

METACESTODES AMONG SHEEP SLAUGHTERED AT MANSOURA ABATTOIR, DAKAHLIA PROVINCE, EGYPT

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ABSTRACT

A total number of 151 sheep are examined by the routine meat inspection. It is found that the total prevalence of metacestodes infecting sheep carcasses was 31.79%. Four types of metacestodes are detected; *Cysticercus ovis*, *Cysticercus tenuicollis*, *Coenurus cerebralis* and *Hydatid cyst*. Prevalence of the revealed parasites are estimated, where the prevalence of *C. ovis* was 11.26%, *Hydatid cyst* (0.66%), *C. tenuicollis* (19.21%) and *C. cerebralis* (7.28%). Concerning the seasonal dynamics of the revealed parasites, autumn season was the highest season for infection with *C. tenuicollis* (28.95%), and winter in case of hydatidosis (2.44%), while *C. ovis* reached its maximum during summer (17.14%). Moreover, spring season was the highest for infection with *C. cerebralis* (10.81%). Heart was the most predilection site for *C. ovis* infection (82.35%) and omentum for *C. tenuicollis* (65.52%). *Hydatid cyst* is only recovered from liver and *C. cerebralis* only detected in brain. Dealing with the prevalence of the revealed parasites in different ages, *Hydatid cyst* was only detected in aged animals and *C. ovis* in sheep 1-2 years old, while *C. cerebralis* and *C. tenuicollis* are revealed from sheep over two years of age. Microscopical examination of the obtained parasites was performed for identification.

Key words: sheep, carcass, metacestodes, *Cysticercus*, *Coenurus*, *Hydatid*

INTRODUCTION

Cestodes of the family Taeniidae, which infect the small intestine of dogs (definitive host), are transmitted to a wide range of intermediate host species where they form their larval stages (metacestodes) in host tissues.

Sheep rearing constitutes an important source of animal protein especially in Arabian countries. Sheep become infected through ingestion of Taeniid eggs resulting in formation of one or more metacestodes namely, *Cysti-*

cercus ovis (the larval stage of *Taenia ovis*), *Cysticercus tenuicollis* (the larval stage of *Taenia hydatigena*), *Coenurus cerebralis* (the larval stage of *Taenia muticeps*) and finally *Hydatid cyst* (the metacestode of *Echinococcus granulosus*), **Solusby, 1982.**

These larval stages are of economic and public health importance. The most obvious economic losses are due to condemnation especially livers (e.g. *C. tenuicollis*, *Hydatid cyst*...etc) and hearts as well as rendering the

carcass unobjectionable for consumers (e.g. *C. ovis*). Also, nervous manifestations and even animal deaths are accompanied with sheep coenurosis. Moreover, Hydatid cyst or hydatidosis is a cyclozoonotic dangerous parasite of worldwide distribution, where human and animal cases have been reported with severe cystic echinococcosis in lungs and livers.

Most of previous studies showed that inspection of slaughtered sheep at abattoirs represents one of the perfect and accurate methods for diagnosis of metacestodes (Gracey et al., 1999). Therefore this work was planned to study the prevalence, seasonal dynamics as well as the morphological features of metacestodes infecting slaughtered sheep at Mansoura abattoir in Dakahlia province, Egypt.

MATERIAL AND METHODS

A total number of 151 sheep were examined by the routine meat inspection for the detection of metacestodes in Dakahlia province, Egypt. Regular weekly visits were carried out to Mansoura abattoir all over a year.

1. Collection of specimens:

1. Heart, esophagus, diaphragm, liver, kidneys, masseter and skeletal muscles were incised and inspected for detection of *C. ovis*.
2. Lungs and livers were palpated and incised for detection of Hydatid cyst and *C. tenuicollis*. The later metacestode was also detected by gross inspection of the peritoneal cavity and its contents.
3. Skulls were incised and brains were inspected for detection of *Coenurus cerebralis*.

4. Positive samples were taken to Parasitology laboratory, Faculty of Veterinary Medicine, Mansoura University for further detailed examination.

