

Article Info

 Open Access

Citation: Dyab, A.K., Ahmed, H.A., Hefnawy, Y.A., Abdel Aziz, A.R., Gomaa, M.M., 2019. Prevalence of Tissue Parasites in Cattle and Buffaloes Slaughtered in El-Minia Governorate Abattoirs, Egypt. PSM Vet. Res., 4(2): 49-58.

Received:

Accepted:

Online first:

Published:

Corresponding Author:
Amer Ragheb Abdel Aziz

Email:
amerragheb36@yahoo.com

Copyright: ©2019 PSM. This work is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial 4.0 International License.

Scan QR code to see this publication on your mobile device.

Prevalence of Tissue Parasites in Cattle and Buffaloes Slaughtered in El-Minia Governorate Abattoirs, Egypt

Ahmed K. Dyab¹, Hesham A. Ahmed², Yehia A. Hefnawy², Amer Ragheb Abdel Aziz^{3*}, Mena M. Gomaa⁴

¹Department of Medical Parasitology, Faculty of Medicine, Assiut University, Egypt.

²Department of Meat Hygiene, Faculty of Veterinary Medicine, Assiut University, Egypt.

³Department of Veterinary Parasitology, Faculty of Veterinary Medicine, Sohag University, Egypt.

⁴A veterinarian at private veterinary clinic.

Abstract:

The present study was conducted to determine the prevalence of meat borne parasitic infection in 170 animals (120 cattle and 50 buffaloes) slaughtered in El-Minia Governorate abattoirs, during the period from June 2017 to May 2018. The obtained data were statistically analysed by SPSS software using ANOVA test at 95 % confidence level ($P \leq 0.05$). The study revealed the overall prevalence in cattle was 35%, the incidence of *Fasciola* spp. (23.3%), *Cysticercus bovis* (6.6%), *Sarcocyst* spp. (0%) and hydatid cyst (5%). On the other hand, total prevalence in buffaloes was 52%, which include *Fasciola* spp., (30%), *Cysticercus bovis* (6%), *Sarcocyst* spp. (12%), and *Hydatid cyst* (4%). Older cattle and buffaloes were more susceptible than young ($P \leq 0.05$). The highest seasonal prevalence rate of infection with *Fasciola* spp. and hydatid cyst was highest in Autumn at ($P \leq 0.05$). The predilection site of *Cysticercus bovis* was significantly highest in the heart of cattle and buffaloes 75%, 100% respectively ($P \leq 0.05$). *Hydatid cyst* mainly present in lung and liver of cattle and buffalo 6% and 2% respectively. While *Sarcocystis* spp. sarcocyst in buffaloes were significantly highest in esophagus 50%. It can be concluded that parasitic infection among beef production livestock has its hazardous zoonotic significance causing serious economic losses.

Keywords: Fasciola, Hydatid, Cysticercus, Sarcocystis, Cattle, Buffalo.

INTRODUCTION

Food animals have been used in Egypt as the main source of both milk and meat (**Borai et al., 2013**). 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 reduces the meat, wool and milk production (**Hassanin et al., 2013**).

There are so many important zoonotic parasitic diseases such as Fascioliasis, *Cysticercosis bovis*, Sarcocystosis and hydatidosis, etc (**Schwabe, 1984**). Fascioliasis cause great economic losses to the livestock industries due to actual liver condemnation at slaughter, and the disease is affecting the general immune status of the animal (**Soliman, 2008**).

Cysticerci cause important economic losses due to condemnation of meat (**Cabaret et al., 2002**), and there are several recent studies were done in Egypt (**Adel Aziz et al., 2019**). the Sarcocystis species are obligatory intracellular parasites (**Dubey et al., 1989**). *Sarcocystis spp.* are a zoonotic parasitic protozoa of cattle worldwide (**Fayer, 2004**), through ingestion of raw or undercooked beef and pork containing viable sarcocystis of *S. hominis* and *S. suis*, respectively, resulted mostly asymptomatic human intestinal Sarcocystosis (**Dyab et al., 2003**).

Hydatidosis is one of the major parasitic problems of domestic animals and zoonotic diseases that cause considerable economic losses and public health problems worldwide (**Eckert and Deplazes, 2004**), (**Abdel-Aziz, and El-Meghanawy, 2016**), they act like tumors that can disrupt the function of the organ where they are found, cause poor growth, reduced production of milk and meat, and rejection of organs at meat inspection (**Dyab et al., 2017a**). Therefore the present investigation, conducted to Study the infection rate of parasitic affection among slaughtered bovine in El-Minia

Governorate, in relation to age, seasonal variations and affected organs.

