

## A Slaughterhouse Study on Prevalence of Some Helminths of Cattle and Sheep in Malatya Province, Turkey

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**Abstract:** An abattoir study was carried out on a total of 513 cattle and 1763 sheep slaughtered and examined for the certain helminths in Malatya province, Turkey. In post-mortem examinations, the prevalence rates were as follows; *Dicrocoelium dendriticum* in 3.85% of sheep and 4.67% of cattle, *Fasciola hepatica* in 4.42% of sheep and cattle, *Paramphistomum* sp. in 1.75% of cattle, *Cysticercus tenuicollis* in 12.13% of sheep, hydatid cyst in 9.1% of sheep and 7.6% of cattle. This study indicated that the prevalence of investigated helminths in cattle and sheep of Malatya were quite lower than expected. The results of this study have positive correlations with the results from some of the studies, which were done in recent years in other provinces or localities of Turkey. It is understood that helminth diseases mentioned above are decreasing in the region, but there is always an outbreak risk of helminth diseases.

**Key words:** *Dicrocoelium dendriticum*, *Fasciola hepatica*, *Paramphistomum* sp., hydatid cyst, *Cysticercus tenuicollis*, cattle, sheep, prevalence, Malatya

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### INTRODUCTION

*Dicrocoelium dendriticum* and *Fasciola hepatica* are two of the well-known trematodes of the livestock worldwide including Turkey. These trematodes still serve cause of liver condemnations in abattoirs. Toparlak *et al.* (1989) reported that the prevalence of *Fasciola hepatica* was 53.7% and *Dicrocoelium dendriticum* was 36.1% in cattle in Van province of Turkey. Gargili *et al.* (1999) also reported for cattle that the rate of infection with *F. hepatica* was 3.99% in Thrace region. In Van province, *F. hepatica* and *D. dendriticum* in sheep were reported as 15.9 and 53.3%, respectively (Toparlak and Gul, 1988). When it was looked at other reports for these two trematodes from sheep, the prevalence rates changed from 3-55.6% for *D. dendriticum* and from 0.57-20.3% for *F. hepatica* (Zeybek, 1980; Handemir, 1997; Gargili *et al.*, 1999; Gicik *et al.*, 2002).

*Paramphistomum* sp. still play an important role in cattle and sheep in different parts of the world (Soulsby, 1982). There are few detailed reports about the prevalence of *Paramphistomum* sp. in Turkey. Guralp (1981) reported that the highest prevalence of paramphistomosis in sheep were recorded in Eskisehir Çifteler State Farm and seasonal rate changing was

between 57.7-100%. The rates were 26.4% in cattle and 2.4% in sheep in Ankara Abattoirs (Coskun, 1987), 0.7% in cattle in Samsun (Celep *et al.*, 1990), 15% in cattle and 5% in sheep in South Marmara region (Tinar *et al.*, 1992). The infection rate in sheep in Kars province was reported as 1.64% (Gicik *et al.*, 2004).

Larval stages of *Echinococcus granulosus* are widely known as one of the major causes of economic losses in productivity of livestock of Turkey and the rest of the world. Hydatidosis due to this parasite is a common disease in both cattle and sheep. The distribution of hydatidosis in cattle and sheep varies greatly among the provinces of Turkey. It was 9.39% in cattle and 57.11% in sheep in Konya province (Dik *et al.*, 1992), 39.7% in cattle and 58.6% in sheep in Sivas province (Ozcelik and Saygi, 1990) and 8.96% in cattle and 16.47% in sheep in Manisa (Cenet and Tasci, 1994), 31.25% in cattle and 63.85% in sheep in Kars province (Gicik *et al.*, 2004).

*Cysticercus tenuicollis* is the larval stage of canine tapeworm *Taenia hydatigena*. The larvae are responsible for morbidity and mortality in sheep. Migration of cysticerci in the liver parenchyma may cause hemorrhagic-fibrotic lesions and also peritonitis (Soulsby, 1982; Blazek *et al.*, 1985). The rates of infections with *C. tenuicollis* in Turkish sheep were 56.7%

in Samsun (Zeybek, 1980), 26.7% in Ankara (Oge *et al.*, 1998), 2% in Marmara region (Oncel, 2000), 24.1% in Bursa province (Senlik, 2008).

