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ORIGINAL ARTICLE

Prevalence of *Cysticercus tenuicollis* in slaughtered sheep and goats by season, sex, age, at Karbala abattoir, Iraq

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ABSTRACT

Objective: The aim of this study is determine the prevalence of *Cysticercus tenuicollis* in sheep and goats at abattoir in Karbala , Iraq.

Methods: The current study was conducted for six months from July to December 2017. The samples were collected from the sheep and goats in Karbala governorate and the work was done in the postgraduate laboratory at the Faculty of Veterinary Medicine at Karbala University.

Results: The results of the study showed that the highest rate of infection of sheep and goats in general was higher in the month of September, 42.65%, August, 45.57%, respectively, while the lowest rate in October, November, the rate of 30.91% , 28.40%. respectively.

As for the percentage of infection by sex, the rates of infection of males and females for the sheep and goat ranged between 29.16% to 38.09% and 20% to 40.65% for males, and for females, the incidence ranged from 25.4% to 47.22% and 36.80% to 50.50%, respectively. In terms of infection rates by age, the proportion of sheep and goats was less than one year 24.86% - 41.64% , 27.20% - 41.95%, while the largest sheep and goat of more year was 26.11% - 43.64% , 21.42% - 50%, respectively.

Conclusion: The results of the study showed no difference in the incidence of infection between males and females, and between less than one year and more than one year.

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INTRODUCTION

The larval stage of *Taenia hydatigena* is *Cysticercus tenuicollis* (metacestode)^{1,2} which reported in a wide variety of mammalian hosts such as sheep, goat, cattle, pig, as well as human^{3,4,5}. The larval stage are found attached to the mesentery, omentum, and occasionally on the liver surface; however, unusual locations of *C. tenuicollis* have been described as lungs, kidneys,

brain, and reproductive system such as ovaries, uterus, uterine tubes, cervix, and vagina⁶. While the adult stage (*Taenia hydatigena*) are found in the intestine of final hosts (Dogs, wolf, hyaena and other wild carnivores are the final hosts) which can harbour this parasite from several months to a year or more^{7,8,9}. The life cycle of *Taenia hydatigena*, start when lays eggs which pass out

in the faeces of the final host and are ingested by the ruminant intermediate host during grazing.

The intermediate host becomes infected by ingesting of proglottids or eggs passed in the faeces of the final hosts in pastures or feeding areas. Eggs reach small intestine and then hatch in to oncospheres which carried in the blood to the liver (which they migrate for about 4 weeks before they emerge on the surface of this organ and attach to the peritoneum) and other visceral organs like the, lung, heart, kidney. Within a further 4 weeks each develops into the large metacystode^{10,11}.

The final host infected by eating infected meat with larval stage which their scolex liberated and adherence to mucosal layer of intestine. After 51 days the worm becomes mature¹².

Pathogenicity of adult parasites is not high for definitive hosts^{13,14}. Cysticercosis (caused by *Cysticercus tenuicollis*) have two clinical forms in sheep, and goat the acute and the chronic one^{15,16}.

The purpose of this study was to determine the prevalence of sheep, and goat infected with *Cysticercus tenuicollis* in certain areas of Karbala during six months.

MATERIALS AND METHODS

A total of 240 sheep, and 240 goats were examined. Two visits per month were made to the Karbala abattoir during six months period (from July to December 2017). The larval stage which was found in omentum of these animals. In this study were recorded for slaughtered animals seasons, sex and age. The samples were collected from the sheep and goats in Karbala governorate and the work was done in the postgraduate laboratory at the Faculty of Veterinary Medicine at Karbala University.

