Turkiye Parazitol Derg 2022;46(3):207-12
DOI: 10.4274/tpd.galenos.2022.74946

Prevalence and Economic Significance of Hidatidosis in Cattle Slaughtered at an Abattoir in Konya, Turkey

Konya'da Mezbahada Kesilen Sığırlarda Hidatidosis'in Yaygınlığı ve Ekonomik Önemi

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Cite this article as: Küçükyağlıoğlu A, Uslu U. Prevalence and Economic Significance of Hidatidosis in Cattle Slaughtered at an Abattoir in Konya, Turkey. Turkiye Parazitol Derg 2022;46(3):207-12.

ABSTRACT

Objective: This study was conducted to determine the period prevalence of hydatid cysts isolated from the livers of cattle slaughtered at a slaughterhouse in Konya.
Methods: For this purpose, 49,545 cattle were slaughtered and examined for the presence of hydatid cysts in the liver. The study was conducted between June 01, 2018, and May 31, 2019.
Results: The highest prevalence of hydatid cysts was observed in autumn 10.83% followed by spring 4.41%, winter 2.90%, and summer 2.66%, with an overall prevalence of 3.93%. Considering the month wise prevalence of hydatid cyst, the highest infection rate was detected in September (7.87%), June (7.16%) and August (7.14%), while the lowest prevalence was observed in February (2.72%) and January (2.83%). In gender-wise investigation, highest prevalence was observed in females (24.65%) during the summer and 18.45% inthe spring. In male animals, the infection rate was very low compared with females. However, the highest prevalence in males was observed throughout the year in autumn (2.36%) and the lowest prevalence in winter (1.68%). The highest prevalence was found among female cattle in heifers in winter (6.52%) and cows in summer (27.52%).
Conclusion: The overall economic losses of 56,434 USD were estimated due to discarded hydatid cyst-infected livers during the study period. This study enlightens the prevalence and economic significance of hydatidosis in Konya.
Keywords: Economic loss, liver hydatidosis, Konya, cattle, prevalence

ÖZ

Amaç: Araştırma Konya'da bir mezbahada kesilen sığırların karaciğerinden izole edilen kist hidatiklerinin mevsimsel prevalansını belirlemek amacıyla yapılmıştır.
Yöntemler: Toplam 49,545 kesilmiş sığır, karaciğerde kist hidatik varlığı yönünden incelendi. Çalışma 1 Haziran 2018 ile 31 Mayıs 2019 tarihleri arasında gerçekleştirildi.
Bulgular: En yüksek kist hidatik prevalansı sonbaharda (%10,83) gözlendi. Bunu ilkbahar (%4,41), kış (%2,90) ve yaz (%2,66) mevsimi izledi. Genel prevalans ise %3,93 idi. Ay bazında kist hidatik prevalansına bakıldığında en yüksek enfeksiyon oranı Eylül (%7,87), Haziran (%7,16) ve Ağustos (%7,14) aylarında tespit edilirken, en düşük prevalans Şubat (%2,72) ve Ocak (%2,83) aylarında görüldü. Cinsiyet açısından bakıldığında en yüksek prevalans dişi hayvanlarda yaz mevsiminde (%24,65) ve ilkbahar mevsiminde (%18,45) rastlandı. Erkek hayvanlarda enfeksiyon oranı dişilere göre çok düşüktü. Ancak yıl boyunca erkeklerde en yüksek prevalans sonbaharda (%2,36) ve en düşük prevalans kışta (%1,68) gözlendi. Dişi sığırlar arasında düvelerde kış döneminde (%6,52) olan en yüksek prevelans, ineklerde yaz aylarında (%27,52) olarak tespit edilmiştir.
Sonuç: Çalışma süresi boyunca kist hidatik ile enfekte karaciğerlerin imhası nedeniyle toplam 56,434 USD'lik ekonomik kayıp tahmin edilmiştir. Çalışma, Konya'da hidatidozun yaygınlığı ve ekonomik önemi hakkında fikir vermektedir.
Anahtar Kelimeler: Ekonomik kayıp, karaciğer hidatidozu, Konya, sığır, yaygınlık

Received/Geliş Tarihi: 04.03.2022 **Accepted/Kabul Tarihi:** 04.07.2022

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Türkiye PARAZİTOLOJİ Dergisi

