

Investigation of Cystic Echinococcosis Knowledge Levels of Animal Breeders and Butchers in Ardahan Province in Türkiye

Ardahan İlindeki Hayvan Yetiştiricilerinin ve Kasapların Kistik Echinococcosis Hakkındaki Bilgi Düzeyinin Araştırılması

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ABSTRACT

Objective: The objective of this study was to ascertain the knowledge level of animal breeders and butchers regarding cystic echinococcosis (CE) in the Ardahan province and its districts situated in the Eastern Anatolia Region of Türkiye. Additionally, the study aimed to identify the potential risk factors that may contribute to the occurrence of the disease.

Methods: The research was conducted between November 2021 and May 2022. A total of 402 animal breeders and 23 butchers participated in the survey. In order to ascertain the extent of awareness regarding CE, a series of multiple-choice questions were administered in a face-to-face setting.

Results: Upon evaluation of the data obtained from the research in a socio-demographic context, it shows that people's awareness of CE increases with age, and women have the most knowledge on this subject (45.85%). A total of 71.76% (305/425) of participants reported owning a dog. Of these, 48.52% (148/305) typically feed their dog food waste. Additionally, 58.03% (177/305) of dog owners do not regularly take their dogs to the vet. The animals were slaughtered by the participants (53.65%; 228/425), and the infected organs found during slaughter were destroyed by deep burial (72.81%; 166/228). The majority of participants (93.41%; 397/425) expressed a desire to gain further insight into the subject.

Conclusion: It was thus established that the districts and province of Ardahan are deficient in the availability of information regarding CE among animal breeders and butchers. It was therefore concluded that the inhabitants of the aforementioned region should be made aware of CE and other zoonotic diseases prevalent in the Ardahan province.

Keywords: Animal breeders, Ardahan, butcher, cystic echinococcosis, level of knowledge

ÖZ

Amaç: Bu çalışmada, Türkiye'nin Doğu Anadolu Bölgesi'nde yer alan Ardahan ili ve ilçelerinde hayvan yetiştiricileri ve kasapların kistik ekinokokkozis (KE) hakkındaki bilgi düzeylerinin belirlenmesi ve hastalığın oluşmasına neden olabilecek risk faktörlerinin belirlenmesi amaçlandı.

Yöntemler: Araştırma Kasım 2021 ile Mayıs 2022 tarihleri arasında gerçekleştirildi. Anket çalışması 402 hayvan yetiştiricisi ve 23 kasap ile gerçekleştirildi. KE ile ilgili bilgi düzeyini belirlemek amacıyla çoktan seçmeli sorulardan oluşan anket soruları gönüllülük esasına göre yüz yüze uygulandı.

Bulgular: Sosyo-demografik açıdan incelendiğinde; KE'nin çoğunlukla kadınlar (%45,85) tarafından bilindiği ve yaş arttıkça kişilerin hastalık hakkında daha fazla bilgi sahibi olduğu belirlendi. Katılımcıların %71,76'sının (305/425) köpeğinin olduğu; köpeklerini genelde yemek atıklarıyla beslediklerini (%48,52; 148/305); köpeklerinin düzenli veteriner hekim muayenesinden geçmediklerini (%58,03; 177/305) ifade ettiler. Hayvanların katılımcılar tarafından kesildiği (%53,65; 228/425) ve kesim sırasında karşılaştıkları enfekte organları derine gömerek (%72,81; 166/228) imha ettiklerini belirttiler. Katılımcıların büyük çoğunluğunun (%93,41; 397/425) konu hakkında bilgi almak istediğini ifade ettiler.

Sonuç: Sonuç olarak Ardahan ili ve ilçelerinde hayvan yetiştiricileri ve kasaplar arasında KE hakkında yeterli bilginin olmadığı, Ardahan ilinde bölgede yaşayan halkın KE ve diğer zoonotik hastalıklar konusunda bilgilendirilmesi gerektiği tespit edilmiştir.

Anahtar Kelimeler: Hayvan yetiştiricileri, Ardahan, kasap, kistik echinococcosis, bilgi düzeyi



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INTRODUCTION

Cystic echinococcosis (CE) represents a significant public health concern in developing countries, including Türkiye, where intensive animal husbandry practices are prevalent (1,2). This disease, classified as an important zoonosis by the World Health Organization, is widely distributed throughout Türkiye (3,4). It is known that *Echinococcus granulosus sensu stricto* is the predominant species causing CE with a wide distribution worldwide (5,6). The definitive hosts of *Echinococcus* species are canids, particularly dogs, while their intermediate hosts are herbivorous animals. Infection of final hosts occurs by eating infected organs and subsequent expulsion of eggs in faeces. The eggs are then dispersed in the environment, depending on prevailing environmental conditions. The transmission occurs when intermediate hosts ingest the eggs through digestion and respiration. The emergence of adult parasites occurs in the final host, which ingests the cyst-containing internal organs of the intermediate host (7). In intermediate hosts, the cysts typically localise to the liver (50-70%) and, in some cases, the lungs (20-30%). Cysts may also be observed in ocular, osseous, muscular, renal, splenic, and peritoneal tissues. In less common instances, the condition may also manifest in various internal organs, including the brain, heart, cerebellum, medulla spinalis, salivary glands, pancreas, uterus, ovary, and diaphragm (8-12). The prevalence of CE is higher in areas where sheep are raised due to the higher rate of fertile cysts among intermediate hosts (13-15). The transmission routes of the disease are as follows: Contamination of food and water with *E. granulosus* eggs, ingestion of soil containing the eggs, inhalation of contaminated dust, and contact with infected final hosts. Moreover, it has been postulated that intrauterine transmission may be a potential avenue for transmission. A number of studies have documented the presence of hydatid cysts in human fetuses (7,16-18).

