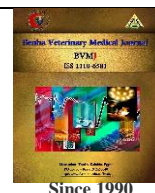




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Original Paper

Prevalence and distribution pattern of Sarcocysts in cattle carcasses slaughtered at the public abattoir of Tanta, Egypt

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ABSTRACT

Sarcocystis species are cyst-forming protozoa belong to the phylum *Apicomplexa*. Genus *Sarcocystis* contains more than twohundred species characterized by global geographic distribution. A total of 200 cattle carcasses, bull and cow (100 each), of different ages were examined in Tanta abattoir, Egypt for detection of *Sarcocystis* during the period from July 2020 to June 2021. Results revealed that the prevalence of macrosarcocysts in cattle carcasses was 0%, while the prevalence of microsarcocysts was 52% (41% in bulls and 63% in cows) with higher incidence in elder cattle than in younger ones. The most affected organ with microscopic *Sarcocystis* in cattle was the esophagus (50%) followed by the tongue (47%), masseter muscle (40.5%), skeletal muscles (39.5%) and finally heart (36%). The obtained results indicated that cattle at Tanta region is infested with *Sarcocystis* species perhaps due to the abundance of definitive hosts, mainly dogs and cats that promote the dispersion of infection by this parasite.

1. INTRODUCTION

Sarcocystosis is a protozoal disease spread all over the world. Its causative agent is coccidian parasites belong to the phylum *Apicomplexa*.

Sarcocystis species have a mandatory two-host life cycle: in the intermediary host occurs the asexual life cycle with cystic formation called sarcocysts, while the sexual life cycle occurs inside the final host, including carnivores and humans, usually become infected by ingestion of undercooked meat containing sarcocysts, while intermediary hosts are infested by intake of sporulated oocysts or sporocysts in contaminated food and water (Dubey, 2015). Cattle are the intermediate hosts for some species of *Sarcocystis*. Cattle may harbor macroscopic or microscopic sarcocysts in their striated muscles (Dubey and Lindsay 2006). At least 3 species of *Sarcocystis* are identified to use cattle as an intermediary host, namely *S. hirsuta* of feline origin, *S. cruzi* of canine origin, and *S. hominis* of human origin (Fayer et al., 2015). Lately, *S. heydorni* and *S. rommeli* were identified to infest cattle as an intermediate host. *S. heydorni* requires a human as the final host, while the final host of *S. rommeli* is still unidentified (Dubey et al., 2015).

It is familiar that a significant rate of cattle populations is contaminated by *Sarcocystis* species in various parts throughout the world. The infection rate of cattle sarcocystosis is greater than 90 % in many parts all over the world (Vangeel et al., 2007; Obijiaku et al., 2013; Nourollahi-Fard et al., 2015).

Human can be infected by ingesting sarcocysts in muscular tissues of intermediate hosts, whereas the intermediary hosts are infested by the intake of sporocysts and sporulated oocysts through contaminated food. Human sarcocystosis occurs in two dissimilar clinical diseases; an intestinal disease, attributable to *S. heydorni*, *S. sui hominis* and *S. hominis*, and muscular disease, attributable to *S. nesbitti*, the only species of *Sarcocystis* that utilize human as intermediary host (Dubey, 2015).

The present study was conducted in Tanta abattoir, Egypt to determine the followings:

- 1- The prevalence rate of macroscopic and microscopic sarcocysts in slaughtered cattle
- 2-The influence of sex and age of slaughtered cattle on the prevalence rate of sarcocysts.
- 3- Microscopic sarcocysts in different slaughtered cattle's organs.

2. MATERIAL AND METHODS

2.1. Study animals

A total number of 200 bulls and cows (100 each) of different ages were examined for macroscopic and microscopic sarcocysts infestation during the period from July 2020 to June 2021 in Tanta abattoir, Egypt. Each animal was identified by sex (bull-cow) and by age (young-old). The age of investigated animals was assessed by visual inspection of teeth.

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2.2. Gross examination:

Macroscopic sarcocysts were identified by visual inspection of muscular tissues according to Huong(1999). Muscle masses from the esophagus, heart, tongue, masseter muscles and skeletal muscles were sliced to facilitate gross inspection to detect any macroscopic sarcocysts. The percentage of positive and negative macroscopic sarcocysts was recorded.

2.3. Samples collection

Muscle samples from the esophagus, tongue, heart, masseter muscle and skeletal muscle were collected from slaughtered cattle to determine the prevalence of microscopic sarcocysts. All samples were labelled and fixed immediately in 10% formalin for further histological analysis in Pathology department, Faculty of Veterinary Medicine, Kafrelshiekh University.

2.4. Histological examination:

All samples were fixed immediately in 10% formalin and prepared for histological examination according to Bancroft and Gamble (2008) through dehydration in graded ethanol, implanted in paraffin wax, sectioned at a thickness of 5 µm and finally all slides were stained by Hematoxylin and Eosin. All slides were visually screened for microscopic sarcocysts by highly experienced staff at Pathology Department, Faculty of Veterinary Medicine, Kafrelshiekh University.