INTRODUCTION

Hydatidosis, also known as cystic echinococcosis (CE), is an important zoonotic disease that causes significant public health and economic losses in the world and in Turkey. The larvae of adult *Echinococcus granulosus*, which are found in the small intestine of carnivores, cause the disease. This disease leads to structural disorders in the liver, spleen, lung and other vital organs, resulting in low productivity and economic losses. Yield losses and deaths (5%) are observed in cattle with hydatidosis, such as a decrease in the amount of meat (5%) and milk (2.5-10%), a slow down in growth, a decrease in the birth rate (5%). In addition, the immunity of infected animals is compromised, which in creases susceptibility to other infections. The destruction of diseased organs leads to insufficient consumption of animal protein sources by humans. CE, which occurs in humans, is a serious public health problem (1-4).

The final hosts of *E. granulosus* are carnivores (dogs, etc.) and intermediate hosts are ruminants, humans, and other mammals. The eggs spread to the environment with the feces of the infected last host are taken by the intermediate hosts with feed and water. Oncospher emerge from the eggs opened in the small intestine and go to the internal organs with the blood circulation. Fluid-filled cysts occur here. The last hosts that eat the cystic organs become infected. The parasite, which is the causative agent of the disease, completes its development in the small intestine of the last host. Parasite eggs are excreted in the feces and become recontaminated the environment. Eggs can survive for up to two years in severe environmental conditions (5). Inter regional climatic conditions, presence of intermediate and final hosts, and human-animal inter action are contributing factors to the prevalence of hydatidosis in animals and humans (3,5,6). Aydın et al. (7) reported the presence of hydatidosis in butchers dealing with infected animals.

It has been reported that production losses due to CE are approximately 12-13% of the total values of animals (8). The cattle population in Turkey is estimated to be around 18 million and 5% of this is in the Konya region (9). However, very few studies have been conducted to investigate the prevalence of CE in Konya to date. The most recent study in this region was carried out in 1995 (10,11). Therefore, this study was planned for the following purposes; a) To investigate the prevalence of CE in the liver of cattle slaughtered in a slaughterhouse in Konya, Turkey; b) Risk factors as sociated with the disease, i.e. age, gender and season, etc. to determine the relationship between and; c) To estimate the economic losses due to the destruction of CE organs.

METHODS

Study Area

The study was carried out at the Konya, Turkey's largest city, with an area of 40.838 sq km. Konya, 1016 m above sea level, is a very important city with a 970,876 bovine population (9). Postmortem examinations were carried out by selecting one of the three slaughterhouses in Konya.

Study Period and Animals

The study was carried out between June 1, 2018, and May 31, 2019. During this period, 49,545 beef livers were examined for hydatid cysts. Cattles under two years ofage were grouped as heifers/young, and cattles above two years were grouped as cows.

Postmortem Examinations

The postmortem examination of the livers was done. First, a shallow examination was performed to check the degree of liver stiffness. While superficial hydatid cysts can be easily seen, the diagnosis is made by the detection of the germinative membrane and protoscolex of the cyst in the parenchyma (2). Infected livers are destroyed regardless of the number of cysts and the degree of infection.

Calculation of Economic Losses

Losses resulting from the annihilation of livers were calculated by considering the offal prices of theprevious year. Accordingly, the price of the beef liver was accepted as 50 TL (7.25 $)/kg (in 2019). The livers were wholly annihilated, regardless of the degree of the infection and the number of cysts present. Therefore, the loss of each infected liver was calculated as 200 TL (29 $) (in 2019).

Total economic loss was calculated following, formula; TEL = NIL X MWL X CLP

TEL: Total economic loss

NIL: Number of infected liver

MWL: Mean weight of liver 4 kg (3-5 kg)

CLP: Current liver price (kg).

Data Management and Statistical Analysis

The data was saved in the Excel sheets and then transferred to Minitab (min-17) statistics program to analyze any statistical association among the variables. Infection rates by sex (male/female), age group (heifers/cows), seasons and months were compared using chi-square test and Fisher's Exact chi-square test. The association was considered significant at p-value less than 0.05.