The breeding of sheep (13-15), the presence of intermediate or final hosts in habitats, uncontrolled animal transfers, the careless disposal of infected organs, the spread of infected organs into the environment in slaughterhouses, and their easy access to final hosts represent a multitude of risk factors for CE. To avoid this outcome, it is essential to undertake the destruction of the infected organ in a manner that is both appropriate and controlled. A further risk factor is constituted by the lack of knowledge about CE and the lack of concern for the problem among the general public (17,19). Failure to guarantee socio-economic and socio-cultural growth, as well as neglect of owned or stray dogs, constitutes a risk factor (20).

To date, the Ardahan province has not undergone a comprehensive investigation into the prevalence of CE or the extent of public awareness of the illness. The objective of the study was to ascertain the level of knowledge that animal breeders and butchers in the Ardahan province and its districts had regarding CE. Furthermore, the objective is to ascertain the risk factors that are associated with the disease. This was achieved through the administration of a survey.

METHODS

Ethics Committee Approval

The necessary permissions for this study were obtained from the Kafkas University Non-Interventional Research Ethics Committee (letter dated: 02.11.2021, numbered: 81829502.903/248).

The study was conducted between November 2021 and May 2022 among animal breeders and butchers in the Ardahan province and district. A total of 425 participants were interviewed in person, comprising 402 animal breeders and 23 butchers. A voluntary survey form comprising 32 questions and an informed consent form verifying the volunteers' consent were also utilized. Please refer to Appendix 1 for the survey form used in the research project. The survey included questions on demographics, dog ownership, livestock ownership, CE, and wishes and expectations.

Statistical Analysis

Data were analysed using Pearson chi-square test and the IBM statistical analysis package program (SPSS 26.0).

RESULTS

The data set was compiled using the information provided in responses to survey questions regarding the occurrence of CE in the Ardahan province and district. In order to facilitate comparison between animal breeders and butchers, this study employed a multiple-choice format to examine a range of socio-demographic characteristics, dog ownership, farm animal ownership, and the extent of knowledge regarding CE.

1. The Results on the Socio-demographic Distribution of Butchers and Animal Breeders

Table 1 presents an analysis of the relationship between gender and educational level among animal breeders and butchers. A low percentage of the participants in the survey were women, representing only 11.29% (48/425) of the total sample.

Table 1. A socio-demographic analysis of animal breeders and butchers

Question	Answer	Butcher (%)	Animal breeder (%)	Total (%)	p
Gender	Female	0 (0)	48 (11.94)	48 (11.29)	0.093
	Male	23 (100)	354 (88.05)	377 (88.70)	
Level of education	Literate	0 (0)	2 (0.50)	2 (0.47)	0.930
	Primary school	3 (13.04)	65 (16.17)	68 (16)	
	Secondary school	9 (39.13)	178 (44.28)	187 (44)	
	High school and its equivalent	8 (34.78)	119 (29.60)	127 (29.88)	
	University	3 (13.04)	38 (9.45)	41 (9.65)	
Total		23 (5.41)	402 (94.59)	425 (100)	

A distribution between the groups revealed that 11.94% (48/402) of the farmers were female. It was determined that gender was not a significant factor, as all butchers were male. A gender-based evaluation of the participants' knowledge about the disease revealed that women were the most informed group, with 45.85% (22/48) having heard about CE. The results of our research indicate that the majority of individuals engaged in animal care are women. Nevertheless, the majority of business owners are male. With regard to gender, the proportions of individuals in both groups who had heard of the disease were similar, although female participants demonstrated a greater awareness of the disease than their male counterparts (Table 2). The results of the survey indicated that women demonstrated a greater awareness of the disease than men when evaluated according to gender. The responses provided to the questions pertaining to the socio-demographic characteristics in the survey were subjected to a comprehensive evaluation. Upon examination of the variables of gender and education level, it was determined that the observed difference was not statistically significant ($p > 0.05$).

In order to evaluate the level of knowledge about CE, the participants were divided into two age groups: Those between 20 and 39 years of age and those aged 40 years and older. As indicated in Table 3, an analysis was conducted to determine

the relationship between age and the participants' awareness of the disease. The results demonstrated that the likelihood of awareness increased with age.

Three groups were constituted on the basis of the participants' level of education, with the objective of evaluating their level of knowledge regarding CE (Table 4). The study cohort comprised the majority of primary, secondary, and high school graduates, as well as their equivalents.

Of the 425 individuals who participated in the survey, 190 (44.70%) indicated that they possessed knowledge about the disease. Of those who have heard of the disease, 0.53% (1/190) are literate, 89.45% (170/190) have graduated from primary, secondary, or high school, and 10% (19/190) have obtained a university degree. The evaluation of the participants' awareness of the disease, according to their educational background, revealed a negative correlation between the level of education and the probability of being aware of the disease. As the level of education increased, the likelihood of being aware of the disease decreased.

Table 5 presents an examination of the relationship between the participants' educational attainment and the manner in which they feed the dogs under their care. No correlation was identified between educational status and nutritional habits.