After searching all databases, it was found that previously no helminthological studies in animals carried out specifically for Malatya which is the most developed provincial capital of the eastern Anatolian region economically and culturally. The aim of this study is to present the results of a slaughter plant study on the prevalence of *D. dendriticum*, *F. hepatica*, *Paramphistomum* sp., cystic echinococcosis and larval *T. hydatigena* in cattle or sheep.

## MATERIALS AND METHODS

**Geographical area:** Malatya is an administrative province located in eastern Anatolian part of Turkey and has a surface measurement of 12,313 km<sup>2</sup> with a population of nearly 800,000. The capital city of the province is located in Malatya plain. This plain surrounded by mountains with medium height. The altitude of the plain is 910 m above the sea level. The climate is hot in summers, somewhat cold, rainy and with a little snow in the winters.

**Animals and sample collection:** Cattle of Malatya province is mostly dominated by the hybrids of Swiss Brown, Holstein and Simmental breeds. These hybrids were obtained by persistent artificial inseminations of native black cattle conducted by state controlled agencies since 1970s. Two races of sheep as Akkaraman and Morkaraman based on the color (white and brown) are found in the region. It is not certain but 85-90% of the sheep are Akkaraman in the province. In the 2007, the total numbers of cattle and sheep kept and raised in the province were 95,078 and 185,250, respectively. According to the records of animal health branch of department of agriculture in Malatya, total of 16,854 cattle and 42,826 sheep were slaughtered in the Malet slaughtering and meat processing plant, which is the only slaughtering unit of the city and vicinity. This plant has been inspected by 3 veterinarians. One of whom is the inspector from department of agriculture.

This abattoir study was carried out in Malet slaughtering and meat processing plant in July 2008, which is located 6 km away from the city center. Lungs, hearts, livers, spleens, rumen and reticulums of 513 cattle and 1,763 sheep were carefully examined for the parasites mentioned above. The age, sex and the numbers of infected animals were recorded. In order to evaluate the data, the animals are divided in two groups as 1-5 years old (younger animals) and older than 5 years old (older animals). *D. dendriticum* and *F. hepatica* recovered

from gallbladders and infected livers by palpating after transversal incision. For *Paramphistomum* sp., rumens and reticulums were inspected after being opened and washed by abattoir researchers. The organs of the abdominal, thoracic and pelvic cavities were critically examined for the presence of larvae of *T. hydatigena* and also *E. granulosus*. Hydatid cysts were examined macroscopically and also by palpating lungs and livers carefully. The data were analyzed by Chi-square ( $\chi^2$ ) test for statistics (Minitab, 1994).

## RESULTS

The prevalence of *D. dendriticum*, *F. hepatica*, *Paramphistomum* sp., hydatid cyst and *C. tenuicollis* in cattle and sheep are presented and shown Table 1 and 2. The occurrence of *D. dendriticum* was 4.67% (24/513) in all of slaughtered cattle. The infection rate was higher in older animals (12.7%) than that of the younger animals (3.04%,  $p < 0.005$ ). The rate was 7.03% in females and 3.89% in males ( $p < 0.05$ ). *Fasciola hepatica* was seen in 28 of 513 cattle (5.45%). The distribution of the parasite was 2.57% (11/427) in younger animals and 19.76% (17/86) in older animals ( $p < 0.05$ ). Paramphistomiasis were seen in 1.75% of 513 cattle. The infection rates were 1.17% in younger animals and 4.65% in older animals ( $p < 0.05$ ). Thirty nine (7.6%) out of 513 slaughtered cattle displayed the cystic larvae of *E. granulosus*. Hydatid cyst was seen 17 of 427 (3.98%) cattle in 1-5 years old (younger animals) and 22 of 86 (25.58%) cattle, which were older than 5 years old (older animals). There was significant difference between these two groups ( $p < 0.05$ ) for hydatid cyst. Infection rate was 16.4% (21/128) in females and 4.67% (18/385) in male cattle ( $p < 0.05$ ). Prevalence of hydatid cyst regarding organ localizations were as follows; 6.62% (34/513) in livers and 5.65% (29/513) in the lungs ( $p > 0.05$ ). *Cysticercus tenuicollis* was not encountered in the cattle examined.