MATERIALS AND METHODS

Sample collection

Samples were collected from slaughterhouses in El-Minia Governorate (Egypt) at routine postmortem exam, during the period from June 2017 to May 2018, of 170 slaughtered animals (120 cattle and 50 buffaloes), muscle, liver, lung samples were preserved in 10% formalin transferred to laboratory of meat hygiene and parasitology department for further investigations for macroscopic and microscopic examination and stored at -20C° till use.

Identification of parasitic infestation

Hydatid cysts from lung, and liver were examined after removal from its adjacent tissues carefully for Shape which was described by the naked eye (**Hassanin et al., 2013**) (**Abdel-Aziz, and El-Meghanawy, 2016**). For detection of *Cysticercus bovis*, examination of the surface and substance of the tongue, heart and skeletal muscles, then 3- incisions through examined organs for presence of cysticercus (**Hassanin et al., 2013**). The viable cysticerci were carefully removed from the connective tissue capsule, compressed between two glass slides and examined (**Gracey et al., 1999**). Detection of Sarcocyst by small pieces of fresh muscle were prepared by muscle squash method and examined microscopically for detection sarcocysts (**Abdel-Hafeez et al., 2015**), (**Abdel Aziz, et al., 2017**).

Statistical analysis

The obtained data were subjected to analysis of variance (ANOVA). Duncan's multiple range test was used to determine differences among means and difference was considered 95% significant at (P value ≤ 0.05). (**Fleiss, 1981**).

RESULTS

Results of the present cross-sectional prospective study in (table 1, and figure 1-7) revealed that, the overall prevalence of parasitic infestation of tissue parasites at local abattoir of El Minia governorate was 35% in examined cattle carcass, and 52% in buffaloes carcass, and there are several parasites were obtained such as; *Fasciola spp.*, with the highest incidence 30% in buffaloes and 23.3 % in cattle carcass then the infestation with *Cysticercus bovis* with incidence of 6% and 6.6% in buffaloes and cattle respectively, then *Sarcocystis spp.*, it was 12% in examined buffaloes but it was absent in cattle carcass, the lowest incidence value was Hydatid cyst with 4 % in buffaloes and 5% in cattle. at 95 % significance at (P. value of 0.009), and confidence interval (C.I. at 0.012-0.002), and belongs to the localisation of parasites in different examined tissues, it was found that; *Fasciola spp* is mainly in liver and nothing else; *Cysticercus bovis* was mostly concentrated in cardiac muscle with an incidence of 66.6% in buffaloes, and 62.5% in cattle; and *hydatid cyst* was mostly in liver with an incidence of 66.6 % in cattle and 100 % in buffaloes; for *Sarcocystis spp.*, it was absent in cattle, but in buffaloes, it was highly concentrated in cardiac muscle, at 95 %