Table 2. Animal breeders and butchers' awareness of CE by gender

Group	Female			Male			Total
	n (%)	Yes (%)	No (%)	n (%)	Yes (%)	No (%)	
Animal breeder	48 (11.95)	22 (45.85)	26 (54.15)	354 (88.05)	164 (46.33)	190 (53.67)	402 (94.59)
Butcher	0	0	0	23 (100)	4 (17.39)	19 (82.61)	23 (5.41)
Total	48 (11.30)	22 (45.85)	26 (54.15)	377 (88.70)	168 (44.56)	209 (55.44)	425 (100)

n: The number of respondents is shown

Table 3. Animal breeders and butchers' awareness of CE by age

Group	20 and 39 years of age			40 years and older			Total
	n (%)	Yes (%)	No (%)	n (%)	Yes (%)	No (%)	
Animal breeder	117 (29.10)	52 (44.44)	65 (55.56)	285 (70.90)	134 (47.02)	151 (52.98)	402 (94.59)
Butcher	5 (21.74)	1 (20)	4 (80)	18 (78.26)	3 (16.67)	15 (83.33)	23 (5.41)
Total	122 (28.71)	53 (43.44)	69 (56.56)	303 (71.29)	137 (45.21)	166 (54.79)	425 (100)

n: The number of respondents is shown

Table 4. Animal breeders and butchers' awareness of CE by education level

Group	Literate			Primary/secondary/high school and its equivalent			University			Total
	n (%)	Yes (%)	No (%)	n (%)	Yes (%)	No (%)	n (%)	Yes (%)	No (%)	
Animal breeder	2 (0.50)	1 (0.50)	1 (0.50)	362 (90.05)	168 (46.41)	194 (53.59)	38 (9.45)	17 (44.74)	21 (55.26)	402 (94.60)
Butcher	0	0	0	20 (86.95)	2 (10)	18 (90)	3 (13.05)	2 (66.67)	1 (33.37)	23 (5.40)
Total	2 (0.47)	1 (0.50)	1 (0.50)	382 (89.88)	170 (44.50)	212 (55.50)	41 (9.65)	19 (46.34)	22 (53.66)	425 (100)

n: The number of respondents is shown

Table 6 presents the distribution of responses to the question “Do you administer anti-parasitic medication to your dog?” posed in the survey. The objective of the analysis was to ascertain whether there was a correlation between the level of education and the administration of anti-parasitic medication to dogs. It has been established that as the level of education increases, the average number of individuals who administer parasitic drugs to their dogs decreases. A comparable situation was identified with regard to animal breeders when the data were analyzed according to occupational groups. It was established that the status of butchers remained unchanged.

The responses of the animal breeders and butchers who participated in the survey to the question “How do you dispose of infected organs following the slaughter of the animal?” were evaluated in terms of their level of education (Table 7). It was determined that the likelihood of destroying the infected organ decreased as the level of education increased, with the exception of those who were literate. Upon evaluation of the participants according to their respective groups, it was observed that the proportion of individuals who selected the option of deep burial and other alternatives decreased, while the rate of those who opted to surrender the animals to the relevant authorities increased. Although the practice of deep burial has become more prevalent among butchers, the proportion of those who elect to transfer animals to the appropriate authorities or select alternative options has declined.

2. The Results of the Study on Animal Breeders’ and Butchers’ Dog Ownership

The responses of animal breeders and butchers in Ardahan province and its districts regarding dog ownership are presented

in Table 8. While 88.45% of the 425 participants indicated that they have a street dog in their vicinity, 71.76% stated that they are responsible for a dog. A total of 48.52% of participants reported feeding their dogs with food waste, while 58.03% revealed that they do not take their dogs for regular veterinary check-ups. A total of 51.48% of respondents indicated that they protect their dogs from disease by administering anti-parasitic medication. Furthermore, 96.39% of respondents stated that they always wash their hands after contact with dogs.

3. The Results of the Study on Animal Breeders’ and Butchers’ Animal Ownership

Table 9 illustrates the distribution of responses to questions on animal ownership, with the objective of determining the level of knowledge of animal breeders and butchers in Ardahan province about CE. Upon evaluation of the responses to the survey on the characteristics of animal ownership among animal breeders and butchers, it becomes evident that the vast majority of participants (98.82%; 420/425) own animals, with the majority of them engaged in cattle rearing (72.62%; 305/420).

4. The Results Regarding the Slaughtering Procedures Applied by Animal Breeders and Butchers

The questions posed to animal breeders and butchers regarding their slaughtering practices were designed to assess their level of knowledge about CE. The responses received are presented in Table 10. The data indicates that 197 participants (46.35%) do not engage in the practice of slaughter, while 228 participants (53.65%) do. It was established that 220 participants (96.50%) proceeded to dispose of the infected organ subsequent to the slaughter, whereas 8 participants (2%) did not dispose of the infected organ.