RESULTS

A total of 49,545 cattles were slaughtered in the integrated meat facility, out of which 44,299 (89.41%) were males and 5.246 (10.58%) were females. Among the female population, 4.179 (79.66%) were cows, and 1067 (20.33%) were heifers. The postmortem examination showed that the number of animals infected with hydatid cysts was 1947, and the overall prevalence of the disease was found 3.93%, as shown in Table 1. The seasonal prevalence was found to be higher in autumn (10.83%), followed by spring (4.41%), winter (2.90%) and summer (2.66%). Month wise prevalence of CE in slaughtered animals and the prevalence of infected animals out of slaughtered animals throughout the

Table 1. Prevalence (%) of hydatid cysts according to seasons in cattle slaughtered

Seasons	Total number of cattle slaughtered	Number of liver infected cattle	Prevalence (%)
Autumn	5558	602	10.83[a]
Winter	20685	598	2.90[b]
Spring	8990	396	4.41[c]
Summer	13193	351	2.66[d]
Total	49545	1947	3.93

X^2: 803.168, DF: 3, $p<0.05$, [a,b,c,d]: Different superscripts in the same column indicate significant difference in season-specific prevalence

Table 2. Prevalence (%) of hydatid cysts in cattle slaughtered in different monts of the year

Months	Total number of cattle slaughtered	Number of liver infected cattle	Prevalence (%)
June	2250	161	7.16[a]
July	2160	108	5.00[b]
August	1148	82	7.14[a]
September	1436	113	7.87[a]
October	5080	175	3.45[c]
November	7796	314	4.03[d]
December	7456	229	3.07[de]
January	8809	249	2.83[adef]
February	4420	120	2.72[fg]
March	1897	119	6.27[abcd]
April	2099	103	4.91[bch]
May	4994	174	3.48[cej]
Total	49545	1947	3.93

[a,b,c,d,e,f,g,h,j]: Different superscripts in the same column indicate significant difference in season-specific prevalence ($p<0.05$)

year have been shown in Table 2 and Figure 1, respectively. A statistically asignificant association ($p<0.05$) was found with the month-wise prevalence of CE. However, the highest month-wise prevalence was observed in September (7.87%), June (7.16%) and August (7.14%), while the lowest prevalence was observed in January (2.83%) and February (2.72%). Considering the gender-wise prevalence, asignificant association ($p<0.05$) of CE was found in females 20.49% (1075/5246) as compared to males 1.97% (872/44299), as shown in Table 3, 4. Similarly, the seasonal prevalence was observed to be higher in females in summer (24.65%) and spring (18.45%). On the contrary, alower prevalence was observed in males in the autumn (2.36%) and spring (1.68%). Among females, the highest prevalence was observed in cows in the summer (27.52%) and heifers in the winter (6.52%). An economic loss of 56.434$ (389.400 TL) was estimated due to the annihilation of livers having CE during the whole year.

DISCUSSION

The prevalence of hydatidosis, seen in almost every region in the world, varies by country. Many factors such as the climate of the area, its ecological structure, and animal breeding methods impact on the prevalence of hydatidosis. Prevalence of hydatidosis has been reportedin various parts of the World, ranging from 0.04-70% in Europe, 0.002-46% in Africa, 0.05-80.60% in Asia, and 0.90% in South America (12-17). The prevalence of hydatidosis in cattle from neighbouring countries has been reported about 5.8-82% (13,18); whereas, in Turkey, the average prevalence of hydatiosis in cattle reported 25.9% (18).

The prevalence of *E. granulosus* in dogs has been reported in different parts of Turkey and its neighbouring countries, ranging from 0.94 to 59% (19,20). Various studies have been done to investigate the prevalence of *E. granulosus* and its economic significance, and most of the studies used the records of physical examinations made in the slaughterhouses. A study on the prevalence of hydatid cysts in dogs has also been done in Konya, Turkey (19). In the study, it was reported that 28.33% of 50 dogs had parasites. Dik et al. (10) reported that they found the prevalence of hydatid cyst at 9.40% in cattle in their study in Konya. In the survey conducted by Çivi et al. (11) in Konya, they reported that they detected the prevalence of hydatid cyst in cattle at about 5.60%.

