Önemi**

**Öz:** Bu çalışma, büyübaş hayvancılığın yaygın olduğu Kastamonu ilinde Belediyeye ait mezbanesinde kesilen sığırlarda Kistik Echinococcosis'in prevalansının araştırılması ve bu hastalık nedeniyle ülke ekonomisindeki ekonomik kaybın belirlenmesi amacıyla yapılmıştır. Ocak-Aralık 2021 tarihlerinde toplam 5511 adet sığır karaciğeri kistik echinococcosis yönünden postmortem olarak incelenmiştir. 5511 sığırın 3872 tanesi erkek, 1639 tanesi ise dişidir. Postmortem muayenede hayvanların karaciğerleri incelenmiş kistik echinococcosisli hayvan sayısının 524 olduğu ve hastalığın prevalansının %9.51 olduğu hesaplanmıştır. Hayvanlarda aylık olarak en yüksek prevalans %14.85 ile Temmuz ayı, en düşük prevalans ise %3.94 ile Aralık ayı olarak görülmüştür. Kış mevsiminde %4.94 olarak en düşük, yaz mevsiminde %13.68 oran ile en yüksek Kistik Echinococcosis belirlenmiştir. Erkek hayvanlarda kış mevsiminde Kistik Echinococcosis sayısında %4.44 ile en düşük, %12.70 ile ise yaz mevsiminde en yüksek prevalans tespit edilmiştir. Hastalığın prevalansı dişi hayvanlarda kış mevsiminde %6.79 olarak görülmüş, yaz mevsiminde ise %21.32 olarak belirlenmiştir. Kistik echinococcosisli karaciğerler enfeksiyon yoğunluğuna bakılmaksızın imha edilmiştir. Bu çalışmanın sonucu olarak, 524 adet karaciğerin imhasıyla beraber 136240 TL (13859 USD) Türkiye ekonomisinde kayıp şekillenmiştir. Kistik echinococcosis Türkiye genelindeki gibi Kastamonu ilinde de yaygın olduğu ve büyük ekonomik kayıplara sebep olduğu açıklanmıştır.

**Anahtar kelimeler:** Echinococcosis, ekonomik kayıp, Kastamonu, sığır, zoonoz

**Introduction**

The amount of animal protein consumed per capita is one of the most important criteria for the development level of countries. In underdeveloped and developing

countries, the increase in animal product production is less than the increase in population. Regardless of the level of development, ensuring the food security of the society is one of the basic responsibilities of every country. Animal husbandry is a sector that makes significant contributions to the country's economy and it is necessary to provide the highest level of importance for food safety in our country. Ensuring the continuity of food security is one of the cornerstones for the development of the country. It is known that parasitic infections cause low yield in cattle breeding

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ding (Uslu et al., 2021; Küçükyağlıoğlu and Uslu, 2022).

*Echinococcus granulosus*, which is the causative agent of the disease, is a helminthozoonosis caused by larval form of hydatid cyst, which lives in the small intestines of dogs, wolves, jackals and other canidae and develops in mammals such as sheep, goats, cattle and humans as intermediate hosts (Umur and Aslantas, 1993; Altintas, 1998; Senlik, 2012). In addition to the environment, host and intermediate host factors, human habits also have a great impact on the spread and interregional differences of CE (Yıldız and Tuncer, 2005).

Symptoms of CE can cause serious losses in labor and economy. It can also result in death in humans and animals. The prevalence of CE in humans in Turkey has been reported as 1/2.000 (Acıöz et al., 2021). In addition to the economic loss in the destruction of livers infected with CE, the cost of treatments applied in human medicine is also important as it causes morbidity and mortality (Balkaya and Simsek, 2010).

Reasons such as illegal slaughtering of animals, stray dogs, inadequate slaughterhouse conditions and inability to destroy diseased organs play a role in the spread of the disease. The spread of the disease occurs through irregular parasitic applications of domestic dogs and close contact with stray dogs (Arslan and Umur, 1997).

Diagnosis is difficult as the disease does not show significant symptoms in intermediate hosts such as cattle, sheep and goats (Senlik, 2000). It has been reported that using ultrasonography in diagnosis is not cost effective and practical (Eckert and Deplazes, 2004). The definitive diagnosis of the disease is made through postmortem examination (Senlik, 2012).

Studies showing the prevalence of CE by months and seasons are limited in our country and in the world (Azami et al., 2013). It has not been determined that any research has been carried out in Kastamonu regarding CE. It is thought that this study conducted in Kastamonu will contribute to the literature.

In the study we conducted in Kastamonu, where livestock breeding is common, it was aimed to determine the damage to the country's economy by grouping the prevalence of CE in cattle slaughtered in abattoirs according to month, season and gender.