Table 5. Dog feeding habits and the educational level distribution of butchers and animal breeders

Group	Literate				Primary/secondary/high school and its equivalent				University				Total
	n (%)	Food residue (%)	Dog food (%)	Animal offal (%)	n (%)	Food residue (%)	Dog food (%)	Animal offal (%)	n (%)	Food residue (%)	Dog food (%)	Animal offal (%)	
Animal breeder	2 (0.65)	0	2 (100)	0	267 (89.3)	129 (48.30)	112 (41.95)	26 (9.75)	30 (10.05)	19 (63.35)	8 (26.65)	3 (10.00)	299 (98.05)
Butcher	0	0	0	0	4 (66.65)	0	0	4 (100)	2 (33.35)	0	0	2 (100)	6 (1.95)
Total	2 (0.65)	0	2 (100)	0	271 (88.85)	129 (47.60)	112 (41.30)	30 (11.10)	32 (10.50)	19 (59.40)	8 (25)	5 (15.60)	305 (100)

n: The number of respondents is shown

Table 6. Distribution of butchers and animal breeders by educational level and whether or not they treat their dogs with parasitic drugs

Group	Literate			Primary/secondary/high school and its equivalent			University			Total
	n (%)	Yes (%)	No (%)	n (%)	Yes (%)	No (%)	n (%)	Yes (%)	No (%)	
Animal breeder	2 (0.65)	2 (100)	0	267 (89.30)	136 (50.95)	131 (49.05)	30 (10.05)	13 (43.35)	17 (56.65)	299 (98.05)
Butcher	0	0	0	4 (66.65)	4 (100)	0	2 (33.35)	2 (100)	0	6 (1.95)
Total	2 (0.65)	2 (100)	0	271 (88.85)	140 (51.66)	131 (48.34)	32 (10.50)	15 (46.88)	17 (53.12)	305 (100)

n: The number of respondents is shown

Table 7. Distribution of animal breeders and butchers according to level of education and the way diseased organs are disposed of

Level of education	Answer	Animal breeder (%)	Butcher (%)	Total
Literate	n	2 (0.96)	0	2 (0.90)
	Deep burial	2 (100)	0	2 (100)
	By discarding	0	0	0
	Giving it to the authorities	0	0	0
	By burning	0	0	0
	Others	0	0	0
Primary/secondary/high school and its equivalent	n	183 (88.41)	18 (85.71)	201 (88.16)
	Deep burial	145 (79.24)	2 (11.11)	147 (73.13)
	By discarding	0	0	0
	Giving it to the authorities	14 (7.65)	14 (77.78)	28 (13.93)
	By burning	0	0	0
	Others	24 (13.11)	2 (11.11)	26 (12.94)
University	n	22 (10.65)	3 (14.30)	25 (10.95)
	Deep burial	16 (72.72)	1 (33.33)	17 (68)
	By discarding	0	0	0
	Giving it to the authorities	4 (18.18)	2 (66.75)	6 (24)
	By burning	0	0	0
	Others	2 (9.09)	0	2 (8)
Total		207 (90.79)	21 (9.21)	228 (100)

n: The number of respondents is shown

Table 8. Distribution of animal breeders and butchers according to their dog ownership characteristics

Question	Answer	Animal breeder (%)	Butcher (%)	p-value
Are there any stray dogs around you?	Yes	358 (89.05)	18 (78.25)	0.167
	No	44 (10.95)	5 (21.75)	
Do you have a dog?	Yes ^a	299 (74.35)	6 (26.10)	<0.001*
	No ^b	103 (25.65)	17 (7.90)	
Is your dog in your living area?	No answer ^a	103 (25.65)	17 (73.90)	<0.001*
	Yes ^b	299 (74.35)	6 (26.10)	
	No	0 (0)	0 (0)	
What type of food do you feed your dog?	No answer ^a	103 (25.65)	17 (73.90)	<0.001*
	Food residues ^b	148 (36.80)	0 (0)	
	Dog food ^b	122 (30.35)	0 (0)	
	Animal offal ^a	29 (7.20)	6 (26.10)	
Are routine veterinary examinations performed for your dog?	No answer ^a	103 (25.65)	17 (73.90)	<0.001*
	Yes ^b	124 (30.85)	4 (17.40)	
	No ^b	175 (43.50)	2 (8.70)	
Do you wash your hands after contact with your dog?	No answer ^a	103 (25.65)	17 (73.90)	<0.001*
	Always ^b	289 (71.90)	5 (21.75)	
	Sometimes/occasionally ^{a,b}	10 (2.45)	1 (4.35)	
Do you administer anti-parasitic medication to your dog?	No answer ^a	103 (25.65)	17 (73.90)	<0.001*
	Yes ^b	151 (37.55)	6 (26.10)	
	No ^c	148 (36.80)	0 (0)	

*: A p-value of less than 0.05 is statistically significant, ^{a, b, c}: The letters in the answers to the questions in the same column indicate statistical differences

It was indicated that 166 individuals (72.81%) disposed of the infected organs by interring them at a depth sufficient to ensure their destruction, 34 individuals (14.90%) by delivering them to the relevant authorities, and 28 individuals (12.30%) by employing alternative procedures.

5. The Results on the Distribution of CE Knowledge Levels of Animal Breeders and Butchers

Table 11 presents the distribution of the survey findings, which were designed to assess the level of knowledge among butchers and animal breeders regarding CE. Of the 425 participants, 235 lacked awareness of the disease (55.30%) and 239 did not know which tissues and organs were affected (56.25%). In response to the question, “What specific tissues and organs are affected by CE?”, 66 participants (35.48%) indicated that the disease affects the liver, while 120 participants (64.52%) stated that the disease affects the lungs. Most respondents (56.25%, 239/425) did not answer the question “What are the clinical symptoms of CE?” 68.09% (128/188), of participants reported nausea and vomiting, 29.26% (58/188) pain and 1.06% (2/188) other symptoms. Most

participants said the disease affected sheep (25.65%; 109/425) and dogs (1.90%; 8/425). 88.44% (176/199) knew how it was transmitted. Most participants (72.24%) were unaware that the disease could be fatal. Among those who had an opinion (22.35%), all stated that it could be. However, 43.05% believed it could be treated. The majority of respondents (95.30%; 405/425) indicated that they had not received any education about the disease from any source.