In studies conducted in different parts of Turkey's in cattle; Van (10.86-19.40%), Adana (3.70%), Ankara (9.40-18.60%), Kars (26.65-31.25%), Manisa (8.96-16.47%), Sivas (4.50%), İzmir (56.50%) and Erzurum (46.40%) (21). In other studies, they detected hydatid cysts in cattle from Sivas (20.40%), Samsun (21.10%) and Van (37.80%) (7). In Kırıkkale (16.68%) and the Thrace region (11.60%), infections of cattle with hydatid cysts have been reported (22). Acıöz et al. (23) stated the presence of

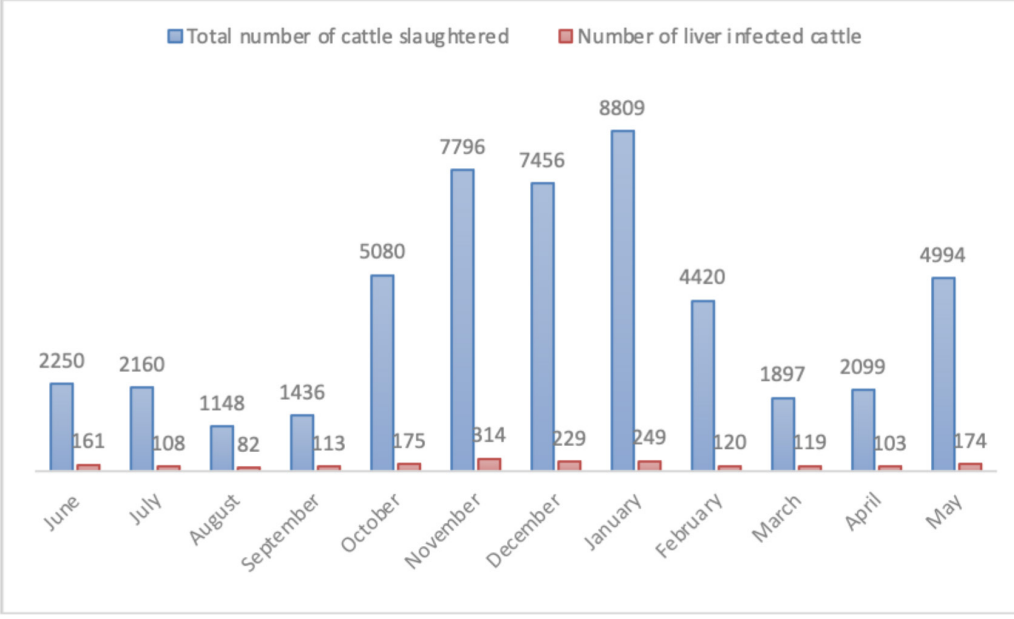

Figure 1. The number of infected and non-infected cattle slaughtered througout the year

Table 3. Prevalence (%) of hydatid cysts in male and female animal slaughtered in different seasons

Seasons	Male			Female		
	Total number of cattle slaughtered	Number of liver infected cattle	Prevalence (%)	Total number of cattle slaughtered	Number of liver infected cattle	Prevalence (%)
Autumn	12716	300[a]	2.36[a]	1596	302	18.92[a]
Winter	19411	326[b]	1.68[a]	1274	272	21.35[a]
Spring	7624	144[bc]	1.89[b]	1366	252	18.45[a]
Summer	4548	102[ac]	2.24[a]	1010	249	24.65[b]
Total	44299	872	1.97	5246	1075	20.49

[a,b,c]: Different superscripts in the same column indicate significant difference in season-specific prevalence ($p<0.05$)

Table 4. Prevalence (%) of hydatid cysts in female cattle slaughtered according to age and seasons

Saesons	Cow			Heifer		
	Total number of cattle slaughtered	Number of liver infected cattle	Prevalence (%)	Total number of cattle slaughtered	Number of liver infected cattle	Prevalence (%)
Autumn	1059	278[a]	26.25	537	24	4.47 n.s.
Winter	1044	257[a]	26.62	230	15	6.52 n.s.
Spring	1182	241[b]	20.39	184	11	5.98 n.s.
Summer	894	246[a]	27.52	116	3	2.59 n.s.
Total	4179	1022	24.46	1067	53	4.97

[a,b]:Different superscripts in the same column indicate significant difference in season-specific prevalence ($p<0.05$, n.s.: Not significant)

hydatid cysts in Sivas (35.70%), Düzlü et al. (24) in Kayseri (3%) and Balkaya and Şimşek (25) in Erzurum (34.30%). Sarıözkan and Yalçin (8) found CE with a rate of 7.40% in cattle. It has been reported that there are hydatid cysts in cattle from Hakkari (6.80%) and Van (38.50) (26).