When the data from slaughtered sheep in Malet slaughtering plant, 68 (3.85%) out of 1763 were infected with *D. dendriticum*. This trematode was seen 36 (2.54%) of 1412 sheep in 1-5 years old and 32 (9.1%) of 351 sheep, which were older than 5 years old ( $p < 0.05$ ). *F. hepatica* was observed in 4.42% of livers examined. Again, the infection rate was higher in older sheep (10.25%) than that of younger sheep (2.97%,  $p < 0.05$ ). *Paramphistomum* sp. were not found in the rumen and reticulums of the sheep interestingly. One hundred sixty one (9.1%), out of 1763 sheep were infected with the larval forms *E. granulosus*. The cyst was seen in 114 (8.0%) of 1412 younger sheep and 47 (13.3%) of 351 older sheep. Regarding cyst localizations, 5.89% of all the livers and 5.02% of all

Table 1: The prevalence of hydatid cyst in cattle and sheep in Malatya

Factors	Cattle					Sheep		
	Infection rates			Sex		Infection rates		
	Age 1-5	Age >5	Total	Female	Male	Age 1-5	Age >5	Total
Age	17/427 (3.98)	22/86 (25.58)	39/513 (7.6)	21/128 (16.40)	18/385 (4.67)	114/1412 (8.0)	47/351 (13.3)	161/1763 (9.10)
p-value	<0.05	-	-	<0.05	-	<0.05	-	-
Liver	11/427 (2.57)	23/86 (26.7)	34/513 (6.62)	-	-	64/1412 (4.53)	40/351 (11.39)	104/1763 (5.89)
p-value	<0.05	-	-	-	-	<0.05	-	-
Lungs	10/427 (2.34)	19/86 (22.0)	29/513 (5.65)	-	-	59/1412 (4.17)	34/351 (9.68)	93/1763 (5.02)
p-value	<0.05	-	-	-	-	<0.05	-	-

Table 2: The prevalence of *Fasciola hepatica*, *Dicrocoelium dendriticum*, *Paramphistomum* sp. and *C. tenuicollis* in cattle and sheep in Malatya

Helminths	Cattle					Sheep		
	Infection rates			Sex		Infection rates		
	Age 1-5	Age >5	Total	Female	Male	Age 1-5	Age >5	Total
<b>Trematodes</b>								
<i>F. hepatica</i>	11/427 (2.57)	17/86 (19.76)	28/513 (5.45)	19/128 (14.8)	9/385 (2.33)	42/1412 (2.97)	36/351 (10.25)	78/1763 (4.42)
p-value	<0.05	-	-	<0.05	-	<0.05	-	-
<i>D. dendriticum</i>	13/427 (3.04)	11/86 (12.7)	24/513 (4.67)	9/128 (7.03)	15/385 (3.89)	36/1412 (2.54)	32/351 (9.1)	68/1763 (3.85)
p-value	<0.05	-	-	>0.05	-	<0.05	-	-
<i>Paramphistomum</i> sp.	5/427 (1.17)	4/86 (4.65)	9/513 (1.75)	-	-	-	-	-
p-value	<0.05	-	-	-	-	-	-	-
<b>Cestode</b>								
<i>C. tenuicollis</i>	-	-	-	-	-	127/1412 (8.99)	87/351 (24.7)	214/1763 (12.13)
p-value	-	-	-	-	-	<0.05	-	-

Values are in brackets are percentage

the lungs were infected ( $p>0.05$ ). The prevalence of *C. tenuicollis* was 12.3% (214/1763) in sheep. This metacestode was not observed in the cattle examined. As expected, the infection rates were higher in older animals (24.7%) than that of younger animals (8.99%,  $p<0.05$ ).

## DISCUSSION

The data revealed in this article give valuable information considering the prevalence of *D. dendriticum*, *F. hepatica*, *Paramphistomum* sp., hydatid cyst and *C. tenuicollis* in slaughtered cattle and sheep in Malatya. No abattoir studies were carried previously on these parasites in Malatya province. The prevalence of these parasites in the animals was below than expected and previously thought.