The results were recorded and photographed by a digital camera.

3. RESULTS

The results listed in table (1) revealed the prevalence rate of macroscopic sarcocysts in cattle was 0%, while the prevalence rate of microscopic sarcocysts in cattle was 52%. Higher prevalence of microscopic sarcocysts was recorded in cows (63%) than bulls (41%). Moreover, the results listed in table (1) revealed a higher prevalence of microscopic sarcocysts in old cattle (63%) than in young cattle (41%). The results in table (2) revealed that the most infected organ with microscopic sarcocysts was the esophagus (50%) followed by the tongue (47%), masseter muscle (40.5%), skeletal muscle (39.5%) and the least infected organ was the heart (36%)

Table 1 Prevalence of macroscopic and microscopic sarcocysts in cattle carcasses concerning age and sex.

Age (Years)	Sex	n	Positive Number		Prevalence %	
			Macro-sarcocysts	Micro-sarcocysts	Macro-sarcocysts	Micro-sarcocysts
1-3	Bull	100	0	41	0%	41%
5-8	Cow	100	0	63	0%	63%
Total		200	0	104	0%	52%

Table 2 Tissue distribution of microscopic sarcocysts in slaughtered cattle

Tissue	Age (years)	Sex	n	Positive Number	Prevalence %	Total prevalence %
Esophagus	1-3	Bull	100	34	34%	50.0%
	5-8	Cow	100	66	66%	
Heart	1-3	Bull	100	21	21%	36.0%
	5-8	Cow	100	51	51%	
Tongue	1-3	Bull	100	31	31%	47.0%
	5-8	Cow	100	63	63%	
Masseter M.	1-3	Bull	100	23	23%	40.5%
	5-8	Cow	100	58	58%	
Skeletal M.	1-3	Bull	100	25	25%	39.5%
	5-8	Cow	100	54	54%	

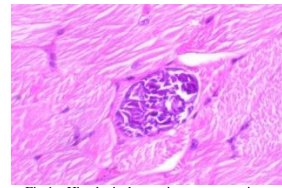


Fig.1 Histological section representing a microscopic sarcocyst isolated from an infected cow's tongue H&E stain, x100

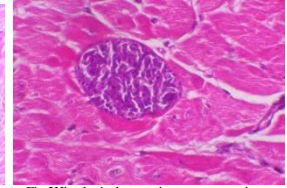


Fig.2 Histological section representing a microscopic sarcocyst isolated from an infected cow's heart H&E stain, x100.

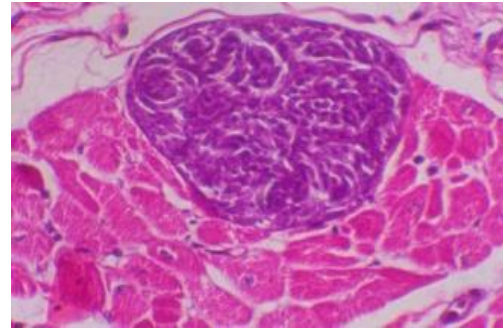


Fig.3 Histological section representing a microscopic sarcocyst isolated from an infected cow's heart. H&E stain, x400.

4. DISCUSSION

Concerning the prevalence rate of macrosarcocysts in cattle, the results listed in table (1) revealed the prevalence rate of macroscopic sarcocysts in cattle was 0%. Nearly, the same results were recorded in Egypt by Youssef et al.(2013), Abdel-Hafeez et al. (2015), Hussein et al.(2017), Dyab et al.(2019), and Mousa et al.(2021). Globally, 0% prevalence rate was recorded by Nourani et al. (2010) in Iran, Obijiaku et al. (2013) in Nigeria, Yang et al. (2018) in China, Januskevicius et al. (2019) in Lithuania, Mekibib et al. (2019) in Ethiopia, and Abdullah (2021) in Iraq. On other hand, this result disagreed with the higher prevalence of macroscopic sarcocysts in cattle slaughtered in Egypt (Nahed et al. (2014) recorded 3.28% in Giza,Ahmed et al. (2016) recorded 7.45% in El-Kharga,El-Morsey et al. (2021) recorded 11.33%) and India (Mounika et al. (2018) recorded 6.57%).

Felids are well-known to be the definitive hosts of macroscopic sarcocysts, while canids are the definitive host of microscopic sarcocysts. In the present study, macroscopic sarcocysts were found to be far less prevalent than microscopic sarcocysts, which were probably due to infrequent opportunities for cats to be in contact with ruminants (El-Dakhly et al., 2011).