In the study in Elazığ, 7.26% prevalence of CE was reported in cattle livers (27). In a study conducted in Bursa, it was reported that the offal from the hydatid cyst and fasciolosis was 2.38% (28). The study conducted in Aydın, reported that the prevalence of hydatid cysts was 2.09% in males and 14.31% in female cattle (29). A recent study conducted in the Aydın region of Turkey by Bağdatlıoğlu (29), the lowest prevalence rate (2.09%) was found in male animals. These results are similar to the prevalence of cattle CE (1.97%) reported in our study. As a result of the general prevalence of 3.93% we found in this study, it was seen that the rate between 3.70-56.50% found in previous studies is in line with the lowest range of prevalence. According to the 9.40% infection rate found in the study in 1992 in Konya, it was observed that the percentage of hydatidosis decreased to one third and the 5.60% prevalence rate found in 1995 decreased to 3.93%.

According to Şenlik (30), the probability of these cysts in young animals may be low because cysts develop very slowly in the intermediate host; therefore, 1% in males were found positive in our study. The presence of 97 ratios may lead to the misconception that the infection in our region has regressed considerably. Studies indicating the prevalence of hydatidosis by months and seasons are limited (31). However, Azami et al. (31) reported that they detected CE in spring (7.89%) and least in winter (4.6%) in their studies in Iran; in our research, the highest prevalence was observed in autumn (10.83%) and in lower in summer (least 2.66%). Similarly, Başpınar et al. (27) reported that they encountered the highest prevalence of hydatid cysts in the study they conducted in Elazig in Winter (9.87%) and least in the spring (4.17%), it shows completely different results with our study in which, the highest rate of infection was observed in cattle in June (7.16%) and in February (2.72%). While Ayad et al. (32) reported that cattle hydatid cyst was observed higher in October in Algeria. Dik et al. (10) reported that infection was highest in October (75.3%) and lowest in June (15.1%), which is different from our study.

According to the regions, it has been reported that various biotic and abiotic factors are responsible for the prevalence of CE in cattle, including; climatic conditions of the area, age and species of animals, the technique used to investigate the prevalence, data acquisition etc. (24). Hydatidosis harms the country's economies by decreasing the amount of meat, milk, and wool in cattle, sheep, and goats, decreasing fertility and destroying infected offal (protein) from animal origin (33). At the same time, the money spent to treat infectious animals increases the cost of damage. Hydatidosis also seriously harms public health and expenditures (surgery, medicine, hospital, etc.) to treat cysts that occur through contact with contaminated food and water, ultimately imposing heavy burdens on national economies (34).

In the study conducted in the province of Burdur to investigate the economic losses caused by the CE found in ruminants, a yearly loss of 583$ was estimated through condemnation of infected liver and lungs (35). In a study in Erzurum, Arslan and Umur (36) found that economic damage was 2.300$ in the post-slaughter examination of 1066 sheep and 530 cattle. In the study conducted in Konya reported that liver and lungs found infected during the investigation of sheep and cattle caused economic losses of 52,264$ yearly (10). It is seen that the loss after liver destruction alone in our study caused much more economic losses of 77,880$. Sarıözkan and Yalçin (8) nationwide, the production loss of CE in ruminants caused by meat, milk, fleece and fertility, decreased fertility, and sacred destroyed in cattle in 2008 was 89.2$ million.

In a study conducted in sheep in the Konya region in 2019, in the slaughtered 42.000 sheep, it was determined that the economic loss due to hydatid cysts in the liver was 36.450 TL (6417$) (37). In the study conducted in cattle, it is seen that the financial loss is much higher than in sheep.

CONCLUSION

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. For control of echinococcus infection, there is dire need to work in collaboration with public health authorities to develop effective control and eradication programs through raising public awareness, controlling and treating dogs, preventing offal and raw meat consumption by dogs, regular inspection of slaughterhouses and condemnation of illegal slaughtering should be adopted as control measures. Routine inspection and treatment of captive dogs keeping in view the parasite's life cycle are also important for public health. Although the prevalence of CE has decreased compared to the prevalence rates found in previous studies, it has been determined that CE is an important public health problem. Control and prevention measures should be carried out together to prevent the spread of the disease. For this purpose, uncontrolled animal slaughter should not be done and post-mortem examinations should be done very carefully. In addition, infected organs must be appropriately disposed of (burning in the oven, burial in deep holes) and never be fed to dogs.

ACKNOWLEDGEMENT

We would like to thank the veterinarians in the slaughterhouse who contributed to our study.