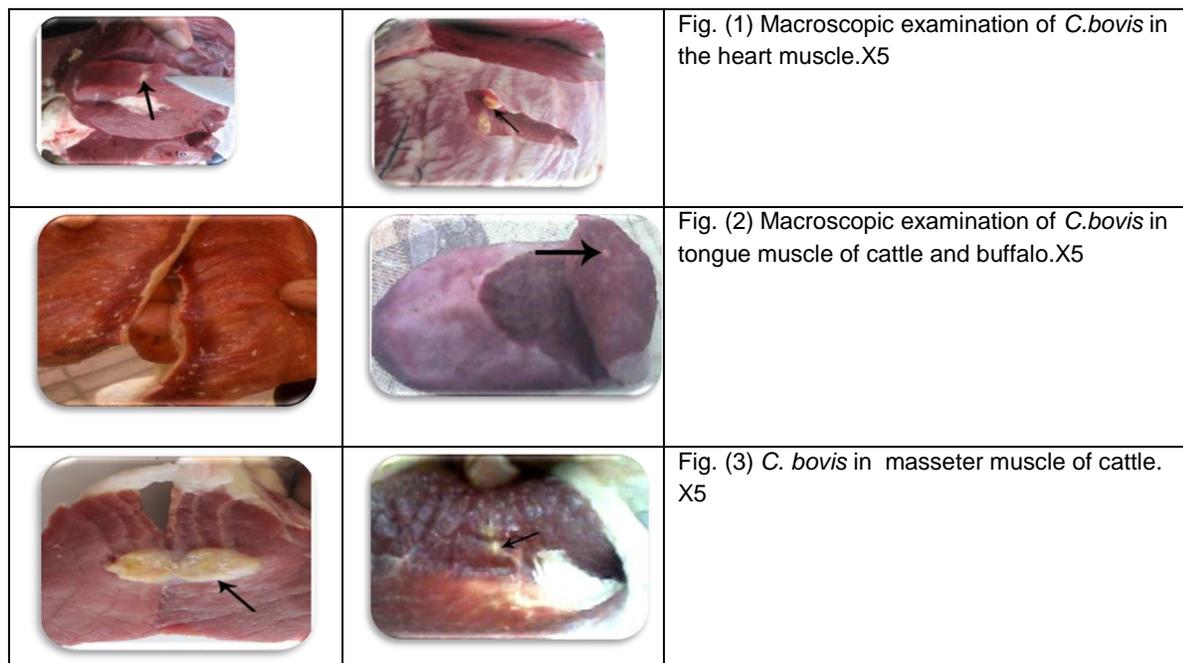
significance at (P. value of 0.032), and confidence interval (C.I. at 0.038-0.017). For age groups in relation to parasitic infestation, it was found that younger animals was highly infested than old animals in all recovered parasites species in both cattle, and buffaloes except hydatid cyst; as follow; For *Fasciola spp.*, it was significantly higher in older animals than young as 45% in buffaloes and 50% cattle; *Cysticercus bovis*, it was significantly higher in young animals than older as 33.3% in buffaloes and 15% cattle, for *Sarcocystis spp.*, was significant higher in young animals than older as 33.3% in buffaloes, for hydatid cyst; it was significantly higher in old animals than older as 10% in buffaloes and cattle at 95 % significance at (P. value of 0.016), and confidence interval (C.I. at 0.049-0.011). Finally for seasonal distribution of the recovered parasites, the highest incidence for *Fasciola spp* was in Spring 30% for buffaloes, and Autumn 40% for cattle, but for *Cysticercus bovis*; Summer was the highest incidence 16.6% in buffaloes and 13.3% in cattle, also for hydatid cyst, the highest incidence was in Autumn 15.3% for buffaloes, and 12% for cattle, for *Sarcocystis spp.*, only it was found in buffaloes and highest incidence was in Autumn 15.3% at 95 % significance at (P. value of 0.023), and confidence interval (C.I. at 0.037-0.091).

Table 1. Prevalence and incidence of different tissue parasites of cattle and buffaloes slaughtered at EL Minia governorate.

Parameters			Total examined cattle carcasses (120)		Total examined buffalo carcasses (50)		S.E	(P. value ≤0.05)	C.I. (95 % significance)
			No. inf.	%	No. inf.	%			
Parasites	<i>Fasciola spp.</i>		28	23.3	15	30	0.034	0.009*	0.012-0.002
	<i>C. bovis</i>		8	6.6	3	6			
	<i>Sarcocyst</i>		0	0	6	12			
	<i>Hydatid cyst</i>		6	5	2	4			
	<i>Total</i>		42	35	26	52			
<i>Fasciola spp.</i>	<i>C. bovis</i>	Liver	28	23.3	15/15	100	0.034	0.032*	0.038-0.017
		Cardiac	5/8	62.5	2/3	66.6			
		Tongue	1/8	12.5	0	0			
		Masseter	1/8	12.5	1/3	33.3			
		Shoulder	1/8	12.5	0	0			
		Esophagus	0	0	0	0			

Organ	<i>Hydatid cyst</i>	Lungs	2/6	33.3	0	0	0.056	0.016*	0.049-0.011
		Liver	4/6	66.6	2/2	100			
	<i>Sarcocyst spp</i>	Heart	0	0	2/6	33.3			
		Tongue	0	0	1/6	16.7			
		Masseter	0	0	0	0			
		Shoulder	0	0	0	0			
		Esophagus	0	0	3/6	50			
Age	<i>Fasciola spp.</i>	Young < 2 y.	8/80	10	6/30	20	0.002	0.023*	0.037-0.091
		Old > 2 y.	20/40	50	9/20	45			
	<i>C. bovis</i>	Young < 2 y.	6/80	15	1/30	33.3			
		Old > 2 y.	2/40	2.5	2/20	10			
	<i>Hydatid cyst</i>	Young < 2 y.	2/80	2.5	0/30	0			
		Old > 2 y.	4/40	10	2/20	10			
	<i>Sarcocyst spp</i>	Young < 2 y.	0/80	0	1/30	33.3			
		Old > 2 y.	0/40	0	5/20	25			
Season	<i>Fasciola spp.</i>	Summer	0/30	10	1/12	8	0.002	0.023*	0.037-0.091
		Autumn	10/25	40	8/13	61.5			
		Winter	7/35	20	3/15	20			
		Spring	8/30	26.6	3/10	30			
	<i>C. bovis</i>	Summer	4/30	13.3	2/12	16.6			
		Autumn	1/25	4	0/13	0			
		Winter	1/35	2.8	0/15	0			
		Spring	2/30	6.6	1/10	10			
	<i>Hydatid cyst</i>	Summer	1/30	3.33	0/12	0			
		Autumn	3/25	12	2/13	15.3			
		Winter	2/35	5.7	0/15	0			
		Spring	0/30	0	0/10	0			
	<i>Sarcocyst spp</i>	Summer	0/30	0	1/12	8.3			
		Autumn	0/25	0	2/13	15.3			
		Winter	0/35	0	1/15	6.6			
		Spring	0/30	0	2/10	20			

