



PARASITIC AFFECTIONS IN EDIBLE OFFAL

Faten S. Hassanin, Fahim A. E. Shaltout, Mostafa E.M. Afifi

Food Control Department, Faculty of Veterinary Med. Moshtohor, Benha University, Egypt

ABSTRACT

A research study was carried out on 1830 food animals included (556) camel, (598) cattle, (383) buffalo, (198) sheep and (95) goat which were examined during the detailed post mortem examination at Tokh and Benha abattoir, Qalubia governorate, Egypt from April 2012 to May 2013 to determine incidence and seasonal variation of hydatid cyst infestation. The obtained results indicated that the incidence of hydatidosis in slaughtered food animals during detailed post mortem examination ranged from April 2012 to May 2013 was 9.7% in camel, 1.83% in cattle, 2.34% in buffalo, 7.57% in sheep and 7.36% in goat. The incidence of hydatid cysts in organs of infested carcasses during detailed post mortem examination was in camel lung 83.3%, liver 16.6%, lung and liver 11.11% and spleen 5.55%. While incidence of *Cysticercus dromedarii* in camels slaughtered from April 2012 to May 2013 according to their age and sex was recorded. While the hearts of young female camels were 1.86% followed by old females 1.81%, old males 1.60% and young males 1.52%. Incidence of *Cysticercus bovis* in cattle and buffalo slaughtered from April 2012 to May 2013. Heart of old females 8.12% were more infested followed by young males 2.25%,

KEY WORDS: hydatidosis, *Cysticercus dromedarii*, *Cysticercus bovis*

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1. INTRODUCTION

The problems of parasitic infestation lead to direct or indirect losses in all species of food animals. The direct losses include retardation of growth, loss in body weight, decrease immunity and increase susceptibility to disease, which increase the mortality rate and leading to financial losses. The indirect damages include interference with reproductive functions as well as partial or total condemnation of carcasses after slaughtering [1]. Parasitic infestation is of economic and public health importance, the most obvious economic losses usually caused by the condemnation of the viscera and sometimes all carcasses and reduce the meat, wool and milk production [2]. Several parasites have been emerged as significant causes of food borne illness, which range from mild discomfort to debilitation and

possibly death [3]. One of the most important parasitic diseases, which is indirectly transmissible to human being, is the hydatid diseases or echinococcosis [4]. Cysticercosis and human taeniasis also constitute one of the common problem of medical and veterinary public health importance; the incidence of *C.dromedarii* in camels slaughtered at Sharkia in Egypt was 1.2% [5]. The prevalence of cysticercosis in cattle was 0.53%, while in the period from August 1977 to July 1978, it was 2.4% [6], the prevalence rate of *C. ovis* in goats was 1.78%, while the prevalence rates were 2.7%, 3.57% and 3.33% in autumn, winter and spring, respectively [7]. Therefore, the current work was carried out to determine the following: 1. Detection of hydatid cysts in slaughtered food animals (camel, cattle, buffalo, sheep and goats).

2. Detection of *C. dromedarii* in camel carcasses. 3. Detection of *C. bovis* in Cattle and Buffalo Carcasses. 4. Detection of *C. ovis* in Sheep Carcasses.

2. MATERIAL AND METHODS

2.1. Collection of data from local authority (Routine P/M) :-

All information's about the number of slaughtered food animals and incidence of parasitic infections (Hydatid cyst) during routine post mortem examination at the period from April 2012 to May 2013 were collected from Tokh and Benha Qalubia governorate, Egypt; and tabulated in table (1) and table (3). A total of 8905 food animals represented by camel (2688), cattle (3550), buffalo (1605), sheep (750) and goat (312) were examined during the routine post mortem examination for detection of hydatid cysts in their different parenchymatous organs.

2.2. Detailed Post mortem examination:

Regular weekly visits were performed to Tokh and Benha abattoir all over the period from April 2012 to May 2013. A total of 1830 food animals represented by camel (556), cattle (598), buffalo (383), sheep (198) and goat (95) were thoroughly examined during the post-mortem examination for detection of hydatid cyst in different parenchymatous organs. If a cyst was found, the entire cyst with the adjacent tissue were cut out from the organ and collected in a plastic bag. These specimens were transported directly to the laboratory for further examination.

2.3. Detection of hydatid cysts:

Inspection of different food animal carcasses and organs was carried out according to technique recommended by [8].