*Ethics

Ethics Committee Approval: As stated in the Regulation on Working Procedures and Principles of Animal Experiments Ethics Committees, Ethics Committee Approval Certificate is required for vertebrate animals. Since the study was conducted on non-living organs after slaughter, the ethics committee approval certificate was not obtained.

Informed Consent: "Patient consent information" document was not requested for our study to be on non-living organs after slaughter.

Peer-review: Internally peer-reviewed.

*Authorship Contributions

Surgical and Medical Practices: A.K., U.U., Concept: A.K., U.U., Design: A.K., U.U., Data Collection or Processing: A.K., U.U., Analysis or Interpretation: A.K., U.U., Literature Search: A.K., U.U., Writing: A.K., U.U.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

REFERENCES

1. Fadakar B, Tabatabaei N, Borji H, Naghibi A. Genotyping of *Echinococcus granulosus* from goats and sheep indicating G7 genotype in goats in the Northeast of Iran. Vet Parasitol 2015; 214: 204-7.
2. Avcıoğlu H. Cystic Echinococcosis (Cyst Hydatid) in Cattle, In: Parasitic Diseases in Cattle. In: Parasitic Diseases in Veterinary Medicine. Eds: İnci A, 2nd edition, Meta Press: İzmir; 2016.p.204-9.
3. Şenlik B. Echinococcosis. In: Parasitic Diseases in Dogs and Cats. In: Parasitic Diseases in Veterinary Medicine. Eds: Dumanlı N, Meta Pres: İzmir; 2016.p1183-95.
4. Yaylak E, Konca Y, Koyubenbe N. A Study on health protection managements and health disorders survey of cattle breeders' association registered farms in Odemis, Izmir. Hayvansal Üretim 2016; 57: 28-40.
5. Soulsby EJL. Helminths, Arthropods and Protozoa of Domesticated Animals. 7th Ed., Bailliere Tindall: London; 1986.
6. Yıldız K, Tunçer Ç. [Prevalence of hydatid cysts in cattle in the province of Kirikkale]. Turkiye Parazitol Derg 2015; 29: 247-50.
7. Aydın MF, Gökmen S, Koç Ş, Adıgüzel E, Kocaman H, Çöplü M, et al. Evaluation the knowledge levels regarding Hydatid cyst mong butchers in Karaman Province of Turkey. Van Vet J 2015; 26: 147-50.
8. Sarıözkan S, Yalçin C. Estimating the production losses due to cystic Echinococcosis in ruminants in Turkey. Vet Parasitol 2009; 163: 330-4.
9. Anonymous. Turkey Statistical Institute, Databases, Animal İstatistikleri 2021. Available from: https://www.tarimorman.gov.tr/sgb/Belgeler/SagMenuVeriler/HAYGEM.pdf Access date: June 2021.
10. Dik B, Cantoray R, Handemir E. The spread and economic importance of hydatidosis in small and bovine animals slaughtered in Konya Meat and Fish Institution Combination. Turkiye Parazitol Derg 1992; 16: 91-2.
11. Çivi S, Güler S, Kesici S. Economic losses due to cyst hydatid according to the records of Konya Meat Fish Institution and Konet Facilities. Turkiye Parazitol Derg 1995; 19: 237-42.
12. Onah DN, Chiejina SN, Emehelu CO. Epidemiology of echinococcosis/hydatidosis in Anambra State, Nigeria. Ann Trop Med Prasitol 1989; 83: 387-93.
13. Isakov SI, Safronov MG, Ivanova RN. Strains of Echinococcus in Yakutiya. Vet Moskva 1993; 9: 36-9.
14. Artures CF, Souza RM, Ribeiro RPM. Prevalence and geographical distrubution of bovine hydatidosis in the state of Minas Gerais, Brasil. Arg Bras Med Vet Zootecnia 1996; 48: 623-7.
15. Lis H. Results of veterinary inspection of slaughtered animals in Poland and their economic significance. Med Weter 1998; 44: 267-9.
16. WHO. Manual on echinococcosis in Humansand Animals: a PublicHealth Problem of Global Concern. World Organization for Animal Health 12, rue de Prony, 75017 Paris: France; 2012.p.286.
17. Almalki E, Al-Quarishy S, Abdel-Baki AS. Assessment of prevalence of hydatidosis in slaughtered Sawakny sheep in Riyadh city, Saudi Arabia. Saudi J Biol Sci 2017; 24: 1534-37.
18. Özçelik S. Cystic echinococcosis and echinococcosis inTurkey. XXth International Congress of Hydatidology, RT9, 69, June, 4-8, Kuşadası-Turkey. 2001.
19. Aydenizöz M. Helmintological researches in dogs of Konya region. Turkiye Parazitol Derg 1997; 4: 429-34.
20. Gıcık Y, Kara M, Sarı B, Kılıç K., Arslan MÖ. Intestinal parasites of Red foxes (Vulpes vulpes) and their zoonotic importance for humans in Kars province. Kafkas Univ Vet Fak Derg 2009; 15: 135-40.
21. Gıcık Y, Kara M. The prevalence of cystic echinococcosis in cattle and sheep slaughtered in the Kars province. Turkiye Parazitol Derg 2004; 28: 136-9.
22. Esatgil MU, Tüzer E. Prevalence of hydatidosis in slaughtered animals in Thrace, Turkey. Turkiye Parazitol Derg 2007; 31: 41-5.
23. Acıöz M, Çeliksöz A, Özçelik S, Değerli S. Prevalence of cyst hydatic in slaughtered cattle between April and May 2005 in Sivas. Turkiye Parazitol Derg 2008; 32: 205-7.
24. Düzlü Ö, Yıldırım A, Sarıözkan S, İnci A. The economic importance of cystic echinococcosis in sheep and cattle from three different slaughterhouses in Kayseri region. Erciyes Üniv Vet Fak Derg 2010; 7: 7-11.
25. Balkaya İ, Şimşek S. Prevalence and economic importance of hydatidosis and fasciolosis in slaughtered cattle in Erzurum province of Turkey. Kafkas Univ Vet Fak Derg 2010; 16: 793-7.