2. Laboratory examination and permanent mounts for identification (according to Richard and Kruse, 1982) :

1. The revealed metacestodes were washed in tap water and kept in a little amount of water in a refrigerator overnight.
2. Small cysts (e.g. *C. ovis*) were compressed between 2 glass slides and fixed in 10% formalin for fixation. Large cysts (*C. cerebralis*) were incised and evacuated then compressed.
3. The compressed specimens were then washed in water to get rid of formalin remnants and stained overnight in acetic acid alum carmine stain, washed in tap water to remove the excess of stain.
4. Differentiation was carried out in acid-alcohol till reaching the desired staining contrast. Then, dehydrated in ascending grades of ethanol and passed in xylene before mounting in Canada balsam.
5. Morphological features and measurements of the revealed parasites were identified using binocular light microscope and screw eye micrometer.
6. Photos were taken by digital Camera (Fuji Film A 340, 4.0 million pixels), modified and resized using computer program ACD See (version 10.0).

RESULTS

Investigation of 151 sheep carcasses at Mansoura abattoir revealed four types of metacestodes. Namely; *Cysticercus ovis*, *Cysticercus tenuicollis*, *Coenurus cerebralis* and Hydatid cyst.

The total prevalence of metacestodes infection was considerably high (31.79%). Individual prevalence of metacestodes revealed that *C. ovis* was found in 11.26%, *C. tenuicollis* in 19.21%, *C. cerebralis* in 7.28% and Hydatid cyst in 0.66% of inspected carcasses as well as 6.62% mixed infections (Table, 1).

Regarding the seasonal fluctuation of the revealed parasites, Table (1) cleared that infection with metacestodes increased during winter (31.70%) to reach its maximum during spring (37.84%); while nearly similar lower incidences were observed during summer (28.57%) and autumn (28.95%). An inverse seasonal fluctuation is observed while comparing the mixed infections, where they are found to increase during summer (8.57%) and autumn (10.53%) but decreased during winter (2.44%) and spring (5.41%). It is also noted that every season had the highest incidence of a certain parasite. i.e. autumn for *C. tenuicollis* (28.95%), winter for Hydatid cyst (2.44%), spring for *C. cerebralis* (10.81%) and summer for *C. ovis* (17.14%).

Seasonal dynamics of *C. ovis* was found to increase during spring season (16.22%) to reach its maximum during summer (17.14%) and started to decrease during autumn (7.89%) to be the lowest in winter season (4.88%). In contrast, *C. tenuicollis* was highest during autumn season (28.95%), de-

creased in winter (19.51%), toward spring (16.22%) to reach its lowest incidence in summer (11.43%). On the other hand, *C. cerebralis* is found to increase during winter (7.32%) and spring (10.81%), while decreased respectively during summer (8.27%) and autumn (2.63%). Meanwhile, Hydatid cyst was only detected during winter (2.44%). Table (1).

Tissue preferred by each parasite was also under our focus. Heart was the most predilection site for *C. ovis* infection (82.35%) followed by diaphragm (23.53%), where there was 11.76% mixed infection in both tissues, while 5.88% of cysts were equally recovered as mixed infection from both kidneys and back muscles.

C. tenuicollis cysts were found to predominate in omentum followed by mesentery and liver (65.52, 48.28 and 34.48% respectively), of which, 10.34% were mixed between liver and omentum and 13.79% showed mixed infection by the same parasite between liver and mesentery, whereas all mesentery infections were mixed with omentum. Specifically, *C. cerebralis* was only revealed from brain. Meanwhile, Hydatid cyst was only revealed from inspected livers. Table (2).

With respect to age groups, *C. ovis* is found to infect all investigated animal groups, where the majority of infection is observed in the age group of 1-2 years old (14.56%), followed by animals over 2 years old (5.56%), while younger animals (6-12 months) are found harboring the lowest incidence (3.33%).

Direct proportion is noticed between the

age and the infection with *C.tenuicollis* and *C.cerebralis*. In this regard, infection of 6 -12 months age group (13.33% and 0.00% respectively) appears lower than animal groups between 1-2 years (17.48% and 4.47% respectively) and those over 2 years old (38.89% and 11.11% respectively). i.e. The older the animal, the highest is the infection rate and vice versa. Table (3).