2.3.1. Examination of the lung:

The lung was examined visually followed by palpation with the fingers, which usually

pressed, firmly into the substance of the lungs to locate the smallest and deepest cysts. The entire organ should be palpated from apex to base then single or multiple incisions were done to detect deep hydatid cyst in the lungs.

2.3.2. Examination of the liver:

The liver was examined visually followed by hand palpation to detect hydatid cyst on the surface, then the incision in the liver substance. Accordingly, the liver is placed on its parietal surface, and two incisions were made, the first was perpendicular to the visceral side of the left lobe base and the second is between the caudate and the right lobe and was slightly oblique towards the portal fissure, incising process was continued until the main bile ducts were opened.

2.4. Macroscopical examination:-

Hydatid cysts from different organs were examined after removal from its adjacent tissues carefully for Shape which was described by the naked eye.

2.5. Histopathological examination

Specimens from lung, liver and spleen of infested food animals were obtained and fixed in 10% formaldehyde solution for histopathological examination. After complete fixation, the specimens were washed with tap water, dehydrated in ascending series of ethanol up to absolute alcohol, cleared in xylene and embedded in paraffin. Section of 5 micron thickness were prepared and stained with Haematoxyline and Eosin [9]

2.6. Data analysis:-

The data obtained from abattoir documents, postmortem and laboratory findings were entered into Ms excel sheet and then analyzed by using SPSS, Inc, Chicago, IL.

2.7. Detection of *Cysticercus dromedarii*:

2.7.1. Observation:

Carried out visually, to inspect the surface of each organ of the carcass.

2.7.2. *Palpation:*

Palpation of an organ or part in order to inspect its substance was performed.

2.7.3. *Multiple incisions:*

Accurately, 3-4 lengthwise thin incisions into the left ventricular wall was made, followed by, a longitudinal incision extending from the base of the heart to its apex through the wall of left ventricle (heavy musculature) and then one incision through the interventricular septum.

2.7.4. *Examination of the surface and substance of the tongue:*

A longitudinal incision along the middle line of the tongue was done to demonstrate cysticerci.

2.8. *Detection of Cysticercus bovis in Cattle and Buffalo Carcasses:*

2.8.1. *Examination of the surface and substance of the tongue:*

The surface and substance of the tongue were examined by a longitudinal incision through the ventral surface but without organ injury.

2.8.2. *Examination of the heart:*

The heart was examined visually for surface cyst, then incised, 3-4 incisions from the base to the apex through the wall of left ventricle (heavy musculature) and then one incision through the interventricular septum.

2.9. *Detection of Cysticercus ovis in sheep and goat Carcasses:*

Accurately, 3-6 incisions were done in heart of slaughtered sheep for detection of *C. ovis*. Skeletal muscles were also inspected.

3. RESULTS

3.1. *Incidence of hydatidosis:*

3.1.1. *Incidence of hydatidosis in slaughtered food animals (camel, cattle, buffalo, sheep and goats)*

The results of the present study revealed that the incidence of hydatid cyst infestation in camels according to data collected from abattoir documents was 8.63% from April 2012 to May 2013 (table,1). Moreover the detailed postmortem examination of slaughtered camels revealed that the incidence of hydatid cyst was 9.7% from April 2012 to May 2013. Also, the results of the present study revealed that the incidence of hydatid cyst infection in cattle according to data collected from abattoir documents was 1.15% from April 2012 to May 2013 (table 1). Moreover, the detailed postmortem examination of slaughtered cattle revealed that the incidence of hydatid cyst was 1.83% from April 2012 to May 2013 (table 2).

Also, the results of the present study revealed that the incidence of hydatid cyst infection in buffalo according to data collected from abattoir documents was 1.30% from April 2012 to May 2013 (table,1) Moreover the detailed postmortem examination of slaughtered buffalo revealed that the incidence of hydatid cyst was 2.34% from April 2012 to May 2013.

The results of the present study revealed that the incidence of hydatid cyst infection in sheep according to data collected from abattoir documents was 5.33% from April 2012 to May 2013 (table,1) Moreover the detailed postmortem examination of slaughtered sheep revealed that the incidence of hydatid cyst was 7.57% from April 2012 to May 2013 (Table,2).