The prevalence rates of *D. dendriticum* and *F. hepatica* are also low. *D. dendriticum* was 4.67% in cattle and 3.85% in sheep. *F. hepatica* was 5.45% in cattle and 4.42% in sheep. The infection rates in livestock in previous studies in Turkey were changing from 3.0-55.6% in *D. dendriticum* and 0.57-20.3% in *F. hepatica* (Gıcık *et al.*, 2002). The prevalence rates of *Paramphistomum* sp. from livestock previously were between 0.5 and 100% in different parts of Turkey (Gıcık *et al.*, 2003). The rates of infections with *C. tenuicollis* in Turkish sheep were changing from 2-56.7% (Zeybek, 1980; Sarimehmetoglu *et al.*, 1993; Oge *et al.*, 1998; Oncel, 2000; Senlik, 2008). The

prevalence rates for these trematodes in neighboring countries were also compared to our study results and it was determined that the rates were lower in our study. Diakou and Papadopoulos (2002) reported from Greece that *F. hepatica*, *D. dendriticum* and *Paramphistomum* sp. from cattle were reported as (0.16%) (4.5%) and (4.66%). The prevalence of fascioliasis were given as 14.7, 2.3 and 8.0% in cattle, sheep and buffaloes which were slaughtered in Mosul, Iraq (Al-Khafaji *et al.*, 2003). In Iran, the prevalence of *F. hepatica* and *D. dendriticum* was 8.5 and 20.0%, respectively (Ghazani *et al.*, 2008). Radfar *et al.* (2005) reported that infection rate of *C. tenuicollis* was 12.7% in sheep of Iran. In another study in Iran, the prevalence of liver infections in livestock due to fascioliasis and dicrocoeliosis were 24.4 and 41.9% of total liver condemnations, respectively (Ghazaei, 2007). Prevalence of paramphistomiasis in sheep was reported as 1.66% in sheep in Fars province of Iran. According to studies of Iran and Iraq that the prevalence rates of the trematodes have dropped considerably in last 10 years because of heavily administered anthelmintics (Al-Khafaji *et al.*, 2003; Ghazaei, 2007; Ghazani *et al.*, 2008).

One of the causes of low prevalence of *F. hepatica* and *Paramphistomum* sp. in Malatya can be the result of vanishing swampy areas because of global warming. These areas are home to intermediate hosts such as *Lymnea truncatula*, *Bulinus* sp., *Planorbis* sp. and etc. In the absence of these snails, the life-cycles of these

parasites are interrupted. Due to global warming, farmers need more water for their orchards or gardens. To obtain water, they have been digging more and more wells with driller, which have desiccated most of the springs or swampy areas in which the snails live in Malatya and also in other parts of Turkey. Pumping subterranean water via wells cause disaster in the nature in which not only snails and also other wild animals go without water.

Hydatidosis is a common disease in Turkey and also in neighbouring countries. In early studies done in other parts of Turkey on slaughterhouse surveys demonstrated that average prevalence rates for hydatid cyst were 25.9% in cattle and 30.6% in sheep (Ozcelik and Saygi, 1990; Gicik *et al.*, 2004). In present study, the prevalences of hydatid cysts were 7.6% in cattle and 9.1% in sheep, which are low rates when it was compared to the rates of other studies in Turkey. When we look at other studies which were done in Bulgaria, Greece, Syria, Iraq and Iran, it is very difficult to correlate and interpret the results. Toncheva and Zhelyaskov (1999) reported that animals from highland regions of Bulgaria had more hydatid disease in sheep (50%) and cattle (29%) than those from semi-highland regions in sheep (29.4%), cattle (17.3%) and plains in sheep (16.2%), cattle (11.8%). In a abattoir survey in Greece, the prevalence of hydatidosis and cysticercosis in sheep flocks were found 39.32 and 29.41%, respectively (Christodouloupoulos *et al.*, 2008). Dajani (1978) reported that 4.5% of sheep, 2.3% of goats and 5.2% of cattle in Syria were infected with hydatidosis. Infection rate of hydatidosis was reported as 15 and 10.9% in sheep and cattle respectively in Arbil province of Iraq (Saeed *et al.*, 2000). In Iraq, the prevalence of *C. tenuicollis* in sheep was reported as 18% (Al-Sultan *et al.*, 1999). In present study, the majority of infected sheep harboured 5-6 hydatid cysts in the liver or lungs. According to our observations without counting, the number of cysts was quite high in the livers and lungs of older animals especially in females. In the studies mentioned above, infection rates of liver with hydatid cyst were higher than that of lungs. The number of cysts were higher in the liver comparing to the lungs, but in the case infection rate, there was no statistical significance ( $p>0.05$ ). The State has no eradication program for cystic echinococcosis and no control program for stray dogs. Although, the prevalence rates seem to be high in livestock in previous studies, it is believed that the rates are also decreasing in other parts of Turkey in last 10 years because of developments in both industry and life style (Arslan *et al.*, 2008). We would like to emphasize that there is also always of risk of high prevalence of hydatid cyst because euthanizing the stray dogs are not allowed due to animal right activists.