Concerning sex, female animals are found more liable, than male ones, to the infection with *C. tenuicollis* (42.86 and 15.38 % respectively) and *C. cerebralis* (9.52 and 6.92% respectively). In contrast, males are found more liable to infection with *C. ovis* than females (11.54 and 9.52% respectively). The only recorded case of hydatidosis was in a female over 2 years of age. Table (3).

Morphological examination revealed non viable - calcified cysts of *C.ovis*. The calcified and degenerated ones were appeared as hard creamy coloured nodules with a core of pus in caseated cyst and hard calcareous nodule in calcified one. Their size ranged from 4 -10 mm in diameter.

Viable detected *C. tenuicollis* was spherical or ovoid in shape, ranged from 1-8 cm in diameter with the wall consisted of a milky-white outer membrane and a thinner inner one. The protoscolex could easily be seen from the cyst wall as a glistening whitish dot invaginated into a long neck. The protoscolices ranged from 250 -1050 μm in length and 200 - 800 μm in width; with 4 cub -shaped muscular suckers (each 75 - 240 μm in diameter) and a rostellum armed with two rows of hooks; inner larger hooks (65-180 μm in

length) and the outer small hooks (35-110 μm in length).

C. cerebralis cyst appeared as a bladder with variable size (1-5 cm in diameter) and contains a clear fluid, which enclosed inside a grayish white translucent membrane. Protoscolices could be seen from the outer wall as small whitish dots floating freely in the fluid or attached to the membrane. Many protoscolices were attached to the germinal layer, these protoscolices varied in number (50-250) and size according to the stage of development (0.5 x 0.4 mm to 1 x 0.8 mm in diameter). Protoscolices have 4 cup-shaped muscular suckers ranged from 75-250 μm , and a rostellum bearing about 30 alternating large and small hooks. The length of the large hooks ranged from 232.5 -257.5 μm and that of small ones was 155 -175 μm .

Hydatid cyst was a unilocular, small (1.3cm in diameter), spherical vesicle and consisted of a cavity filled with fluid. The thick cyst wall consisted of an outer layer of laminated connective tissue and an inner nucleated germinal epithelium. It was sterile (no protoscolices were found).

DISCUSSION

Results revealed a relatively high incidence of sheep metacestodes infection. This could be attributed to the fact that most of sheep are reared beside dogs which are the final host of dog's Taeniid.

Concerning the prevalence of the revealed parasites, incidence of *C. ovis* is found higher than that recorded by **El-Masry, 1986** (0%), **El-Metenawy, 1999** (0.29%) and **Dada and**

Belino, 2006 (1%) but lower than **Sissy et al., 2007** (26%). *C. tenuicollis* in the present work nearly agreed with **Hasslinger and Weber-Werrighen, 1988** (16.7%), and **Dada and Belino, 2006** (21.4%). Meanwhile, Higher rate was recorded by **El-Masry, 1986** (23.27%) and lower rates by **El-Metenawy, 1999** (1.25%) and **Radfar et al., 2005** (12.57%). *C. cerebralis*, is found lower than **Nagi et al., 2005** (9.4%) and **Oryan et al., 1994** (9.4%), but higher than **Karim, 1979** (2.9%), **Akkaya and Vurusaner, 1998** (1.3%) and **Abo-Shehada et al; 2002** (3%).

These differences may referred to different sheep management systems including rearing beside dogs, locality and / or number of examined carcasses.

Prevalence of Hydatid cyst (0.66%), follows that recorded by **Hegazi et al., 1986** (0.42%) in Dakahlia province, Egypt; but lower than **Scala et al., 2005** (75%) in Italy. This lower incidence of sheep hydatidosis may be explained by the lower incidence of *Echinococcus granulosus* in dogs in Dakahlia province, Egypt (5%), which reported by **El-Shazly et al., 2007**.

With regard to the seasonal dynamics of the revealed parasites, the increasing of *C. ovis* during spring to reach its maximum incidence in summer season may attributed to the infection of sheep with *Taenia ovis* eggs during the green feeding (Barseem) in winter season. Seasonal dynamics of *C. tenuicollis* coincided with that mentioned by **Pathak and Guar, 1982** (increased in rainy seasons) and **El-Masry, 1986** (increased in autumn).