RESULTS

A total of 240 sheep, and 240 goats were examined. The larval stage which was found on omentum of carcasses. At July month the number of examined carcasses was 40 goat and 40 sheep, The total infection rate of the goat more than sheep was 35.41% 32.5% respectively, as well as the infection rate of female goat higher than female sheep was 41.66% , 37.5%, respectively, while the male infection rate of goat and sheep was 29.16% , while the infection rate of goat less than one year higher than sheep less than one year was 29.16%, 27.5%, respectively , as well as the infection rate of goat more than one year higher than sheep more than one year was 41.66% , 37.5%, respectively, as showed in the Table 1. At degree of freedom 0.05 the cl. χ^2 to the male and female goat = 0.193 , and the cl. χ^2 to the less and more one year = 0.275 while the cl. χ^2 to the male and female sheep = 0.153, and the cl. χ^2 to the less and more one year = 0.322 .

At August month the number of examined carcasses was 40 goat and 40 sheep , The total infection rate of the goat higher than sheep was 45.57%, 34.58% respectively, as well as the infection rate of female goat higher than female sheep was 50.5%, 35.41%,

respectively, as well as the male infection rate of goat higher than the male infection rate of sheep was 40.65%, 33.75% and the infection rate of goat less than one year higher than sheep less than one year was 41.95% , 31.66%, respectively, as well as the infection rate of goat more than one year higher than sheep more than one year was 49.2% , 37.5% respectively as showed in the Table 2. At degree of freedom 0.05 the cl. χ^2 to the male and female goat = 0.153 , and the cl. χ^2 to the less and more one year = 0.101 while the cl. χ^2 to the male and female sheep = 0.019, and the cl. χ^2 to the less and more one year = 0.08.

At September month the number of examined carcasses was 40 goat and 40 sheep, The total infection rate of the goat lower than sheep was 39.5%, 42.65%, respectively, while the infection rate of female goat higher than female sheep was 47.22%, 42.22%, respectively, while the male infection rate of goat lower than the male infection rate of sheep was 31.78%, 38.09% and the infection rate of goat less than one year lower than sheep less than one year was 39.72%, 41.66%, respectively, as well as the infection rate of goat more than one year lower than sheep more than one year was 39.28%, 43.64%, respectively, as showed in the Table 3. At degree of freedom 0.05 the cl. χ^2 to the male and female goat = 0.271 , and the cl. χ^2 to the less and more one year = 0.004 while the cl. χ^2 to the male and female sheep = 0.007, and the cl. χ^2 to the less and more one year = 0.192.

At October month the number of examined carcasses was 40 goat and 40 sheep. The total infection rate of the goat lower than sheep was 33.48%, 30.91%, respectively, while the infection rate of female goat higher than female sheep was 39.77%, 25.4%, respectively, while the male infection rate of goat lower than the male infection rate of sheep was 27.2%, 36.42%, and the infection rate of goat less than one year lower than sheep less than one year was 27.2%, 35.57%, respectively, as well as the infection rate of goat more than one year higher than sheep more than one year was 39.77% , 26.11% respectively as showed in the Table 4. At degree of freedom 0.05 the cl. χ^2 to the male and female goat = 0.386 , and the cl. χ^2 to the less and more one year = 0.671 while the cl. χ^2 to the male and female sheep = 0.126, and the cl. χ^2 to the less and more one year = 0.011.

At November month the number of examined carcasses was 40 goat and 40 sheep , The total infection rate of the goat lower than sheep was 28.4% , 34.43% respectively, while the infection rate of female goat higher than female sheep was 38.8% , 31.94% respectively while the male infection rate of goat lower than the male infection rate of sheep was 20% , 36.93% respectively while the infection rate of goat less than one year higher than sheep less than one year was 35.38%, 29.86% respectively, while the infection rate of goat more than one year lower than sheep more than one year was 21.42%, 39.01% respectively as showed in the Table 5. At degree of freedom 0.05 the cl. χ^2 to the male and female goat = 0.049 , and the cl. χ^2 to the less and more