26. Oğuz B, Değer S. Cystic Echinococcosis and cysticerci of *Taenia hydatigena* in cattle and sheep slaughtered in a Van local slaughterhouse. Turkiye Parazitol Derg 2013; 37: 186-9.

27. Başpınar S, Kaplan M, Keleştemur N. The prevalance of cystic echonicoccosis in live stock slaughtered between 2008-2012 FU Med J Health Sci 2014; 28: 89-92.

28. Yibar A, Selcuk O, Senlik B. Major causes of organ/carcass condemnation and financial loss estimation in animals slaughtered at two abattoirs in Bursa Province, Turkey. Prev Vet Med 2015; 118 : 28-35.

29. Bağdatlıoğlu Aİ. Prevalance of some cestodes larvae (*Hydatid cyst, Cysticercus bovis, Cystcercus tenuicollis*) among the slaugthered cattle in Aydın region. Aydın Adnan Menderes University Institute of Health Sciences Veterinary Parasitology (Veterinary) Program Master Thesis. 2019.

30. Şenlik B. Development of Echinococcus Species, Echinococcosis. Altıntaş N, Tınar R, Çoker A. Eds. Ege University Printing House, Bornova: İzmir; 2004.p.31-44.

31. Azami M, Anvarinejad M, Ezatpour B, Alirezaei M. Prevalence of hydatidosis in slaughtered animals in Iran. Turkiye Parazitol Derg 2013; 37: 102-6.

32. Ayad A, Benhanifia M, Balla, EH, Moussouni L, Ait-Yahia F, Benakhla A. A retrospectivesurvey of fasciolosisandhydatidosis in domesticruminantsbased on abattoirs' data in Bejaiaprovince, Algeria. Veterinaria 2019; 68: 47-51.

33. Şenlik B. The prevalence of hydatidosis in sheep in Bursa region and its relationship with age, race and gender. Turkiye Parazitol Derg 2000; 24: 304-8.

34. Torgerson PR. Economiceffects of echinococcosis. Acta Trop 2003; 85: 113-8.

35. Umur S. Prevalence and economic importance of cystic echinococcosis in slaughtered ruminants in Burdur, Turkey. J Vet Med B Infect Dis Vet Public Health 2003; 50: 247-52.

36. Arslan MÖ, Umur Ş. Prevalence and economic importance of hydatidosis in slaughtered sheep and cattle in Erzurum slaughterhouses. Kafkas Univ Vet Fak Derg 1997; 3: 167-71.

37. Uslu U, Küçükyağlıoğlu A, Şenlik B. Prevalence of liver hydatidosis and its economic significance in sheep slaughtered in a private abattoir in Konya. Turkiye Parazitol Derg 2021; 45: 5-10.