## Material and Method

### Study area

According to the data of the Turkish Statistical Institute, Kastamonu province has an important place in the country's livestock with 276859 cattle in 2021 (TSI, 2021).

### Study period and animals

The research was carried out in cattle slaughtered in the slaughterhouse of Kastamonu Municipality between January and December 2021.

In this study, postmortem examination of 5511 bovine livers for CE was performed. After postmortem examination, domestic and imported beef and dairy cattle slaughtered were evaluated by classifying them according to gender, month and season.

### Postmortem examinations

In the study, CE in other organs was not included in the evaluation since CE is mostly found in the liver and the economic value of the liver is high.

During the examinations of the internal organs, the liver was first examined macroscopically, then by superficially stroking and applying pressure, the presence of hardness and swelling in the inner parts of the liver, as well as the presence of a section with a knife, the internal parts of the organ were examined for CE. All infected livers were destroyed regardless of the number of cysts and the degree of infection.

### Calculation of economic losses

The damage caused to the national economy due to the destruction of the liver infected with CE was determined as 65 TL/kg on average and the average liver weight of cattle was 4 kg over the offal prices in 2021. Since the entire liver is destroyed regardless of the degree of infection, the economic loss caused by CE in an animal was calculated as  $65 \times 4 \text{ kg} = 260 \text{ TL}$  on average.

Total economic loss was calculated following, formula;  $TEL = NLCE \times CPL$

TEL: Total economic loss (TL)

NLCE: Number of livers with CE

CPL: Current price of the liver

### Data management and statistical analysis

Excel program was used in the documentation process and the data were; The comparison of CE according to months, seasons and genders was evaluated by performing a Fisher's exact chi-square and Bonferroni corrected Post Hoc tests in the

“SPSS29.0 statistical program (IBM Corporation, Armonk, New York, USA.)”. For the significance level of the tests,  $P < 0.001$  was accepted. Categorized data are shown with frequency and percentage values.

## Results

In the study, 3872 of the 5511 cattle slaughtered in Kastamonu Municipality slaughterhouse are male and 1639 of them are females. Livers of slaughtered animals were examined for CE in postmortem examination.

number of animals with CE was 524 and the prevalence of the disease was 9.51%. The month with the highest prevalence was found to be July with 14.85% and the lowest prevalence was determined as December with 3.94%.

Table 2 shows the data on the number of cattle slaughtered and the number of infected animals according to the seasons. When the number of infected animals was analyzed by months, a statistically significant difference was found ( $P < 0.001$ ). Different letters next to the infection rates

**Table 1.** Cystic echinococcosis numbers by months

Months	Number of Slaughtered Cattle	Number of Infected Animals	Infected Rate (%)
January	192	8	4.17 <sup>a</sup>
February	413	29	7.02 <sup>b</sup>
March	302	33	10.93 <sup>c</sup>
April	674	67	9.94 <sup>b,c</sup>
May	262	35	13.36 <sup>d</sup>
June	531	65	12.24 <sup>c,d</sup>
July	680	101	14.85 <sup>d</sup>
August	514	70	13.62 <sup>d</sup>
September	464	47	10.13 <sup>c,d</sup>
October	343	21	6.12 <sup>a,b</sup>
November	426	20	4.69 <sup>a</sup>
December	710	28	3.94 <sup>a</sup>
<b>Total</b>	<b>5511</b>	<b>551</b>	<b>9.51</b>

The difference between groups with different letters in the same column is statistically significant ( $P < 0.001$ ).

<sup>a-d</sup>: There is a statistical difference between different letters and letter groups.

Table 1 shows data on the number of cattle slaughtered and the number of infected animals by month. When the number of infected animals was analyzed by months, a statistically significant difference was found ( $P < 0.001$ ). Letters that differ from each other are categories with statistically significant differences. Significant for animals infected between January (4.17), February (7.02), March (10.93), April (9.94), May (13.36), June (12.24), July (14.85), August (13.62) and September (10.13) difference was found. However, there is no significant difference between January and October (6.12), November (4.69) and December (3.94). In the postmortem examination, it was determined that the

are the categories that have a statistical difference. While there was no statistically significant difference in the number of infected animals between January (10.9) and February (13.7), a difference was found between January and March (7.1) and April (4.9) ( $P < 0.001$ ). The rates of seasonally infected cattle with CE are indicated in the table as winter in December-January-February, spring in March-April-May, summer in June-July-August and autumn in September-October- November. In the study, it was observed that animals with CE were slaughtered at the lowest rate as 4.94% in the winter season and at the highest rate with 13.68% in the summer season

**Table 2.** Cystic echinococcosis numbers by seasons

Seasons	Number of Slaughtered Cattle	Number of Infected Animals	Infected Rate (%)
Spring	1238	135	10.9 <sup>a</sup>
Summer	1725	236	13.7 <sup>a</sup>
Autumn	1233	88	7.1 <sup>b</sup>
Winter	1315	65	4.9 <sup>b</sup>

The difference between groups with different letters in the same column is statistically significant ( $P < 0.001$ ).