3.1.2. *Seasonal variations of hydatidosis in Slaughtered food animals*

According to data collected from abattoir, it was obvious from (table 3) that the highest rate of infestation with hydatidosis from April 2012 to May 2013 was occurred in Autumn in all species as follow: 14.3% for camel, 2.9% for cattle, 2.5% for buffalo, 7.31% for

Table (1): Incidence of hydatidosis in slaughtered food animals during routine post-mortem examination according to abattoir data from April 2012 to May 2013:

	Number	Positive	%
Camel carcass	2688	232	8.63%
Cattle carcass	3550	41	1.15%
Buffalo carcass	1605	21	1.30%
Sheep carcass	750	40	5.33%
Goat carcass	312	21	6.73%
Total	8905	355	3.99%

Table (2): Incidence of hydatidosis in slaughtered food animals during detailed post-mortem examination from April 2012 to May 2013:

	Number	Positive	%
Camel carcass	556	54	9.7%
Cattle carcass	598	11	1.83%
Buffalo carcass	383	9	2.34%
Sheep carcass	198	15	7.57%
Goat carcass	95	7	7.36%
Total	1830	96	5.24%

Table (3): Incidence and seasonal variation of hydatidosis during routine post-mortem examination of slaughtered food animals according to abattoir data from April 2012 to May 2013.

season	Winter			Spring			Summer			Autumn			Total
	No	+ve	%										
Camel	373	42	11.26	751	55	7.323	835	68	8.143	529	76	14.366	2688
Cattle	882	5	0.566	854	6	0.702	1026	16	1.559	788	23	2.918	3550
Buffalo	324	-	-	408	6	1.470	403	9	2.233	470	12	2.553	1605
Sheep	41	-	-	111	8	7.21	255	11	4.31	301	22	7.31	708
Goat	28	-	-	52	4	7.69	131	6	4.58	143	13	9.091	354
Total	1848	47	254	2176	79	3.63	2650	110	4.151	2231	146	6.544	8905

Table (4): Incidence and seasonal variation of hydatidosis during detailed post-mortem examination of slaughtered food animals from April 2012 to May 2013.

season	Winter			Spring			Summer			Autumn			Total
	No	+ve	%	No	+ve	%	No	+ve	%	No	+ve	%	
Camel	133	11	8.2706	144	12	8.333	148	14	9.459	131	20	15.267	556
Cattle	145	3	2.068	157	3	1.9108	160	4	2.5	136	4	2.9411	598
Buffalo	94	-	-	92	3	3.2608	108	4	3.703	89	4	4.4943	383
Sheep	12	-	-	31	3	9.677	61	4	6.557	91	6	6.593	195
Goat	8	-	-	18	2	11.111	28	2	7.143	44	4	9.091	98
Total	392	14	3.571	442	23	5.204	505	28	5.544	491	38	7.739	1830

Table (5): Incidence of hydatid cysts in offal of infested carcasses during detailed post-mortem examination from April 2012 to May 2013.

Organ	Lung	%	Liver	%	Lung +liver	%	Spleen	%
Camel	45	83.3	9	16.6	6	11.11	3	5.55
Cattle	6	54.5	8	72.72	--	--	--	--
Buffalo	7	77.7	6	66.6	--	--	--	--
Sheep	7	46.6	11	73.3	--	--	--	--
Goat	4	57.1	5	71.4	--	--	--	--
Total	69	71.9	39	40.6	6	6.25	3	3.12

Table (6): Incidence of *Cysticercus dromedarii* infested camel carcasses from April 2012 to May 2013 in relation to age and sex:

Sex	Age	No of examined camels	Infested heart	
			No	%
Male	Old	561	9	1.60
	Young	131	2	1.52
Female	Old	607	11	1.81
	Young**	107	2	1.86

Table (7): Incidence of *C. bovis* in hearts of slaughtered cattle judged from April 2012 to May 2013.

Season	Winter			Spring			Summer			Autumn			Total		
	Age	No.	+ve	%	No.	+ve	%	No.	+ve	%	No.	+ve	%	No.	+ve
Young Females	100	1	1	100	2	2	100	3	3	100	3	3	400	9	2.25
Old Females	40	2	5	40	4	10	40	3	7.5	40	4	10	160	13	8.12
Total	130	3	2.31	130	6	4.61	130	6	4.61	130	7	5.38	520	22	4.23

Table (8): Incidence of *C. ovis* in hearts of slaughtered sheep judged from April 2012 to May 2013.