one year = 0.046 while the cl. χ^2 to the male and female sheep = 0.198, and the cl. χ^2 to the less and more one year = 0.026. At Desember month the number of examined caracases was 40 goat and 40 sheep. The total infection rate of the goat higher than sheep was 39.44%, 33.14% respectively, as well as the infection rate of female goat higher than female sheep was 38.88%, 31.58%, respectively and the male infection rate of goat higher than the male infection rate of sheep was 40%, 34.75% respectively as well as the infection rate of goat

less than one year higher than sheep less than one year was 28.88%, 24.86% respectively, and the infection rate of goat more than one year higher than sheep more than one year was 50%, 41.42% respectively as showed in the Table 6. At degree of freedom 0.05 the cl. χ^2 to the male and female goat = 0.01, and the cl. χ^2 to the less and more one year = 0.771 while the cl. χ^2 to the male and female sheep = 0.571, and the cl. χ^2 to the less and more one year = 0.042.

Table 1: Numbers and infection rates with cysticercus tenuicollis for slaughtered goats and sheep at July

Animal Age	Examined animals		Infection animals		Infection rates		Total
	Female	Male	Female	Male	Female	Male	
Goat less than one year	18	8	6	2	33.33%	25%	29.16%
Sheep less than one year	8	20	2	6	25%	30%	27.5%
Goat more than one year	8	6	4	2	50%	33.33%	41.66%
Sheep more than one year	8	4	4	1	50%	25%	37.5%
Total goat	26	14	10	4	41.66%	29.16%	35.41%
Total sheep	16	24	6	7	37.5%	29.16%	32.5%

Table 2: Numbers and infection rates with cysticercus tenuicollis for slaughtered goats and sheep at August

Animal Age	Examined animals		Infection animals		Infection rates		Total
	Female	Male	Female	Male	Female	Male	
Goat less than one year	11	13	5	5	45.45%	38.46%	41.95%
Sheep less than one year	6	10	2	3	33.33%	30%	31.66%
Goat more than one year	9	7	5	3	55.55%	42.85%	49.2%
Sheep more than one year	16	8	6	3	37.5%	37.5%	37.5%
Total goat	20	20	10	8	50.5%	40.65%	45.57%
Total sheep	16	24	8	6	35.41%	33.75%	34.58%

Table 3: Numbers and infection rates with cysticercus tenuicollis for slaughtered goats and sheep at September

Animal Age	Examined animals		Infection animals		Infection rates		Total
	Female	Male	Female	Male	Female	Male	
Goat less than one year	9	20	4	7	44.44%	35%	39.72%
Sheep less than one year	12	12	6	4	50%	33.33%	41.66%
Goat more than one year	4	7	2	2	50%	28.57%	39.28%
Sheep more than one year	9	7	4	3	44.44%	42.857%	43.64%
Total goat	13	27	6	9	47.22%	31.78%	39.50%
Total sheep	21	19	10	7	47.22%	38.09%	42.65%

Table 4: Numbers and infection rates with cysticercus tenuicollis for slaughtered goats and sheep at October

Animal Age	Examined animals		Infection animals		Infection rates		Total
	Female	Male	Female	Male	Female	Male	
Goat less than one year	8	17	2	5	25%	29.41%	27.20%
Sheep less than one year	7	14	3	4	28.57%	42.85%	35.57%
Goat more than one year	11	4	6	1	54.54%	25%	39.77%
Sheep more than one year	9	10	2	3	22.23%	30%	26.11%
Total goat	19	21	8	6	39.77%	27.20%	33.48%
Total sheep	16	24	5	7	25.4%	36.42%	30.91%

Table 5: Numbers and infection rates with *Cysticercus tenuicollis* for slaughtered goats and sheep at November

Animal Age	Examined animals		Infection animals		Infection rates		Total	
	Female	Male	Female	Male	Female	Male		
Goat less than one year	13	20	4	8	30.76%	40%	35.38%	
Sheep less than one year	9	8	2	3	22.22%	37.5%	29.86%	
Goat more than one year	7	0	3	0	42.85%	0 %	21.42%	
Sheep more than one year	12	11	5	4	41.66%	36.36%	39.01%	
Total	goat	20	20	7	8	36.80%	20%	28.40%
	sheep	21	19	7	7	31.94%	36.93%	34.43%