Increasing of *C. cerebralis* during spring followed by summer season being identical to **Abo-Shehada et al., 2002** (increased in spring) and **Scala et al., 2007** (increased in spring and summer), while disagreed with **Uslu and Guclu, 2007** (increased in winter and decreased in summer). The unique case of Hydatid cyst of the present issue is only detected in winter season.

On studying the tissue preferred by the revealed metacestodes, the obtained results of *C. ovis* are found in agreement with **Green et al., 1995** (heart, diaphragm, kidneys and back muscles) and disagreed with **Burroughs et al., 1991** (biceps brachii muscle).

Investigation results obtained for *C. tenuicollis* are found coincided with **Jensen and Pierson, 1975 and Radfar et al., 2005** (84.85% in omentum). The higher liver infection in this study than **Ibrahim et al., 2002** (4.6%) may be contributed to that most examined animals were 1-2 years age (the time of exposure to new infections).

C. cerebralis cysts were specifically recovered from the brain tissue, being identical to that reported by **Oryan et al., 1994, Islam and Rahman, 1997, Nagi et al., 2005 and Uslu and Guclu, 2007**.

The unique case of hydatidosis was recovered from the liver. This is agreed with **Al-Yaman et al., 1985**.

Referring to the age and sex groups infected with *C. tenuicollis*, the present results being similar to **Pathak and Guar, 1982** (increased in aged animals) and **Alim et al.,**

2002 (females more than males), but disagreed with **El-Masry, 1986** (males more than females). Results of *C. ovis* infected age group and sex agreed with **Kimberling, 1988** (sheep 1-2 years old) and disagreed with **Sissy et al., 2007** (ewes more than rams). Similarly, *C. cerebralis* infected age group and sex is coincided with **Akkaya and Vurusaner, 1998 and Karim, 1979** but disagreed with **Abo-Shehada et al., 2002** (younger more than adults) and **Uslu and Guclu, 2007** (males more than females). From our opinion, these differences may be attributed to the difference in the number of the examined animals rather than the longstanding criteria of tissue parasites. The unique Hydatid cyst was revealed from an adult female over 2 years old which, coincided with **Scala et al., 2005**.

Finally, with regard to the morphological characteristics of the detected parasites, no viable *C. ovis* were detected which, may owing to the early degeneration of the cyst (**Wilson and Wilson, 1998**). The degenerated cyst appeared as that reported by **Green et al., 1995**.

The obtained *C. tenuicollis* specimens agreed with **Jensen and Pierson, 1975; El-Masry, 1986 and Kimberling, 1988**. The size of protoscolices and suckers is found similar to **El-Masry, 1986**. The length of the large hooks and smaller ones being within the ranges given by **El-Nawawy, 1969** (large hooks 170-220 μm and small ones 110-160 μm), **Radfar et al., 2005** (large hooks 199.1 μm and small ones 134.85 μm) and **El-Masry, 1986** (large hooks 165-224 μm and small ones 112-155 μm). These differences in the morphological characterization of the rostellar

hooks may be due to the existence of strain difference of *Taenia hydatigena* cysticerci (**Radfar et al., 2005**).

Results of *C. cerebralis*, agreed with **Nooruddin et al., 1996 and Nagi et al., 2005**. The number of protoscolices per cyst is similar to **Sun, 1994** (50-100) but lower than **Jones et al., 1997** (500) and Gracey et al., 1999 (400-500). The size of the protoscolices coincided with **Nagi et al; 2005** (0.12 x 0.15 - 1.2 x 0.8 mm).

The detected morphological features of Hydatid cyst agreed with that mentioned by **Urquhart et al., 1996 and Solusby, 1982**

CONCLUSION

From the above mentioned results, it could be concluded that sheep carcasses are infected with a relatively high incidence of metacestodes, that constraints both national economy and public health hazards. Therefore, the following recommendations should be taken in consideration while rearing sheep:

- (1) Sheep stocks must be reared away from dogs (the final host of dog's Taeniids) in order to prevent metacestode infections with subsequent avoidance of economic losses especially because these larval stages are usually diagnosed after slaughtering, at meat inspection.
- (2) In this regard, we have to emphasize the important role of meat inspection to offer a healthy meat for human consumption, free from public health hazards, especially in the absence of specific treatments of metacestode infections.