Season	Winter			Spring			Summer			Autumn			Total		
	Age	No.	+ve	%	No.	+ve	%	No.	+ve	%	No.	+ve	%	No.	+ve
Young males	100	2	2	100	1	1	100	3	3	100	2	2	400	8	2
Old Females	40	2	5	40	4	10	40	3	7.5	40	1	2.5	160	10	6.25
Total	130	4	3.07	130	5	3.85	130	6	4.62	130	3	2.31	520	18	3.46

sheep and 9.091% for goat. Moreover, (table,4) indicated that the highest rate of infestation with hydatidosis from April 2012 to May 2013 was recorded in Autumn in all species as follows: 15.2% for camel, 2.9% for cattle, 4.4% buffalo, 6.5% for sheep and 9.091% for goat.

3.1.3. Incidence of hydatid cysts in offal of infested carcasses:

The results of the present study revealed that the incidence of hydatid cyst infection in offal of slaughtered camels during detailed postmortem examination was 83.3% camel's lung, 16.6% in camel's liver, 11.11% in camel's lung & liver and 5.55% in camel's spleen from April 2012 to May 2013. The results of the present study revealed that the incidence of hydatid cyst infection in offal of slaughtered cattle during detailed postmortem examination was 54.5% cattle's lung and 72.7% in cattle's liver, from April 2012 to May 2013. The results of the present study revealed that the incidence of hydatid cyst infection in offal-slaughtered buffalo during detailed postmortem examination was 77.7% buffalo's lung and 66.6% buffalo's liver, from April 2012 to May 2013 (table 5). The results of the present study revealed that the incidence of hydatid cyst infection in offal of slaughtered sheep during detailed postmortem examination was 46.6% sheep's lung and 73.3% sheep's liver, from April 2012 to May 2013 (table 5). The results of the present study revealed that the incidence of hydatid cyst infection in offal of slaughtered goat during detailed postmortem examination was 57.1% goat's lung and 71.4% goat's liver, from April 2012 to May 2013 (table 5).

3.1.4. HISTOPATHOLOGICAL FINDINGS OF HYDATIDOSIS:

LIVER:

Homogenous eosinophilic parasitic cyst wall was embedded in the outer surface of the hepatic tissue with underlying necrosis, inflammatory cells infiltration,

Fibrosis with collagen fibers were extended from the hepatic capsule in the area underlying the parasitic cysts to the degenerated hepatic parenchyma

LUNG:

Parasitic cyst was detected in the surface of the lung tissue characterized by transparent smooth or polyps eosinophilic structurless membrane with underlying necrosis and inflammatory cells infiltration as well as calcification and collapsed air alveoli.

3.2. *Cysticercus dromedarii*:

The limited data in the literature, camels may be infested with *Cysticercus dromedarii* (*C. cameli*), *C. bovis* and *C. OVIS*. Incidence of *Cysticercus dromedarii* infested camel hearts depending on the age and sex from April 2012 to May 2013 was recorded in table (6). Out of 561, 131, 607 and 107 old male, young male old female and young female camels slaughtered in 2012, 1.60%, 1.52%, 1.81% and 1.86% were infested with *Cysticercus dromedarii*, respectively. It is of interest to mention that *Cysticercus dromedarii* was not detected in all examined liver and spleen samples in the current study.

4. DISCUSSION

The results of the present study revealed that the incidence of hydatid cyst infection in camels according to data collected from abattoir documents was 8.63% from April 2012 to May 2013 (table 1). Moreover, the detailed postmortem examination of slaughtered camels revealed that the incidence of hydatid cyst was 9.7% from April 2012 to May 2013. Nearly similar results were recorded in Assuit governorate by [10], [11] who reported that the incidence of hydatidosis was 7.6%, 12.3% and 8.9%, respectively. [12] recorded lower results (2.5%) and higher results (30.1%) were reported in Muritania by [13]. Also, the results of the present study revealed that the incidence of hydatid cyst infection in cattle

according to data collected from abattoir documents was 1.15% from April 2012 to May 2013 (table 1). Moreover, the detailed postmortem examination of slaughtered cattle revealed that the incidence of hydatid cyst was 1.83% from April 2012 to May 2013 (table 2). Lower results (0.07%) were recorded in Nigeria by [11], while higher results (16.35%) were reported in Ethiopia by [12]. Also, the results of the present study revealed that the incidence of hydatid cyst infection in buffalo according to data collected from abattoir documents was 1.30% from April 2012 to May 2013 (table 1). Moreover, the detailed postmortem examination of slaughtered buffalo revealed that the incidence of hydatid cyst was 2.34% from April 2012 to May 2013. The results of the present study revealed that the incidence of hydatid cyst infection in sheep according to data collected from abattoir documents was 5.33% from April 2012 to May 2013 (table 1). Moreover, the detailed postmortem examination of slaughtered sheep revealed that the incidence of hydatid cyst was 7.57% from April 2012 to May 2013 (Table 2).