The infection rates were higher in female animals than that of male animals because female animals are not slaughtered in younger ages as long as they are fertile. They are sent to abattoirs after milking and getting calves or lambs for years. Therefore, the chance of catching an infection in females increases as the animals aging. And also feeding conditions in cows are quite different from the male cattle stocks, which do not graze in general, which are kept and fed in stables while cows are grazed around water ditch in the fields of villages especially in small family farms. Therefore, older sheep or cows are exposed to the parasites over time. Most of cattle and sheep slaughtered in Malatya are younger animals. Therefore, overall parasitic infection rates might be lower than expected. Because of the present study was carried out in summer, an assessment could not be made of any seasonal variations in the prevalence of the parasites we studied.

The pasture-grazing semi-nomadic sheep, goat and cattle population has been decreasing over the years. People of Turkey are becoming more urban and leaving behind village life and preferring modern life in the cities. Industrialization of Turkey and degradation of existing grassland is the number one problem facing low agricultural production. Total coverage of grasslands was decreased with 50% over the years (Akman *et al.*, 2000). Because of the semi-nomadic pasture grazing of livestock are vanishing and industrial animal husbandry is replacing the old style especially for cattle breeding. This may have been causing less prevalence rates of helminths in the country and also, we want to point out that farmers are more conscious for parasites than what they were in the past. Especially in recent years herd or flock owners medicate their animals with anti-parasitic drugs at least 2 times a year regularly. In the personal communications and observations, control of animal parasites in Malatya province and probably in other parts of Turkey depends on anti-parasitic medicines. Development of resistance in parasite populations may threaten animal health because of uncontrolled use of the drugs. In this point, Department of Agriculture must take serious actions and put on strict educational programs for animal owners to obtain maintained control of parasitic infections and also to protect wild life and human health.

## CONCLUSION

Even if the prevalence rates to these parasites are limited to Malatya, it is thought that heavy economic losses are owing to organ condemnations in abattoirs may not be seen much in the future. The prevalence of investigated helminths in cattle and sheep of Malatya were quite lower than expected due to excessive use of

anti-parasitic medicines and global warming. It can be concluded that the helminth diseases mentioned in the text are decreasing in the region, but it should be kept in the mind that there is always an outbreak risk of helminth diseases.