Regarding the prevalence of microscopic sarcocysts in cattle, the results listed in table (1) revealed the prevalence of microscopic sarcocysts in cattle was 52%. Nearly, the same results were recorded by Nahed et al. (2014) in Egypt (59%), Obijiaku et al. (2013) in Nigeria (42.5%), Yang et al. (2018) in China (41.5%), Latif et al. (2013) in Malaysia (36.2%) and Zeng et al. (2021) in Belgium (64%). On the other hand, this result disagreed with the higher prevalence of microscopic sarcocysts in cattle obtained in Egypt by El-Kady et al. (2018) in Qena (85.7%), Abdel-Hafeez et al. (2015) in El-Minia (80%) and Mousa et al. (2021) in Sirs-Elian (88%). The difference in prevalence rates may be due to the different methods of diagnosis, different localities, and different management practices (Aziz et al., 2017). A higher prevalence of microscopic sarcocysts than macroscopic sarcocysts reflects a significant role played by stray dogs, rather than cats, in the transmission of these parasites(El-Dakhly et al., 2011).

Referencing to the prevalence of sarcocysts in cattle concerning sex, the results in table (1) revealed a higher prevalence of microscopic sarcocysts in cows (63%) than in bulls (41%). Nearly, the same results were recorded by Ibrahim et al. (2018) who recorded a higher prevalence of microscopic sarcocysts in cows (44.6%) than bulls (28.6%) in Cairo, Egypt, and Zeng et al. (2021) recorded a higher prevalence of microscopic sarcocysts in cows (74%) than bulls (22%) in Belgium. On other hand, this result disagreed with Mousa et al. (2021), who recorded a higher prevalence of microscopic sarcocysts in bulls (92%) than cows (84%) in Sirs-Elian, Egypt, El-Kady et al. (2018) recorded 76.2% in bulls and 9.5% in cows in Qena, Egypt and Obijiaku et al. (2013) recorded 47.7% in bulls and 40% in cows in Nigeria. The low percentage of the infected bulls may be attributed to the animal management system in Egypt, as most of the bulls are kept only for the fattening system and are slaughtered around two years old, while cows are kept for long times for milk production (El Shanawany *et al.*, 2019). Concerning to the prevalence of sarcocysts in cattle concerning age, the results listed in table (1) revealed the prevalence of microscopic sarcocysts was higher in old cattle (63%) than in young cattle (41%). Nearly, the same results were recorded by Ibrahim et al. (2018), who recorded a higher prevalence in old cattle (43.2%) than in young cattle (29.6%) in Cairo, Egypt, Mohammad (2012) recorded a higher prevalence in old cattle (87.32%) than in young cattle (30.76%) in Iraq and Yang et al. (2018) recorded 50% in old cattle and 26.94% in young cattle in China. On other hand, this result disagreed with Obijiaku et al. (2013) who recorded 45.8% in young cattle and 36.2% in old cattle.

The correlation between the age and the increased infection rate may be attributed to repeated exposure to *Sarcocystis* infection, which results in sarcocysts accumulation gradually inside muscles (Taib *et al.*, 2016).

Regarding the organ distribution of sarcocysts in cattle, the results in table (2) revealed that the most infected organ by microscopic sarcocyst was the esophagus (50%) followed by the tongue (47%), masseter muscle (40.5%), skeletal muscle (39.5%) and Heart (36%). Nearly, the same results were recorded in Egypt by Nahed et al. (2014), who recorded the highest prevalence in the esophagus (53.45%), and Abdel-Hafeez et al. (2015), who recorded the highest prevalence in the esophagus (68%) followed by the tongue (53%) and the lowest prevalence in the heart (35%). Globally, the prevalence of esophageal infestation was (92%) in Iraq (Abdullah, 2021), (88.2%) in Nigeria (Obijiaku et al., 2013), (84.52%) in India (Dafedar et al., 2011), (91%) in Iran (Nourani et al., 2010). At the same time, Domenis et al. (2011) recorded the highest prevalence in the esophagus and the lowest prevalence in the heart in Italy. On other hand, this result disagreed with Mousa et al. (2021), who recorded that the heart was the most infected organ (88%) followed by the esophagus (72%) in Sirs-Elian, Egypt, Bucca et al. (2011) recorded the highest prevalence in the heart (74%) in Italy, Latif et al. (2013) recorded the highest prevalence in skeletal muscles and diaphragm (27% each) in Malaysia and Fukuyo et al. (2002) recorded the highest prevalence in the heart (100%) in Mongolia.

5. CONCLUSION

This survey reports the existence of *Sarcocystis* infection in slaughtered cattle at Tanta slaughterhouse, Egypt. The prevalence of macrosarcocysts in cattle carcasses was 0%, while the prevalence of microsarcocysts was 52% (41% in

bulls and 63% in cows) and higher in older cattle than in younger ones. The most affected organ with microscopic sarcocysts in cattle was the esophagus (50%) followed by the tongue (47%), masseter muscle (40.5%), skeletal muscles (39.5%) and finally heart (36%). The results are definite that cattle are infested with *Sarcocystis*. Therefore, beef must be heated adequately or refrigerated prior to consumption to avoid hazards to human beings.

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