Nearly similar results were recorded in Italy by [13], by [14] and who reported that incidence of hydatidosis was 10.3%, 6.5%, 7.52% and 7.8% respectively. According to data collected from abattoir, it is obvious from (table 3) indicated that the highest rate of infestation with hydatidosis from April 2012 to May 2013 was occurred in Autumn in all species as follow: 14.3% for camel, 2.9% for cattle, 2.5% for buffalo, 7.31% for sheep and 9.091% for goat. Moreover, (table 4) indicated that the highest rate of infestation with hydatidosis from April 2012 to May 2013 was occurred in autumn in all species as follows: 15.2% for camel, 2.9% for cattle, 4.4% for buffalo, 6.59% for sheep and 9.091% for goat. Liver condemnations due to hydatidosis were, higher in the spring and summer for sheep. Liver condemnations in the cattle were higher in winter [6]. The monthly prevalence of hydatidosis was the

highest in July (36.44%) and the lowest in April (25.11%), these results indicate that different seasons had significantly affect on its prevalence. [12]. The results of the present study revealed that the incidence of hydatid cyst infection in offal of slaughtered camels during detailed postmortem examination was 83.3% camel's lung, 16.6% in camel's liver, 11.11% in camel's lung & liver and 5.55% in camel's spleen from April 2012 to May 2013. The results of the present study revealed that the incidence of hydatid cyst infection in offal of slaughtered cattle during detailed postmortem examination was 54.5% cattle's lung and 72.7% in cattle's liver, from April 2012 to May 2013. The results of the present study revealed that the incidence of hydatid cyst infection in offal-slaughtered buffalo during detailed postmortem examination was 77.7% buffalo's lung and 66.6% buffalo's liver, from April 2012 to May 2013 (table 5). The results of the present study revealed that the incidence of hydatid cyst infection in offal of slaughtered sheep during detailed postmortem examination was 46.6% sheep's lung and 73.3% sheep's liver, from April 2012 to May 2013 (table 5). The results of the present study revealed that the incidence of hydatid cyst infection in offal of slaughtered goat during detailed postmortem examination was 57.1% goat's lung and 71.4% goat's liver, from April 2012 to May 2013 (table 5). It is obvious from the result that the highest rate of infestation with hydatidosis was occurred in camel carcasses and its infested organs specially the lung. In addition, camel was found to be 4 time more at risk than cattle and buffalo, 2 times than sheep & goat this may be attributed to close contact between camel and dogs more than cattle, buffalo, sheep and goat. From the limited data in literature, camels may be infested with *Cysticercus dromedarii* (*C. cameli*), *C. bovis* and *C. ovis*. Moreover, *Cysticercus dromedarii* was chiefly located in the heart and in liver, measseter muscles, tongue, cervical muscles and lungs [4]. Incidence of

Cysticercus dromedarii infested camel carcasses depending on age and sex from April 2012 to May 2013 was recorded in table (6). Out of 561, 131, 607 and 107 old male, young male old female and young female camels slaughtered from April 2012 to May 2013, 1.60%, 1.52%, 1.81% and 1.86% were infested with *Cysticercus dromedarii* in their hearts, respectively. It is of interest to mention that *Cysticercus dromedarii* was not detected in all examined liver and spleen samples in the current study. Only hearts of investigated camels were affected with these cysts. *Cysticercus dromedarii* is the only type of cysticerci infesting camel meat and heart; therefore, such infested carcasses should be dealt with by removing the cysts with the surrounding tissue or by total condemnation of the whole carcasses if they caused substantial disorders that render meat unmarketable [4].