*significant at 95% confidence level (p value ≤0.05), S.E.: standard error; C.I.: confidence interval



	<p>Fig. (4) Microscopic examination of <i>C. bovis</i> dissected from muscle tissues and stained with acetic acid alum carmine stain X10.</p>	
		<p>Fig. (5) Macroscopic examination of <i>Fasciola sp.</i> in the liver of cattle. X5.</p>
		<p>Fig. (6) Macroscopic examination of <i>Sarcocystis sp.</i> in Oesophagus x20 (left) heart (right) , of buffaloes 5x.</p>
		<p>Fig. (7)-Macroscopic examination of Hydatid cyst in the liver of buffaloes X5 (left), in lungs (right).</p>

Fig. (1-7). Different gross infestation of tissue parasites.

DISCUSSION

Gracey et al. (1999) has stated that; in developing countries like Egypt, abattoirs play a major role in providing and serving as a source of information and reference center for diseases prevalence, and there are a little study and scarce data about the parasitic infestation of public health significance in El Minia governorate especially from slaughterhouses, and so; the main aim of this study was to evaluate the incidence and occurrence status of these parasites in this governorate, and there are several previous studies in different governorate in Egypt was conducted that is in accordance with this study; such as El-Shazly et al. (2005) in Dakahlia Governorate, Egypt, with an overall prevalence of *Fasciola spp.*, of 12.31% which was lower than results of present study (23.3%), in Bangladesh; Hazzaz et al. (2010) revealed

that, the prevalence of *Fasciola spp.* 27.26 % of examined cattle, and also in Iran, Ahmadi and Meshkehkar (2009) showed a higher incidence rate than the present study, and this may be due to the low awareness of farmers with prevention and control methods of these parasites, and the bad habits of animals defecation in water canals, and irrigation of plants and roughages that ingested by animals by infected water contaminated with the encysted metacercaria, in the present study we reported that fascioliasis incriminated in 23-30% in total liver condemnation in cattle and buffaloes at abattoirs of El Minia governorate, this statements was in agreement with Maqbool et al. (2002) in Pakistan, who reported 25.6% of slaughtered cattle infected with *Fasciola spp.*, but it was higher that results of Hazzaz et al. (2010) in Bangladesh who recorded that the prevalence in buffaloes was 10%, furthermore, this difference

might be attributed to the favorable ecological factors for the intermediate hosts and there by the parasite (**Chanie and Begashaw, 2012**).

According to this study, the infection with bovine fascioliasis was higher among aged slaughtered cattle and buffaloes above 2 years than those below 2 years. Statistical analysis for incidence rate of *Fasciola spp.* with **Hazzaz et al. (2010)** found that the prevalence of fascioliasis in cattle was higher in aged (30.37%) than young (21.71%). While **Kuchai et al. (2011)** noticed that a higher infection rate was recorded in young cattle ages (0- 2 years) (40.02%) than in adult ones (28.04%) (3- 8 years). In relation to seasonal variation, the highest prevalence rate of *Fasciola spp.* in cattle was found during autumn which begin to decline in spring, winter to be the lowest during summer. Also in buffaloes the highest prevalence rate of *Fasciola spp.* were found during autumn which begin to decline in spring, winter to be the lowest during summer. This results agree with **Maqbool et al. (2002)** who reported that the highest overall prevalence was recorded during autumn (47.26%) followed by spring (29.1%) and winter (20.8%). **Pfukenyi and Mukaratirwa (2004)** found that the pattern of distribution of *Fascioliasis* was significantly higher in cattle originating from areas of high rainfall than in those of relatively low rainfall, and in those slaughtered during the wet season than those slaughtered during the dry season.