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#### REFERENCES

- Akman, N., K. Ozkutuk, S. Kumlu and S.M. Yener, 2000. Cattle raising in Turkey and its future. In: 5th Technical Congress of the Agriculture, 17-21 Jan. Chambers of Agricultural Engineers, pp: 741-764.
- Al-Khafaji, N.J., A.M. Ridha and M.T. Jarjees, 2003. Common parasitic infections of livers of ruminants slaughtered in Mosul abattoir, Iraq. *Iraqi J. Vet. Sci.*, 16 (1): 81-87.
- Al-Sultan, I.I., M.T. Jarjees and R.A. Al-Sanjary, 1999. Tenuicollis in sheep and cattle at Mosul abattoir, Iraq. *Iraqi J. Vet. Sci.*, 12 (1): 115-119.
- Arslan, M.O., M. Kara, A. Temur, S.K. Altun and O.F. Kucukkalem, 2008. Kuzey Dogu Anadolu Bolgesi ciftlik hayvanlarında paraziter hastalıkların değerlendirilmesi. *Kafkas Univ. Vet. Fak. Derg.*, 14 (1): 31-35. [http://vetdergi.kafkas.edu.tr/extdocs/2008\\_1/31\\_35.pdf](http://vetdergi.kafkas.edu.tr/extdocs/2008_1/31_35.pdf).
- Blazek, K., J. Schramlová and D. Hulínká, 1985. Pathology of the migration phase of *Taenia hydatigena* (Pallas, 1766) larvae. *Folia Parasitol (Praha)*, 32 (2): 127-137.
- Celep, A., M. Acici, M. Cetindag, S.Z. Coskun and S. Gursay, 1990. Helminthological studies on cattle from the Samson region. *Etlik Vet. Mikrobiol. Derg.*, 6 (6): 117-130.
- Cenet, O. and S. Tasci, 1994. Manisa Et ve Balık Kurumu'nda (EBK) 1986-1993 yılları arasında kesilen kasaplık hayvanlarda kesim sonrası görülen hastalıkların araştırılması. *Türkiye Parazitol. Derg.*, 18: 511-516.
- Christodoulouopoulos, G., G. Theodoropoulos and G. Petrakos, 2008. Epidemiological survey of cestode-larva disease in Greek sheep flocks. *Vet. Parasitol.*, 153 (3-4): 368-373. PMID: 18346853. DOI: 10.1016/j.vetpar.2008.02.002.
- Coskun, S.Z., 1987. Incidence and prevalence of *Paramphistomum* in ruminants. *Doga Turk. Vet. Hay. Derg.*, 12 (3): 168-179.
- Dajani, Y.F., 1978. Prevalence of hydatid disease in Syria and Jordan: Preliminary results. *Trans. R. Soc. Trop. Med. Hyg.*, 72 (3): 320-321. PMID: 675793.
- Diakou, A. and E. Papadopoulos, 2002. Prevalence of gastrointestinal parasites of cattle in Greece. *J. Hellen. Vet. Med. Soc.*, 53 (4): 304-309.
- Dik, B., R. Cantoray and E. Handemir, 1992. Konya Et ve Balık Kurumu Kombinasyonunda kesilen küçük ve büyük bas hayvanlarda hidatidozun yayılımı ve ekonomik önemi. *Türkiye Parazitol. Derg.*, 16: 91-99.
- Gargili, A., E. Tuzer, A. Gulnaber, M. Toprak, I. Efil, V. Keles and M. Ulutas, 1999. Prevalence of liver fluke infections in slaughtered animals in Turkey (Thrace), Turkey. *Turk. J. Vet. Anim. Sci.*, 23 (2): 115-116. <http://journals.tubitak.gov.tr/veterinary/issues/vet-99-23-2/vet-23-2-3-98046.pdf>.
- Ghazaei, C., 2007. An abattoir survey of hydatid and liver fluke disease in sheep and cattle in Ardabil abattoir, Ardabil state, Iran. *J. Anim. Vet. Adv.*, 6 (5): 595-596. <http://www.medwelljournals.com/fulltext/java/2007/595-596.pdf>.
- Ghazani, M.H.M., M.R. Valilou, A.R. Ahmadzadeh, A.R. Karami and K. Zirak, 2008. The prevalence of sheep liver trematodes in the Northwest region of Iran. *Turk. J. Vet. Anim. Sci.*, 32 (4): 305-307. <http://journals.tubitak.gov.tr/veterinary/issues/vet-08-32-4/vet-32-4-12-0701-4.pdf>.
- Gıcık, Y., M.O. Arslan, A. Akca and M. Kara, 2002. Kars ilinde kesilen koyunlarda karaciğer trematodlarının yaygınlığı. *Kafkas Univ. Vet. Fak. Derg.*, 8: 101-102. [http://vetdergi.kafkas.edu.tr/extdocs/8\\_2/101\\_102.pdf](http://vetdergi.kafkas.edu.tr/extdocs/8_2/101_102.pdf).
- Gıcık, Y., M.O. Arslan, M. Kara and M. Kose, 2003. Kars ilinde kesilen koyunlarda paramphistomiosis yaygınlığı. *Türkiye Parazitol. Derg.*, 27: 260-261.
- Gıcık, Y., M.O. Arslan, M. Kara and M. Kose, 2004. Kars ilinde kesilen sigir ve koyunlarda kistik ekinokokkozisin yaygınlığı. *Türkiye Parazitol. Derg.*, 28 (3): 136-139. [http://www.tparazitolderg.org/pdf/pdf\\_TPD\\_153.pdf](http://www.tparazitolderg.org/pdf/pdf_TPD_153.pdf).
- Guralp, N., 1981. *Helmintoloji 2*. Baskı, Ankara Univ. Basımevi, Ankara.
- Handemir, E., 1997. Liver fluke parasitic infections in sheep slaughtered in Konya Meat and Fish Plant. *Türkiye Parazitol. Derg.*, 21 (3): 311-316.
- Minitab Inc., 1994. Minitab Reference Manual. Release 10, for Windows.