Table 1 : Prevalence and seasonal dynamics of metacestodes revealed from sheep slaughtered at Mansoura abattoir.

Coenurus cerebralis		Cysticercus tenuicollis		Hydatid cyst		Cysicercus ovis		%	Mixed +ve	%	Total +ve	No. Ex.	Season
%	+ve	%	+ve	%	+ve	%	+ve						
2.63	1	28.95	11	0.00	-	7.89	3	10.53	4 ^A	28.95	11	38	Autumn
7.32	3	19.51	8	2.44	1	4.88	2	2.44	1 ^B	31.70	13	41	Winter
10.81	4	16.22	6	0.00	-	16.22	6	5.41	2 ^C	37.84	14	37	Spring
8.27	3	11.43	4	0.00	-	17.14	6	8.57	3 ^D	28.57	10	35	Summer
7.28	11	19.21	29	0.66	1	11.26	17	6.62	10	31.79	48	151	Total

A: Three cases C.ovis mixed with C. tenuicollis + one case C.tenuicollis mixed with coenurus cerebralis

B: One case C.ovis mixed with C.tenuicollis

C: One case C.ovis mixed with Coenurus cerebralis + one case C.tenuicollis mixed with Coenurus cerebralis

D: Three cases C.ovis mixed with C.tenuicollis

Table 2 : Prevalence of *C. tenuicollis* and *C. ovis* in different tissues of sheep.

Prevalence of <i>C. tenuicollis</i> in different tissues of sheep.												
Liver & Mesentery		Liver & Omentum		Mesentery & Omentum		Omentum		Liver		%	+ve	No. Ex.
%	+ve	%	+ve	%	+ve	%	+ve	%	+ve			
13.79	4	10.34	3	48.28	14	65.52	19	34.48	10	19.21	29	151
Prevalence of <i>C. ovis</i> in different tissues of sheep.												
Back muscles and Kidneys			Heart & Diaphragm		Diaphragm		Heart		%	+ve	No. Ex.	
%		+ve	%	+ve	%	+ve	%	+ve				
5.88		1	11.76	2	23.53	4	82.35	14	11.26	17	151	

Table (3): Prevalence of *C. ovis*, *C. tenuicollis* and *Coenurus cerebralis* in relation to age and sex of sheep.

Prevalence of the revealed parasites in relation to age							
C. cerebralis		C. tenuicollis		C. ovis		No. Ex.	Age group
%	+ve	%	+ve	%	+ve		
0.00	-	13.33	4	3.33	1	30	6 -12 months
4.74	9	17.48	18	14.56	15	103	1- 2 years
11.11	2	38.89	7	5.56	1	18	Over 2 years
Prevalence of the revealed parasites in relation to sex							
C. cerebralis		C. tenuicollis		C. ovis		No. Ex.	Sex
%	+ve	%	+ve	%	+ve		
9.52	2	42.86	9	9.52	2	21	Females
6.92	9	15.38	20	11.54	15	130	Male