In this study the occurrence of *Cysticercus bovis* reported in cattle was agree with these reported by **Elkhtam et al. (2016)** in Menofia Governorate (Egypt), who recorded 6.09%. While the finding was higher than mentioned by **Hassanin et al. (2013)** in Qalubia Governorate reported 4.23%. The obtained results are lower than those reported by **Abdel-Hafeez et al. (2015)** in El-Minia (Egypt), who found that 20%. The occurrence of *Cysticercus bovis* reported among 50 buffaloes was 6%, this results lower than those reported by **Fahmy et al. (2015)** in Kalioubia (Egypt), who found that 9.07%. While it was higher than those reported

Ali (2013) in Upper Egypt, who revealed that 0.58% of examined buffaloes. In relation to age, the infection with *cysticercus bovis* was higher among young animal below 2 years. These results was not agree with that reported by **Hassanin et al. (2013)** in Benha (Egypt), who found that the old animals (8.12%) were more infested than young (2.25%), age correlation may be due to cumulative exposure of animals less 2 years to the different sources of infection. **Basem et al. (2009)**. Concerning seasonal dynamics of *Cysticercus bovis* recorded among slaughtered cattle, the highest prevalence were found during Summer which began to decline in Spring and Autumn to be the lowest during Winter, in buffaloes, the highest prevalence in Summer followed by Spring (10%), no infection detected in Autumn and Winter, this result agree with **Fahmi (2014)** who found that the highest infection rate (19.84%) was in summer, while the lowest rate (10.21%) was found in winter. While **Abu-Elwafa and Al-Araby (2008)** in Dakahlia (Egypt), who reported that the highest prevalence in winter (21.7%), followed by spring (18.4%) and summer (15.65%) to be the lowest during autumn season (12.45%). *Cysticercus bovis* predilection seats were mostly in cardiac muscles of cattle and buffaloes, followed by masseter muscle and tongue, this result agree with **Basem et al. (2009)** in Assiut (Egypt), who reported that predilection seats in cattle were heart (1.4%), tongue (0.4%) and gluteal muscle (0.2%) while in buffaloes, the heart was the predilection seat with a percentage of 0.4%. While **Rabi and Jegede (2010)** in Nigeria, who reported that cysts were found in the tongue, diaphragm, heart, masseter and liver in a percentage of 13%, 7.6%, 7.3%, 4.1% and 0.3%, respectively. The variation in the predilection seats may be attributed to the different management practices of the animals in such areas like using the cattle and buffaloes in the daily agricultural activities which in turn influence the distribution of the cysticercus. It is important that whatever the priority of the predilection seats we should examine the carcasses in details and not depends only on the

inspection of the heart, tongue and the masseters (**Basem et al., 2009**)

In this study the occurrence of hydatid cyst was low in both cattle and buffaloes, this was agreed with **Omer et al. (2010)** in Sudan and **Salem et al. (2011)** in Mauritania. While the obtained results higher than **Toulah et al. (2012)** in Saudi Arabia, who determined 3.63% and **Fahmi (2014)** in Cairo (Egypt), who showed 0.67% . These results were lower than that obtained by **Dawit et al. (2013)** in Ethiopia, who recorded (28.09%). In the present study, for buffaloes, the obtained results agree with **Pednekar et al. (2009)** in India, who studied the prevalence 3.81%, while such results was lower than that mentioned by **Beyhan and Umur (2011)** in Turkey, found that (10.24%). Incidence was much higher significantly in adult cattle and buffaloes above 2 years than younger animals. This was agreed with **Kabir et al. (2010)** in Bangladesh and **Ismail et al. (2016)** in Sudan. While **Yimer et al. (2016)** in Ethiopia mentioned that there was no significant association between hydatidosis infection and age of the animals. The highest seasonal incidence rate of hydatid cyst in cattle and buffaloes was noted in Autumn season, the recorded results agree with **Kadir and Rasheed (2008)** who found that hydatid cyst in cattle were highest in autumn (8.33%). While **Berhe (2009)** recorded that the monthly prevalence of hydatidosis was highest (36.44%) in July and lowest (25.11%) in April. The distribution of hydatid cyst was restricted in liver and lungs only in cattle and buffaloes, as mentioned by **Fahmi (2014)** in Cairo (Egypt), and **Ibrahim et al. (2011)**. **Beyhan and Umur (2011)** reported that the prevalence rate was 29.4% in liver, 47.06% in lungs and 23.53% in both liver and lungs. **Ismail et al. (2016)** reported that the lung was the most affected organ (84.6%), followed by the liver (15.4%). Variation in infection rates with this larval stage may be attributed to the endemic infection of stray dogs by adult cestodes which infect the pasture area leads to infection of animals during grazing process. The occurrence of *Sarcocystis* spp. sarcocyst reported in buffaloes was 12%