<sup>a,b</sup>: There is a statistical difference between different letters and letter groups.

Table 3 shows data on the number of male cattle slaughtered by season and the number of infected male animals. When the number of infected animals was analyzed by months, a statistically significant difference was found ( $P<0.001$ ). Different letters next to the infection rates are the categories that have a statistical difference. There was a significant difference in the number of infected male animals between spring (9.8) and summer (12.7) and winter (4.4) in terms of infected male animals but there was no significant difference between spring and autumn (6.7) and winter (4.4) and autumn (6.7). The number of male cattle with CE is the lowest with 4.4% in winter and the highest prevalence with 12.7% in summer.

is calculated as 9.83 TL on average during the dates of the study, it is seen that the economic damage to the country is approximately 13859 USD.

### Discussion and Conclusion

The CE, which has a high spread in Turkey, causes serious economic losses as well as the damage it causes to animal and human health (Düzlü et al., 2010). CE which has a high spread in Turkey, causes serious economic losses as well as the damage it causes to animal and human health (Düzlü et al., 2010). The prevalence of CE in cattle was observed at low rates of 0.002%-8.28% in countries such as Nigeria, Brazil, China, Saudi Arabia and Iran (Onah

**Table 3.** Cystic echinococcosis numbers in male animals by seasons

Seasons	Number of Slaughtered Cattle	Number of Infected Animals	Infected Rate (%)
Spring	1080	106	9.8 <sup>a</sup>
Summer	1528	194	12.7 <sup>b</sup>
Autumn	1148	77	6.7 <sup>a,c</sup>
Winter	1035	46	4.4 <sup>c</sup>

*The difference between groups with different letters in the same column is statistically significant ( $P<0.001$ ).*

<sup>a,c</sup>: *There is a statistical difference between different letters and letter groups.*

Table 4 shows data on the number of female cattle slaughtered by season and the number of infected females. When the number of infected animals was analyzed by months, a statistically significant difference was found ( $P<0.001$ ). Different letters next to the infection rates are the categories that have a statistical difference. There was a significant difference in the number of infected female animals between spring (18.4) and winter (6.8) in terms of infected female animals but there was no significant difference between spring and summer (21.3) and autumn (12.9). While the prevalence was low in female animals at 6.79% in winter, the prevalence was calculated as 21.32% in summer.

et al., 1989; Artures et al. 1996; He and Wang, 2001; Ibrahim 2010; Azami et al., 2013), and at rates of 11.3%-19.4% in countries such as Libya, India, Iran, Kenya and Ethiopia (Sarma et al., 2000; Dalimi et al., 2002; Njoroge et al., 2002; Tashani et al., 2002; Kumsa 2019). While the prevalence is as low as 0.21%-9.4% in Turkey's Muğla, Kayseri, Sivas, Kars, Elâzığ, Konya and Ankara provinces (Öge et al., 1998; Acioz et al., 2008; Düzlü et al., 2010; Demir and Mor, 2011; Baspınar et al., 2014; Acioz et al., 2021; Küçükyağlıoğlu and Uslu, 2022). It was determined at higher rates such as 11.6%-56.5% in the Thrace region, Burdur, Kırıkkale, Samsun, Afyonkarahisar, Kars, Sivas, Van and Erzurum provinces

**Table 4.** Cystic echinococcosis numbers in female animals according to seasons

Months	Number of Slaughtered Cattle	Number of Infected Animals	Infected Rate (%)
Spring	158	29	18.4 <sup>a</sup>
Summer	197	42	21.3 <sup>a</sup>
Autumn	85	11	12.9 <sup>a,b</sup>
Winter	280	19	6.8 <sup>c</sup>

*The difference between groups with different letters in the same column is statistically significant ( $P<0.005$ ).*

<sup>a,c</sup>: *There is a statistical difference between different letters and letter groups.*

Regardless of the density or type of cysts (small, large, calcified) in the livers with infection in the study, all of them were destroyed. A total of 524 livers were destroyed and since the price of a cattle liver in 2021 was 260 TL, the total loss was calculated as  $260 \times 524 = 136\,240$  TL. When the USD exchange rate

(Toparlak and Gül, 1989; Celep et al., 1990; Umur and Aslantas, 1993; Yıldız and Tuncer, 2005; Ulutaş Esatgil and Tüzer, 2007; Köse and Kırçalı Sevimli, 2008; Balkaya and Simsek, 2010; Erol et al., 2021). The result obtained in this study (9.51%) was found to be close to the rates in Saudi Arabia (8.28%) and

Ankara in Turkey (9.4%).