Fig (1): *C. ovis* in kidney

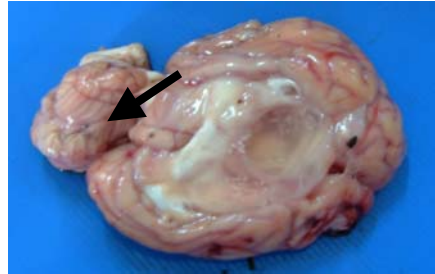


Fig (5): *C. cerebralis* in brain

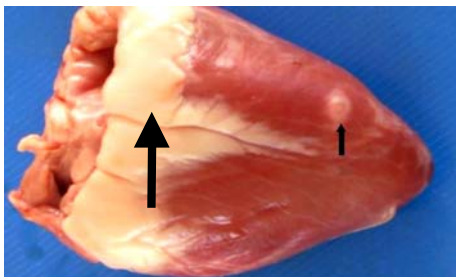


Fig (2): *C. ovis* in heart

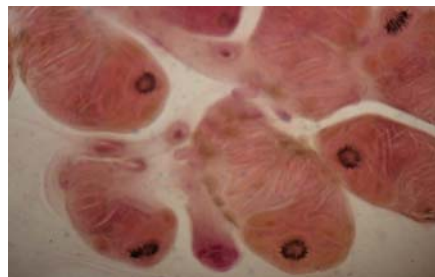


Fig (6): *C. cerebralis* on a slide



Fig (3): *C. tenuicollis* in mesentery



Fig (7): Protoscolex of *C. cerebralis*

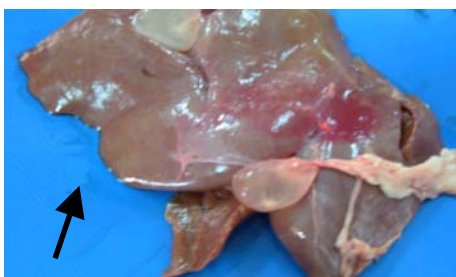


Fig (4) : *C. tenuicollis* in liver



Fig (8): Rostellar hooks of *C. cerebralis*

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الملخص العربى

الأطوار اليرقية للديدان الشريطية فى الأغنام المذبوحة بمجزر المنصورة محافظة الدقهلية - مصر

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يعتبر فحص ذبائح الأغنام داخل المجازر من أفضل الطرق لتشخيص إصابتها بالأطوار اليرقية للديدان الشريطية ولذلك فقد أجريت هذه الدراسة لتحديد مدى إصابة الأغنام المذبوحة بمجزر المنصورة التابع لمحافظة الدقهلية بتلك اليرقات، حيث تم توقيع الكشف الظاهرى على ١٥١ ذبيحة من الأغنام الواردة من المراكز المختلفة للمحافظة داخل المجزر.

وبالفحص وجدت ٤ أنواع من الأطوار اليرقية وهى : الأكياس المائية الهيداتيديية، اليرقة المثانية الغنمية، اليرقة المثانية ذات الرقبة المعلقة والأكياس المائية المخية.

وكانت نسبة الإصابة الكلية بالأطوار اليرقية المختلفة ٣١٫٧٩٪ وقد تم تسجيل نسبة الإصابة لكل طفيل على حدة فى الأغنام المذبوحة حيث وجد أن نسبة الإصابة بالأكياس المائية الهيداتيديية ٠٫٦٦٪ واليرقة المثانية الغنمية ١١٫٢٦٪ واليرقة المثانية ذات الرقبة المعلقة ١٩٫٢١٪ والأكياس المائية المخية ٧٫٢٨٪.

وبالنسبة للإصابة الموسمية على مدار فصول السنة الأربعة فكانت أعلى نسبة إصابة للأكياس المائية الهيداتيديية فى فصل الصيف (١٧٫١٤٪)، اليرقة المثانية ذات الرقبة المعلقة فى فصل الخريف (٢٨٫٩٥٪) والأكياس المائية المخية فى فصل الربيع (١٠٫٨١٪).

وقد تم تحديد أكثر أعضاء الجسم إصابة بهذه اليرقات حيث وجد أن القلب هو أكثر الأعضاء إصابة باليرقة المثانية الغنمية، وكان مندبل الكرش الأكثر إصابة باليرقة المثانية ذات الرقبة المعلقة والمخ أكثر الأعضاء إصابة بالأكياس المائية المخية، أما الأكياس المائية الهيداتيديية فكان الكبد هو العضو الوحيد المصاب بها.

وكذلك تم تحديد أكثر الفئات العمرية إصابة بالطفيليات المذكورة فكانت الحيوانات البالغة (أكثر من سنتين) هى أكثر الفئات إصابة باليرقة المثانية ذات الرقبة المعلقة والأكياس المائية المخية فى حين أن الفئة العمرية (من سنة إلى سنتين) كانت هى الأكثر إصابة باليرقة المثانية الغنمية، وعموماً فإن الحيوانات البالغة والمتقدمة فى العمر هى أكثر الحيوانات إصابة بالأكياس المائية الهيداتيديية.

واشتملت هذه الدراسة أيضاً على إجراء الفحص الميكروسكوبى لكل طفيل على حدة وذلك لتحديد صفاته المورفولوجية وتصنيفه طبقاً لمعايير التصنيف العلمية.

الكلمات الدالة : الديدان الشريطية، اليرقة المثانية، الهيداتيدي، الأكياس المخية.