Twenty percent of participants knew they could safeguard their health by eating fruit and veg after washing. Butchers didn't provide a response. 74.82% of the sample took disease-related precautions. Furthermore, 397 individuals (93.41%) had expectations and desires regarding the survey. One hundred and fifty nine individuals (37.41%) answered “all” to the question comprising eight answer options (p<0.05).

It was determined that very few people in the environment of the participants had the disease (7.53%; 32/425) and those who had it were not relatives (2.82%; 12/425). It was stated that only one of these people was a relative of the butcher (p<0.05).

Table 9. Distribution of animal breeders and butchers according to their animal ownership characteristics

Question	Answer	Animal breeder (%)	Butcher (%)	p-value
Do you breed animals such as ovine, caprine, and bovine species?	Yes ^a	402 (100)	18 (78.25)	<0.001*
	No ^b	0 (0)	5 (21.75)	
If yes, specify animal species.	No answer ^a	0 (0)	5 (21.75)	<0.001*
	Large animal ^b	290 (72.15)	15 (65.20)	
	Small animal ^b	21 (5.20)	2 (8.70)	
	Mix ^b	91 (22.65)	1 (4.35)	
Total		402 (100)	23 (100)	

*: A p-value of less than 0.05 is statistically significant, ^{a,b,c}: The letters in the answers to the questions in the same column indicate statistical differences

Table 10. Distribution according to slaughtering practices of animal breeders and butchers

Question	Answer	Animal breeder (%)	Butcher (%)	p-value
Do you slaughter?	Yes ^a	207 (51.50)	21 (91.30)	<0.001*
	No ^b	195 (48.50)	2 (8.70)	
Where is the slaughter conducted?	No answer ^a	195 (48.50)	2 (8.70)	<0.001*
	In the garden of the house ^a	165 (41.05)	0 (0)	
	Abattoir ^b	42 (10.45)	21 (91.30)	
After slaughter, do you destroy diseased organs?	No answer ^a	195 (48.50)	2 (8.70)	<0.001*
	Yes ^b	199 (49.50)	21 (91.30)	
	No ^{a,b}	8 (2)	0 (0)	
After slaughter, how are diseased organs disposed of?	No answer ^a	195 (48.50)	2 (8.70)	<0.001*
	Deep burial ^a	163 (40.55)	3 (13.05)	
	By discarding	0 (0)	0 (0)	
	Giving it to the authorities ^b	18 (4.50)	16 (69.55)	
	By burning	0 (0)	0 (0)	
	Others ^a	26 (6.45)	2 (8.70)	
Total		402 (100)	23 (100)	

*: A p-value of less than 0.05 is statistically significant, ^{a,b,c}: The letters in the answers to the questions in the same column indicate statistical differences

Table 11. Distribution according to CE knowledge levels of animal breeders and butchers

Question	Answer	Animal breeder (%)	Butcher (%)	p-value
Have you heard of cystic echinococcosis disease?	Yes ^a	186 (46.25)	4 (17.40)	0.008
	No ^b	216 (53.75)	19 (82.60)	
What specific tissues and organs are affected by cystic echinococcosis?	No answer	220 (54.75)	19 (82.60)	0.030
	Liver	64 (15.90)	2 (8.70)	
	Lung	118 (29.35)	2 (8.70)	
	Kidney	0 (0)	0 (0)	
	Brain	0 (0)	0 (0)	
	Spleen	0 (0)	0 (0)	
	Heart	0 (0)	0 (0)	
	Others (muscle-bone)	0 (0)	0 (0)	
What are the clinical symptoms of cystic echinococcosis?	No answer ^a	218 (54.20)	19 (82.60)	<0.001*
	Nauseation, vomiting ^b	128 (31.85)	0 (0)	
	Pain around the cysted organ ^{a,b}	56 (13.95)	2 (8.70)	
	Others (cough, fever) ^c	0 (0)	2 (8.70)	
Which species of animals are affected by cystic echinococcosis?	Sheep ^a	108 (26.85)	1 (4.35)	0.004
	Dog ^b	6 (1.50)	2 (8.70)	
	Cat	0 (0)	0 (0)	
	Horse	0 (0)	0 (0)	
	Mouse	0 (0)	0 (0)	
	No idea ^{a,b}	288 (71.65)	20 (86.95)	
How does humans become infected with cystic echinococcosis?	No answer ^a	207 (51.50)	19 (82.60)	0.027
	Water and food ^{a,b}	26 (6.45)	0 (0)	
	Air ^b	148 (36.80)	2 (8.70)	
	Blood ^{a,b}	1 (0.25)	0 (0)	
	Contact ^{a,b}	20 (5)	2 (8.70)	
Is cystic echinococcosis a fatal disease?	Yes	94 (23.40)	1 (4.35)	0.093
	No	21 (5.20)	2 (8.70)	
	No idea	287 (71.40)	20 (86.95)	
Is cystic echinococcosis a treatable disease?	Yes ^a	182 (45.25)	1 (4.35)	<0.001*
	No ^b	0 (0)	1 (4.35)	
	No idea ^c	220 (54.75)	21 (91.30)	
Have you received training or information anywhere about cystic echinococcosis?	Yes	17 (4.20)	3 (13.05)	0.086
	No	385 (95.80)	20 (86.95)	
Do you know ways to protect against cystic echinococcosis?	Yes	83 (20.65)	3 (13.05)	0.593
	No	319 (79.35)	20 (86.95)	
Which of the ways to protect against cystic echinococcosis do you know?	Vaccine	17 (4.25)	0 (0)	0.165
	Hand washing	33 (8.20)	3 (13.05)	
	Anthelmintic drug treatment	0 (0)	0 (0)	
	Destruction of infected organs	0 (0)	0 (0)	
	Washing fruits and vegetables	67 (16.65)	0 (0)	
	Informing the public	40 (9.95)	2 (8.70)	
	No idea	245 (60.95)	18 (78.25)	
Are you taking any preventative measures against cystic echinococcosis?	Yes ^a	312 (77.60)	6 (26.10)	<0.001*
	No ^b	90 (22.40)	17 (73.90)	