Although CE is widely distributed in the world, CE cases are more common especially in rural areas of underdeveloped countries (Dar and Alkarmi, 1997). The prevalence of CE, which is seen in almost every region of the world, varies from country to country. The climate of the region, ecological structure, animal breeding methods, age and species of animals, techniques used in researching their prevalence and data collection etc. many biotic and abiotic factors such as CE are thought to be effective in determining the prevalence (Senlik, 2000; Eckert et al., 2004; Düzlü et al., 2010; Almalki et al., 2017). The reasons for this difference are as follows. In studies carried out to date, it has been determined that butchers do not have enough information about how CE disease occurs (Aydın et al., 2015). In the study conducted in Iran, they detected CE at the most 7.89% in the spring and at least 4.6% in the winter season; (Azami et al., 2013) in our study, the highest prevalence was 13.68% in summer and 4.94% in winter season. In another study in Elâziğ, they reported highest prevalence in winter with 9.87% and the lowest prevalence as 4.17% in spring (Baspınar et al. 2014). Studies indicating the prevalence of CE by months and seasons are limited. While it was reported that the prevalence of CE was higher in October in Algeria, the highest rate of infection was observed in July in our study (Ayad et al., 2019). Although the rates detected in the winter months in our study are similar to the rates in the winter months in Iran, we think that it is not possible to draw a consistent conclusion according to seasons and months because many factors are effective in the spread of the disease.

In a study conducted in Aydın, the prevalence of CE was reported to be 2.09% in males and 14.31% in female cattle. In this study, it was determined that it was 8.83% in males and 14.02% in female cattle. Although the prevalence in female cattle was similar to the study conducted in Aydın, it was observed that the rate in males was 4 times on average (Bağdatlıoğlu, 2019). It is thought that the reason for this difference is the number of slaughtered animals and the excess of males in livestock.

It has been reported that CE causes economic damage of 4 billion USD worldwide (Uslu et al., 2021). In a country-wide study, it was reported that the loss of CE, which causes a decrease in meat, milk, fleece and fertility in ruminants, to the country's economy in 2008 was 89.2 million USD (Sarıözkan and Yalcın, 2009). In a study conducted in Erzurum, in the CE examination of 1066 sheep and 530 cattle after slaughter, the infection rate in cattle was reported as 46.41% and the economic loss was calculated as 2300 USD (Arslan and Umur, 1997). Although it is seen that there are infected animals about 5 times as many as our study, it is seen that the economic loss

is below our study. In a study conducted in Konya, the prevalence of hydatid cysts in cattle was reported as 9.40% (Gıcık et al., 2004). Although the rate of 9.40% in Konya is similar to the rate of 9.51% in our study, it is different from our study when the CE infection values are examined by month. The prevalence was highest in October (75.3%) and lowest in June (15.1%). It has been calculated that the destruction of the infected liver and lungs causes an annual economic loss of 52 264 USD (Dik et al., 1992). This value shows that there is a high economic loss according to our study. In the study conducted in the same region in Konya in cattle, it was reported that the prevalence of hydatid cyst was around 5.60% (Civi et al., 1995). In a study conducted by Küçükyağlıoğlu and Uslu (2022) on 49 545 cattle between 2018 and 2019 in Konya, it was reported that the livers of 1947 (3.93%) cattle were destroyed and an economic loss of 56 434 USD (384 400 TL) occurred. Although the rate seems low according to our research, the total value of the economic loss due to the excess amount of animals examined was found to be higher than our study (Küçükyağlıoğlu and Uslu, 2022). In the study conducted to investigate the economic losses caused by CE in ruminant animals in Burdur province, an annual loss of 583 USD was observed with the destruction of the infected liver and lungs of 183 cattle out of 1355 cattle (Umur and Aslantas 1993). Considering the ratio, 13.5% is higher than our study but it remains low in terms of USD.

Hydatid cyst is a zoonotic disease that continues to be an important problem in terms of public health in many parts of the World and our region. Control and prevention measures should be carried out together to prevent the spread of the disease. For the control of the disease, public awareness, control and treatment of dogs, prevention of offal and raw meat consumption by dogs, regular inspection and effective control of slaughterhouses, cooperation with public health authorities for the eradication of the disease show the importance of working. For this purpose, uncontrolled animal slaughter should not be done. In addition, infected organs should be disposed of properly (burned in ovens, buried in deep pits) and never fed to dogs. Considering the life cycle of the parasite, the routine examination and treatment of stray dogs by municipalities or private veterinary clinics is also important for public health. Legal animal slaughter should be adopted as a control measure and stray dogs roaming around the slaughterhouse should be removed if possible.

It has been observed that the dog population has increased abnormally in our country in recent years and it has been determined that the streets, walking areas and parks are wandered by stray dogs. We think that hydatidosis transmitted from these animals will threaten public health more in the coming years and cause much higher economic losses.

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