Table 6: Numbers and infection rates with *Cysticercus tenuicollis* for slaughtered goats and sheep at December

Animal Age	Examined animals		Infection animals		Infection rates		Total	
	Female	Male	Female	Male	Female	Male		
Goat less than one year	18	10	5	3	27.77%	30%	28.88%	
Sheep less than one year	13	15	3	4	23.07%	26.66%	24.86%	
Goat more than one year	6	6	3	3	50%	50%	50%	
Sheep more than one year	5	7	2	3	40%	42.85%	41.42%	
Total	goat	24	16	8	6	38.88%	40%	39.44%
	sheep	18	22	5	7	31.53%	34.75%	33.14%

Discussion

Iraq as one of the endemic areas of *Taenia hydatigena* in dogs as final hosts, and livestock (sheep, goats and cattle) as intermediate hosts. The results of the present study showed that sheep and goats were infected with *C. tenuicollis*. The higher rate of sheep infection at September was 42.65% which agrees with the result of¹⁷, and with¹⁸ in Burkina Faso, while the low rate of sheep infection at October was 30.91% which is similar to the result of¹⁹ in Egypt and^[20] in Nigeria, but it differs with^[21] in Iraq and²² in Egypt.

The results of the study showed that the highest rate of infection of goats in general was higher in the month of August, 45.57% which agrees with the result of²³ in Pradesh Uttar of India and^[24] in Ethiopia, while the low rate of goat infection at November was 28.40% which agrees with the result of¹⁷ in Iraq and¹⁹ in Egypt as well as²⁵, and²⁶ in Sudan, but it differs with²¹ in Iraq and²⁷ in Mazandaran province in Iran and²⁸ in Ethiopia.

The infection rates according to sex, the male infection rate of sheep was 29.16% - 38.09% which agrees with the result of²⁹ in Ethiopia, but it differs with some studies in Iran such as³⁰ in Tabreez city and²⁷ in Mazandaran province, while the male infection rate of goat was 20% - 40.65% which agrees with the result of¹⁷ in Basrah in Iraq, and with the result of²⁹ in Ethiopia, but it differs with³⁰ in Tabreez city and²⁷ in Mazandaran province in Iran.

On the other hand, the female infection rate of sheep was 25.4% - 47.22% which agrees with the result of²⁹ in Ethiopia, but it differs with¹⁷ in Basrah in Iraq, and³⁰ in Tabreez city. While the female infection rate of goat was 36.80% - 50.50% which was higher than¹⁷ in Basrah in Iraq, and³⁰ in Tabreez city but agrees with

the result of²⁹ in Ethiopia. The infection rate according to age, the infection rate of sheep less than one year was 24.86% - 41.64% which agrees with²⁴ in the center of Ethiopia, but it differs with³¹ in Sokoto, Nigeria, and with²⁸ in Ethiopia and²⁷ in Mazandaran province in Iran, while the infection rate of sheep more than one year was 26.11% - 43.64% which agrees with²⁴ in the center of Ethiopia, and¹⁸ in Burkina Faso, but it differs with³¹ in Sokoto, Nigeria and with²⁸ in Ethiopia. The infection rate of goat less than one year was 27.20% - 41.95% which differs with²⁸ in Ethiopia and with³² in Egypt, but agrees with²³, while the infection rate of goat more than one year was 21.42% - 50% which agrees with^{24,25}, but it differs with²⁸ in Ethiopia and with²¹ in Iraq.

The main reasons for variation in prevalence are mainly accounted to the management system prevailing in the local areas and the grazing behavior, and the main causes of the persistence of the disease are the presence of stray dogs in pastures and beside abattoirs³³.

The infection rate of goat was higher than the infection rate of sheep because most sheep develop protective immunity early in life and this immunity regulates the parasite population, while goat develops the immunity more slowly²³.

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