Table 11. Continued

Question	Answer	Animal breeder (%)	Butcher (%)	p-value
Do you have expectations and wishes to prevent the spread of cystic echinococcosis?	Yes	377 (93.80)	20 (86.95)	0.187
	No	25 (6.20)	3 (13.05)	
If you have expectations and wishes, what are they?	Giving importance to personal hygiene^a	118 (29.35)	0 (0)	<0.001*
	Information should be provided through mass media^{a,b}	48 (11.95)	2 (8.70)	
	There should be health education in schools^{a,b}	8 (2)	0 (0)	
	Seminars should be given	0 (0)	0 (0)	
	Fighting should be done without polluting the environment	0 (0)	0 (0)	
	Collaboration should be made with an expert on the subject^{a,b}	84 (20.90)	4 (17.40)	
	All^b	144 (35.80)	15 (65.20)	
	Others^c	0 (0)	2 (8.70)	
Is there anyone around you who has CE disease?	Yes	11 (2.75)	21 (91.30)	0.152
	No	391 (97.25)	2 (8.70)	
If so, what is the degree of closeness?	No answer^a	391 (97.25)	21 (91.30)	<0.001*
	Relative^b	0 (0)	1 (4.35)	
	Others^a	11 (2.75)	1 (4.35)	

*: A p-value of less than 0.05 is statistically significant, ^{a,b,c}: The letters in the answers to the questions in the same column indicate statistical differences

DISCUSSION

CE, a disease caused by helminths, is a prevalent illness affecting both humans and animals. It has been identified in all regions of Türkiye (4). Apart from the two studies on this disease (21,22), no further epidemiological data related to this region has been identified. The objective of this study was to ascertain the level of awareness among animal breeders and butchers in the province of Ardahan regarding the disease and to collate the most recent information on CE in order to facilitate awareness and implement preventative measures.

This study examines the relationship between socio-demographic factors, including age, gender, and education, and CE. Previous research has identified a correlation between infection and age and gender (21,23-26). However, only a few studies have addressed this topic (27,28). Our findings demonstrate that as age increases, both the probability of encountering the disease and knowledge about it rise, in accordance with the findings of Aydın et al. (29). The proportion of female participants is minimal, comprising only 11.29% (48/425) of the total sample. The evaluation of knowledge about the disease according to gender revealed that among the participants, women were the most likely to have heard of or know about CE (45.85%; 22/48). This result is consistent with other studies (27,30).

The literature shows that dog ownership raises the risk of CE (29,31,32). 71.76% of participants (305/425) were dog owners. Dogs not adequately cared for pose a CE risk to their owners (29,31,32). The study data support these findings. Occupations with intense contact with dogs, including shepherds, hunters, farmers, and butchers, are at high risk of CE (12,33). 26.10% (6/23) of butchers and 74.35% (299/402) of animal breeders kept

dogs. Previous studies have shown that both occupational groups are at risk of CE (12,33). The participants also lacked sufficient information on the potential for dogs to transmit certain diseases, particularly CE.

The disease is on the rise, particularly in light of the rising number of stray dogs (34). The prevalence of CE in dogs ranges from 1% to 65% (35-37). 71.76% of participants owned at least one dog. In the intergroup evaluation, 74.35% of animal breeders stated that they own dogs and do not have regular veterinary checks conducted on them. 26.10% (6/23) of butchers surveyed reported owning dogs, with the majority (17.40%; 4/6) taking them for regular check-ups. Most butchers who own dogs protect their pets from disease by giving them parasitic drugs. The dog is at risk of CE due to a high population, lack of records, and lack of effective medication. A factor has been identified as a risk for the disease in the region. Further studies are needed to detect and control the disease.

It has been established that there is a direct correlation between education level and the feeding of dogs (offal, fetus) (29), the administration of antiparasitic drugs to dogs (38), and the destruction of organs by producers (25). People who own dogs stated that they applied parasitic drugs to their dogs (51.48%; 157/305). However, they did not provide information about how frequent the application was or which parasitic drug they used. Additionally, when this situation is associated with the level of education, it has been observed that as the education level increases, the average number of individuals applying parasitic drugs to their dogs decreases. This situation is thought to be due to the lack of equal distribution between the groups according to the education levels of the participants.