and not recorded in cattle, this result agree with **Latif et al. (1999)** in Iraq, who found that *Sarcocyst* among slaughtered buffaloes was 15.6% and 0.2% in cattle. While the recorded results lower than that obtained by **EI-Dakhly et al. (2011)** in Beni-suef (Egypt), who recorded 78.9% in buffaloes, **Metwally et al. (2014)** in Assiut, who found 27,7% in buffaloes, and with (**Abdel Aziz, et al., 2017**), who detect the incidence rate of *Sarcocystis* spp. from Egyptian Water Buffaloes (*Bubalus bubalis*) in Sohag governorate, Egypt, and they found that; *S. buffalonis* 33.8%, *S. levinei* 14.48% and *S. fusiformis* 0.41% were recognized by microscopic examination and confirmed by indirect immunofluorescence antibody technique (IFAT). Results showed that 26.9% examined samples were positive by routine abattoir examination while 52.4% examined samples were positive by microscopic examination, on the other hand; 64.8% samples were positive by IFAT. In the present study the infection rate is much higher in adult buffaloes than young animal, the obtained results agree with **Houng (1999)** in Vietnam, **EI-Dakhly et al. (2011)** in Beni-Suef (Egypt). **Atif (2012)** in Qena (Egypt). Concerning seasonal dynamics of *Sarcocyst* recorded among buffaloes, the significant highest incidence was found during spring followed by Autumn and the lowest during Summer and Winter . While **Atif (2012)** in Qena (Egypt), who recorded that no significant difference between incidences of infestation all over the years, approximately all seasons equal in the incidence of infection with *Sarcocystis* cysts in buffaloes. The distribution of *Sarcocyst* in different organs of the examined buffaloes, were highest in esophagus then heart and the lowest in tongue, as shown by **Houng (1999)** in Vietnam, **EI-Dakhly et al. (2011)** Beni-Suef (Egypt). While **Oryan et al. (2010)** detected that the highest prevalence rate of microscopic cysts was found in masseter muscle (57.1%) followed by tongue, diaphragm, esophagus, heart, and finally, thigh muscles (30.0%).

CONCLUSION

Moreover, the present work illustrated the different fauna of parasitic infestation in slaughtered cattle and buffaloes in El-Minia Governorate (Egypt), which may be of utmost benefit to future researchers in El-Minia, who are interested in the prevalence of particular parasite which may be more prevalent in one district than the other.

ACKNOWLEDGEMENT

The financial support of this work is from the grant office, Faculty of Medicine, Assiut University, Assiut, Egypt.

CONFLICT OF INTEREST

All the authors have declared that no conflict of interest exists.

REFERENCES

- Amer Ragheb Adel Aziz, Amal A. Hassan, Ehab Kotb, Reda E. Khalafalla, Abdulaziz M. Almuzaini**, 2019. Molecular phylogenetic analysis of *Cysticercus ovis* from Egypt based on *MT-COI* gene sequences. *Braz. J. Vet. Parasitol., Jaboticabal*, 28, (2) 258- 265.
- Doi: <https://doi.org/10.1590/S1984-29612019028>
- Abdel-Aziz, A.R., El-Meghanawy, R.A.**, 2016. Molecular characterization of Hydatid Cyst from Egyptian one humped Camels (*Camelus dromedaries*). *PSM Vet. Res.*, 01(1): 13-16.
- Abdel Aziz, A.R., Ali, F.A.Z., Salman, D.**, 2017. Microscopic and IFAT Based Incidence of Sarcocystis in Naturally Infected Buffaloes (*Bubalus bubalis*) at Sohag, Egypt. *PSM Vet. Res.*, 2(2): 22-28.
- Abdel-Hafeez EH, Kamal AM, Abdelgelil NH et al.**, 2015. Parasites transmitted to human by ingestion of different types of meat, El-Minia City, El-Minia Governorate, Egypt. *Journal of the Egyptian Society of Parasitology*, 240(2496): 1-10.
- Abu-Elwafa SA, Al-Araby MA.**, 2008. Prevalence of tissue parasites among slaughtered animals in Dakahlia province, Mansoura. *Med. Vet. J.* 10(1):79–91.
- Ahmadi NA, Meshkehkar M.**, 2009. Prevalence and long term trend of liver fluke infections in sheep, goats and cattle slaughtered in Khuzestan, Southwestern Iran. *J. Paramed. Sci.* 1: 26-31.
- Atif A., A.**, 2012. Prevalence of some parasitic infestation in tissues of animals slaughtered in Qena abattoirs, Egypt. Ph.D. Thesis Department of Food Hygiene. Faculty of Veterinary Medicine. Assiut University.
- Basem RN, Sayed AS, Hussein A.A. et al.**, 2009. Occurrence of cysticercosis in cattle and buffaloes and *Taenia saginata* in man in Assiut Governorate of Egypt. *Veterinary World.* 2, (5), 173–176.
- Beyhan YE, Umur S.**, 2011. Molecular characterization and prevalence of cystic echinococcosis in slaughtered water buffaloes in Turkey. *Veterinary Parasitology.* 181, 174–79.
- Berhe G.**, 2009. Abattoir survey on cattle hydatidosis in Tigray Region of Ethiopia. *Trop Anim Health Prod.* 41, 1347-52.
- Borai MGE, Nagi AA, Gab-Allah MS et al.**, 2013. Comparative pathological studies on parasitic affections of liver in farm animals. *Benha Veterinary Medical Journal*, Vol. 25, (2):284-295.
- Cabaret J., Geerts S., Madeline M. et al.**, 2002. The use of urban sewage sludge on pastures: the cysticercosis threat. *Vet. Res.*, 33(5), 575-597.
- Chanie M., Begashaw S.**, 2012. Assessment of the economic impact and prevalence of ovine fasciolosis in Menz Lalo Midir