- Oge, H., Y. Gicik, F. Kalinbacak and K. Yildiz, 1998. The prevalence of some metacestodes (Hydatid cyst, *Cysticercus tenuicollis*, *Cysticercus bovis*) in sheep, goats and cattle slaughtered in Ankara province. Ankara Univ. Vet. Fak. Derg., 45 (1): 123-130. <http://dergiler.ankara.edu.tr/dergiler/11/559/6918.pdf>.
- Oncel, T., 2000. The prevalence of helminth species in sheep in the southern region of Marmara. Turkiye Parazit. Derg., 24 (4): 414-419.
- Ozcelik, S. and G. Saygi, 1990. Sivas mezbahasinda kesilen koyun ve sigirlarda kist hidatik gorulme oranlari. Turkiye Parazit. Derg., 14 (1): 41-44.
- Radfar, M.H., S. Tajalli and M. Jalalzadeh, 2005. Prevalence and morphological characterization of *Cysticercus tenuicollis* (*Taenia hydatigena* cysticerci) from sheep and goats in Iran. Vet. Arhiv., 75 (6): 469-476. <http://www.vet.hr/vetarhiv/papers/2005-75-6-2.pdf>.
- Saeed, I., C. Kapel, L.A. Saida, L. Willingham and P. Nansen, 2000. Epidemiology of *Echinococcus granulosus* in Arbil province, Northern Iraq (1990-1998). J. Helminthol., 74 (1): 83-88. PMID: 1083 1057.
- Sarimehmetoglu, H.O., B. Gonenc, F.C. Piskin and E. Ayaz, 1993. Prevalence of *Cysticercus tenuicollis* in sheep, goats, cattle and buffaloes. Ankara Univ. Vet. Fak. Derg., 40 (4): 488-496. <http://dergiler.ankara.edu.tr/dergiler/11/608/11552.pdf>.
- Senlik, B., 2008. Influence of host breed, sex and age on the prevalence and intensity of *C. tenuicollis* in sheep. J. Anim. Vet. Adv., 7 (5): 548-551. <http://medwelljournals.com/fulltext/java/2008/548-551.pdf>.
- Soulsby, E.J.L., 1982. Helminths, Arthropods and Protozoa of Domesticated Animals. Bailliere Tindall, London, pp: 113-114.
- Tinar, R., S.Z. Coskun, H. Dogan, S. Demir and C.V. Akyol, 1992. Prevalence of paramphistome species in ruminants in the Southern Marmara region. Doga Turk. Vet. Hay. Derg., 16 (2): 187-197.
- Toparlak, M. and Y. Gul, 1988. Van ili belediye mezbahasinda kesilen kecirlerde karaciger trematode enfeksiyonlari. Ankara Univ. Vet. Fak. Derg., 35(2-3): 412-417. <http://dergiler.ankara.edu.tr/dergiler/11/588/7450.pdf>.
- Toparlak, M., S. Tasci and Y. Gul, 1989. Van ili belediye mezbahasinda kesilen sigirlarda karaciger trematode enfeksiyonlari. Ankara Univ. Vet. Fak. Derg., 36 (2): 419-423. <http://dergiler.ankara.edu.tr/dergiler/11/595/7594.pdf>.
- Toncheva, V. and P. Zhelyaskov, 1999. Prevalence of the hydatid echinococcosis in Plovdiv district. Bulg. J. Agric. Sci., 5 (3): 525-528. <http://www.agrojournal.org/05/321.htm>.
- Zeybek, H., 1980. Determination of the parasitic fauna of lambs in the vicinity of Samson. Ankara Univ. Vet. Fak. Derg., 27 (1-2): 215-236. <http://dergiler.ankara.edu.tr/dergiler/11/573/7177.pdf>.