It has been demonstrated that contact with dog feces and exposure to the *Echinococcus granulosus* parasite, which causes CE, are associated with an increased risk of seropositivity in humans (39). A statistically significant relationship has been identified between CE cases and offal consumption by dogs (40). In a study conducted by Varcasia et al. (41), it was found that 17% of farmers utilize offal as a source of nutrition for their canine companions. In light of the aforementioned evidence, it can be reasonably deduced that the dietary habits of the fetus and offal, which have been identified as a contributing factor to the disease, play a pivotal role in the disease's emergence and dissemination. The data obtained from this research indicated that as the level of education increases, the status of feeding animal offal also increases. These findings differ from those of other studies (29,39-41). This discrepancy is attributable to the geographical context of the other studies. It is established that the region where the study was conducted has a higher incidence of animal slaughter than other regions, coupled with a harsh winter period of 5-6 months. It is hypothesized that this is caused by feeding dogs offal that is rich in protein and fat, which is likely to increase in prevalence as the level of education increases.

In a study conducted in Aydın province, it was stated that the organs that were considered unsafe for consumption after slaughter (88.66%) were mostly buried and 6.40% were thrown away (27). In a study conducted in Karaman province, it was reported that butchers disposed of internal organs incorrectly at a rate of 59.2% (28). In the study conducted by Aydın et al. (29), in parallel with the previous study, it was stated that animal breeders' practices regarding the destruction of infected internal organs were inappropriate at a rate of 57.9%. Of those who took the survey, 96.50% (220/228) admitted to destroying organs. Upon evaluation of the results of the study conducted in Ardahan, it was determined that despite the participants' lack of awareness regarding the disease, they opted to destroy the infected organs, which play a crucial role in disease transmission, rather than feeding them to the final host dogs (either by burying them or handing them over to the authorities). Furthermore, they employed an appropriate disposal method to prevent disease spread.

It is hypothesized that animal husbandry in Türkiye is predominantly undertaken by individuals with limited educational levels. It is of paramount importance for those engaged in animal breeding to be able to identify cysts associated with CE, given the prevalence of the illness in Türkiye. A number of studies have demonstrated a positive correlation between educational level and knowledge of CE. This is evidenced by the findings of Akalin et al. (42), Demir et al. (25) and Aydın et al. (29). The findings of this study indicate that the proportion of individuals with awareness of the disease was higher among secondary school graduates (44%; 187/425). Furthermore, there was no statistically significant correlation between education level and awareness of the disease ($p=0.930$). It is hypothesized that this discrepancy is attributable to an imbalance in the distribution of educational attainment between the groups of participants.

Raw meat consumption, education/knowledge status, contact with dogs, not giving antiparasitic drugs to dogs, and inadequate hygiene conditions are reported to be important risk factors for CE (29,43). Control programs have been implemented with the objective of protecting dogs from echinococcosis (44). "Do you administer anti-parasitic medication to your dog?" 51.48% of

participants responded positively to the inquiry. In the study conducted by Aydın et al. (29), it was determined that 77.5% of dog owners did not administer antiparasitic drugs to their dogs. In our study, 48.52% (148/305) of participants reported administering antiparasitic drugs to their dogs, which is a lower prevalence than that reported by Aydın et al. (29). It is hypothesized that the aforementioned situation was caused by the fact that the participants lacked the requisite knowledge to identify the specific parasitic disease they were utilizing the pharmaceutical agents against, coupled with a dearth of information pertaining to CE.

Upon inquiry as to which animal in the study CE affected, the majority of respondents (25.65%; 109/425) indicated that it affected sheep, while only 1.90 percent (8/425) stated that it affected dogs. The data indicated that animal breeders reported a prevalence of 26.85% (108/402) in sheep and 1.50% (6/402) in dogs. However, the prevalence reported by butchers was 4.35% (1/23) in sheep and 8.70% (2/23) in dogs. A review of the literature reveals that CE affects both ruminants, which serve as intermediate hosts (25,45), and dogs, which act as final hosts (37,46). The findings of this study corroborate those of previous research in this field. Despite their lack of awareness regarding the illness, the participants demonstrated an understanding of the animals affected, suggesting that they may not have provided a conscious response to the relevant inquiry.

CE has been demonstrated to affect a number of internal organs, with the liver and lungs being the most commonly affected in intermediate hosts (47). This is supported by a number of studies, including those conducted by Gundogdu et al. (21), Hakverdi et al. (23), Aksu et al. (24), Dashti et al. (48), Türkoğlu et al. (49) and Aydın and Adıguzel (50). In response to the question, "What specific tissues and organs are affected by CE?", 66 participants (35.48%) indicated that the disease affects the liver, while 120 participants (64.52%) stated that the disease affects the lungs. Although fewer individuals are aware of CE than those who are not, it can be inferred that the participants answered the pertinent question without a comprehensive understanding of the subject matter.

The failure to dispose of infected organs in an appropriate manner, or the lack of attention to this issue, represents a significant contributing factor to the transmission of CE. In our study, 88.44% (176/199) of participants indicated awareness of the disease's mode of transmission. In other studies, the route of transmission of the disease has been identified as a factor in 61.5% of cases (40), 67.4% of cases (51) and 81.3% of cases (29). The findings of our study indicated a higher prevalence of this phenomenon. Although the number of individuals who are aware of the disease is less than those who are not, the fact that they indicate that they are aware of the manner in which the disease is transmitted suggests that the participants responded to the pertinent question without focusing on it.