5. REFERENCES

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الإصابات الطفيلية في الأحشاء المأكولة

فاتن سيد حسائين - فهميم عزيز الدين شلتوت - مصطفى السيد محمد عفيفي

قسم مراقبه الأغذية-كلية الطب البيطري بمشهر-جامعه بنها

الملخص العربي

داء الحويصلات القنفذية مرض ذو أبعاد صحية وبيطرية هامة على مستوى العالم. فهو يصيب الإنسان ومختلف أنواع الحيوانات عن طريق الإصابة المباشرة بالتهام بويضات ديدان الحويصلات القنفذية الملوثة للخضروات أو المراعي. وتعد الكلاب والثعالب وآكلات اللحوم الأخرى عائلا أساسيا لهذه الدودة الشريطية في حين يصبح الإنسان وكذلك الحيوانات آكلة العشب شاملة حيوانات الذبح عائلا وسيطا يصاب بالطور اليرقي في صورة حويصلات أو أكياس مائية. وقد أجريت هذه الدراسة على عدد 556 من الجمال و 598 من الأبقار و 383 من الجاموس و 293 من الأغنام والماعز من مجزر بنها وطوخ بمحافظة القليوبية على مدار عام من أبريل 2012 إلى مايو 2013 وقد أسفرت النتائج عن أن نسبة تواجد الحويصلات القنفذية خلال الفترة المذكورة (9.7%) في الجمال و(1.83) في الأبقار و (2.34%) في الجاموس و(7.57%) في الأغنام و(7.36%) في الماعز. وقد أظهرت النتائج من أبريل 2012 إلى مايو 2013 إن أعلى الإصابات كانت في فصل الخريف لمختلف ذبائح الحيوانات حيث كانت 15.2% في الجمال و 2.9% في الأبقار و 4.4% في الجاموس و 6.5% في الأغنام و 9.091% في الماعز. وأيضاً أظهرت تلك الدراسة أن داء الحويصلات القنفذية يصيب مختلف أنواع الحيوانات وعلى وجه الخصوص الجمال حيث كانت الإصابة في أكثر من عضو واحد حيث كانت نسبة الإصابة في الفترة من أبريل 2012 إلى مايو 2013 83.3% والكبد 16.6% والرئة مع الكبد 11.11% والطحال 5.55%. مدى تواجد الإصابة بحويصلات الدودة الشريطية في ذبائح الجمال خلال الفترة من ابريل 2012 إلى مايو 2013 مع علاقتها بالسن والجنس قد تم تسجيلها. الإصابة في إناث الجمال صغيرة السن 1.86% كانت أعلى إصابة بحويصلات الدودة الشريطية ثم ذبائح الإناث كبيرة السن 1.81% ثم ذبائح الذكور كبيرة السن 1.60% وتليها ذبائح الذكور صغيرة السن 1.52%. كانت النسبة الأقل خلال فصل الخريف حيث سجل عدد 139 و 143 من ذبائح الذكور الكبيرة السن وذبائح الإناث الكبيرة السن 1.43% و 0.69% كانت مصابة. وعن مدى تواجد الإصابة بحويصلات الدودة الشريطية في ذبائح الأبقار خلال الفترة من ابريل 2012 إلى مايو 2013 مع علاقتها بالسن والجنس قد تم تسجيلها. الإصابة في الإناث كبيرة السن 8.12% كانت أعلى إصابة بحويصلات الدودة الشريطية ثم ذبائح الذكور صغيرة السن 2.25% . كانت النسبة الأقل خلال فصل الشتاء حيث سجل عدد 100 و 40 من ذبائح الذكور الصغيرة السن وذبائح الإناث الكبيرة السن 1% و 5% كانت مصابة. وكان أعلى معدل للإصابة قد تم تسجيله خلال موسم الخريف والربيع. وعن مدى تواجد الإصابة بحويصلات الدودة الشريطية في ذبائح الأغنام خلال الفترة من ابريل 2012 إلى مايو 2013. وكانت الإصابة في الإناث الكبيرة السن 6.25% كانت أعلى إصابة بحويصلات الدودة الشريطية ثم ذبائح الذكور الصغيرة السن 2% . وكانت النسبة الأقل خلال فصل الخريف حيث سجل عدد 40 و 100 من ذبائح الإناث الكبيرة السن وذبائح الذكور الصغيرة السن 2.5% و 2% كانت مصابة. وكان أعلى معدل للإصابة قد تم تسجيله خلال موسم الصيف والربيع. وقد نوقشت الأهمية الصحية للإصابة بهذه الطفيليات وكذلك طرق الوقاية المختلفة وذلك لحماية صحة الإنسان من الإصابة بمثل هذه الطفيليات التي تنتقل عن طريق تناول اللحوم المصابة بحويصلات مثل هذه الطفيليات بالأخص عندما تكون اللحم غير جيدة الطهي.

(مجلة بنها للعلوم الطبية البيطرية: عدد 25(1): 46-55, سبتمبر 2013)