District, Northeast Ethiopia. *Vet. World*, 5(5): 261-264

- Dawit G, Adem A, Simenew K. et al., 2013.** Prevalence, cyst characterization and economic importance of bovine hydatidosis in Mekelle municipality abattoir, Northern Ethiopia. *Journal of Veterinary Medicine and Animal Health*, 5(3): 87-93.
- Dubey JP, Speer CA, Charleston WAG et al., 1989.** Ultrastructural differentiation between sarcocysts of *Sarcocystis hirsuta* and *Sarcocystis hominis*. *Veterinary Parasitology*, 34(1-2): 153-157.
- Dyab K., Arafa M., Elsalahy M., et al., 2003.** Studies on ocular sarcocystis in Buffales in Assuit governorate. *Assuit Unive. Environ. Res.* 6: (1).27-36.
- Dyab K, Mohammed E., Ragaa A. et al., 2017.** *Taenia saginata* in man and cysticercosis in cattle and buffaloes in Aswan governorate, EGYPT. *J. Egypt. Soc. Parasitol.* 47(2): 389 – 394.
- Eckert J., Deplazes P., 2004.** Biological, epidemiological, and clinical aspects of echinococcosis, a zoonosis of increasing concern. *Clinical Microbiology Reviews*, 17(1):107-135.
- EI-Dakhly K. M., EI-Nesr K.A., EI-Nahass E. et al., 2011.** Prevalence and distribution patterns of *Sarcocystis spp.* in buffaloes in Beni-Suef, Egypt. *Trop Anim Health Prod.*43: 1549-1554.
- Elkhtam A.O., Mostafa I.A., Shawish R.R., 2016.** Prevalence and economic impact of *Cysticercus bovis* in slaughtered cattle in Menofia Province, Egypt. *Alexandria Journal for Veterinary Sciences*, 50(1): 130-134.
- EI-Shazly A.M., Abdel-Magied A.A., EI-Nahas H.A. et al., 2005.** On the main reservoir host of fasciola in Dakahlia Governorate, Egypt. *Journal of the Egyptian Society of Parasitology* 35: 243–252.
- Fahmi S.A., 2014.** Studies on larval cestodes infecting sheep and cattle." M.V.Sc. Thesis presented to Cairo University, Faculty of Vet. Medicine, Department of Parasitology.
- Fahmy H.A., Khalifa N.O., EL-Madawy R. S., et al. 2015.** Prevalence of bovine cysticercosis and *Taenia saginata* in man. *Global Veterinaria* 15: 372-80.
- Fayer R., 2004.** *Sarcocystis spp.* in human infections. *Clinical Microbiology Reviews*, 17(4): 894-902.
- Fleiss, J.L., 1981.** The Measurement of Interrater Agreement, *Statistical Methods for Rates and Proportions*, Second edition. John Wiley & Sons, Inc, New York, pp. 212-304.
- Gracey J.F., Collins D.S., Hiley R.J., 1999.** Meat Hygiene. 10th edition. Publisher. W.B. Saunders Co. Ltd / Harcourt Brace and Co. Ltd. London, U.K. Pp 667-680.
- Hassanin F.S., Shaltout F.A., Afifi M.E., 2013.** Parasitic affections in edible offal. Food Control Department, Faculty of Veterinary Med. Moshtohor, Benha University, Egypt.
- Hazzaz B.K., Mohammad E., Abul-Hashem M. et al., 2010.** Prevalence of zoonotic parasitic diseases of domestic animals in different abattoir of Comilla and Brahman Baria region in Bangladesh. *Univ. j. zool. Rajshahi. Univ.* (28): 21-25.
- Huong L.T., 1999.** Prevalence of *Sarcocystis spp.* in water buffaloes in Vietnam, *Veterinary Parasitology*, 86, 33–39.
- Ibrahim K., Thomas R., Peter K. et al., 2011.** A molecular survey on cystic echinococcosis in Sinnar area, Blue Nile state (Sudan). *Chin. Med. J.* 124: 2829-2833.
- Ismail N.B.O., Elfadil A.A.M., Ahmed E.G.M., 2016.** Epidemiological study on bovine hydatidosis in North Kordofan state, Sudan. *International Journal of Veterinary Science*, 5(2), 74-78.
- Kabir M., Eliyas M., Hashem M. et al., 2010.** Prevalence of zoonotic parasitic diseases of domestic animals in different abattoir of Comilla and Brahman Baria region in