In the study conducted by Aydın et al. (29), it was determined that those who heard/know the disease attended courses about CE. Upon evaluation of the level of education and the source of any received education or information, it was determined that the likelihood of having received such education or information increased in conjunction with the level of education, with the exception of those who were literate. Group evaluations yielded consistent results. These findings corroborate those of previous studies (29,51), indicating that the desire to receive education or

information about CE is positively correlated with rising levels of education.

The persistence of CE in many countries, including Türkiye, is attributed to the ineffectiveness of eradication programs, the inadequate use of antiparasitic drugs in stray dogs, uncontrolled animal slaughter, and misapplications resulting from a lack of knowledge in humans (18,50,52). The results of our survey indicate that there is a lack of awareness among animal owners and butchers regarding the infection and its transmission route. In particular, 44.70% (190/425) of respondents reported a lack of knowledge about the infection, while 20.24% (86/425) were similarly unaware of the available protection methods. Conversely, the majority of respondents (88.44%; 176/199) demonstrated a good understanding of the transmission route. Additionally, the majority of infected organs are destroyed after slaughter (51.76%; 220/425), and the majority of animal offal is not fed to dogs (11.48%; 35/305). Upon evaluation of the responses provided in the survey, it can be reasonably inferred that the disease is prevalent in Ardahan province. It is evident that disease screening on both intermediate and final hosts in the region is essential to gain a comprehensive understanding of the situation. Nevertheless, it is imperative that the local population is made aware of this illness and provided with education about it.

CONCLUSION

The research was conducted in the Ardahan Province and its districts. Butchers and animal breeders lacked knowledge of CE. To avoid health risks, we must inform animal breeders, butchers, and the public about how the disease is spread and how to stop it. Control programs are needed to protect humans and animals from this disease. These programs must address the treatment and protection of stray dogs, controlled slaughtering, the disposal of infected organs, and public awareness. The region is at risk of disease, so further studies are needed to detect and control it.

*Ethics

Ethics Committee Approval: The necessary permissions for this study were obtained from the Kafkas University Non-Interventional Research Ethics Committee (letter dated: 02.11.2021, numbered: 81829502.903/248).

Informed Consent: A voluntary survey form comprising 32 questions and an informed consent form verifying the volunteers' consent were also utilized.

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Footnotes

*Authorship Contributions

Concept: N.A., E.G.A., Design: N.A., E.G.A., Data Collection or Processing: E.G.A., Analysis or Interpretation: N.A., E.G.A., Literature Search: E.G.A., Writing: N.A., E.G.A.

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Appendix 1.	
1- Gender a-Female b-Male	24- Have you received training or information anywhere about cystic echinococcosis? a-Yes b-No
2- Level of education a- Literate b- Primary school c- Secondary school d- High school and its equivalent d- University	25- Do you know ways to protect against cystic echinococcosis? a-Yes b-No
3- Your job a- Animal breeder b- Butcher	26- Which of the ways to protect against cystic echinococcosis do you know? a- Vaccine b- Hand washing c- Antihelmintic drug treatment d- Destruction of infected organs e- Washing fruits and vegetables f- Informing the public g-No idea
4- Are there any stray dogs around you? a-Yes b-No	27- Are you taking any preventative measures against cystic echinococcosis? a-Yes b-No
5- Do you have a dog? a-Yes b-No	28- Do you have expectations and wishes to prevent the spread of cystic echinococcosis? a-Yes b-No
6- Is your dog in your living area (home)? a-Yes b-No	29- If you have expectations and wishes, what are they? a- Giving importance to personal hygiene b- Information should be provided through mass media c- There should be health education in schools d- Seminars should be given e- Fighting should be done without polluting the environment f- Collaboration should be made with an expert on the subject g- All h- Others
7- What type of food do you feed your dog? a- Food residues b- Dog food c- Animal offal	30- Is there anyone around you who has CE disease? a-Yes b-No
8- Are routine veterinary examinations performed for your dog? a-Yes b-No	31- If so, what is the degree of closeness? a-Relative b-Others
9- Do you wash your hands after contact with your dog? a- Always b- Sometimes/occasionally	
10- Do you administer anti-parasitic medication to your dog? a-Yes b-No	
11- Do you breed animals such as ovine, caprine, and bovine species? a-Yes b-No	
12- If yes, specify animal species. a-Large animal b-Small animal c-Mix	
13- Do you slaughter? a-Yes b-No	
14- Where is the slaughter conducted? a- In the garden of the house b- Abattoir	
15- After slaughter, do you destroy diseased organs? a-Yes b-No	
16- After slaughter, how are diseased organs disposed of? a- Deep burial b- By discarding c- Giving it to the authorities d- By burning e-Others	
17- Have you heard of cystic echinococcosis disease? a-Yes b-No	
18- What specific tissues and organs are affected by cystic echinococcosis? a-Liver b-Lung c-Kidney d-Brain e-Spleen f-Heart g-Others (Muscle-Bone)	
19- What are the clinical symptoms of cystic echinococcosis? a- Nauseation, vomiting b- Pain around the cysted organ c- Others (cough, fever)	
20- Which species of animals are affected by cystic echinococcosis? a-Sheep b-Dog c-Cat d-Horse e-Mouse f-No idea	
21- How does humans become infected with cystic echinococcosis? a-Water and food b- Air c-Blood d-Contact	
22- Is cystic echinococcosis a fatal disease? a-Yes b-No c-No idea	
23- Is cystic echinococcosis a treatable disease? a-Yes b-No c-No idea	