- Bangladesh. Univ. J. Zool. Rajshahi Univ. 28: 21-25.
- Kadir M.A., Rasheed S.A., 2008.** Prevalence of some parasitic helminthes among slaughtered ruminants in Kirkuk, Iraq. *Iraqi J. Vet. Sci.* 22(2):81-85.
- Kuchai J. A., Chishti M. Z., Zaki M.M. et al., 2011.** Some epidemiological aspects of fascioliasis among cattle of Ladakh. *Global Vet*, 7(4):342-346.
- Latif BMA, Al-Delemi JK, Mohammed BS et al., 1999.** Prevalence of *Sarcocystis spp.* in meat-producing animals in Iraq. *Vet Parasitol.* 84:85-90.
- Maqbool A., Hayat C.S., Akhtar et al., 2002.** Epidemiology of fasciolosis in buffaloes under different managerial conditions. *Veterinarski arhiv*, 72 (4): 221-228.
- Metwalley AM, Abd Ellah MR, Al-Hosary AA et al., 2013.** Microscopical and serological studies on *Sarcocystis* infection with first report of *S. cruzi* (*Bubalus bubalis*) in Assiut, Egypt. *J Parasit Dis.* 38(4):378-382.
- Omer R.A., Dinkel A., Romig T et al., 2010.** A molecular survey of cystic echinococcosis in Sudan. *Vet. Parasitol.* 169: 340-346.
- Oryan A., Ahmadi N., Mostafa S. et al., 2010.** Prevalence, biology and distribution pattern of *Sarcocystis* infection in water buffalo (*Bubalus bubalis*) in Iran, *Tropical Animal and Health Production*, 42, 1513-1518.
- Pednekar R.P., Gatne M.L., Thompson R.A. et al., 2009.** Molecular and morphological characterisation of *Echinococcus* from food producing animals in India. *Veterinary Parasitology*, 165(1-2): 58-65.
- Pfukenyi D.M., Mukaratirwa S., 2004.** A retrospective study of the prevalence, seasonal variation of *Fasciola gigantica* in cattle slaughtered in the major abattoirs of Zimbabwe between 1990 and 1999. *J. Vet. Res.* 71:181-187.
- Rabi B., Jegede O., 2010.** Incidence of bovine cysticercosis in Kano state, northwestern, Nigeria. *Bayero Journal of Pure and Applied Sciences*, 3(1): 100-103.
- Salem C.O., Schneegans F., Chollet J. et al., 2011.** Epidemiological studies on echinococcosis and characterization of human and livestock hydatid cysts in Mauritania. *Iran. J. Parasitol.* 6: 49-57.
- Schwabe C.W., 1984.** *Veterinary Medicine and Human Health*, 3rd edition., Williams and Wilkins, Baltimore, pp. 472-85.
- Soliman F. M., 2008.** Epidemiological review of human and animal fascioliasis in Egypt. *J Infect Developing Countries* 2 (3):182-189.
- Toulah F., El Shafei A., Alsolami M. 2012.** Prevalence of hydatidosis among slaughtered animals in Jeddah, Kingdom of Saudi Arabia. *J. Egypt. Soc. Parasitol.*2012; 42: 563-572.
- Yimer A., Ayen M., Ali, M. et al., 2016.** Prevalence, cyst characterization and economic importance of bovine hydatidosis in Addis Ababa Abattoirs Enterprise, Ethiopia. *Journal of Animal Research*, 6(3): 375-379.