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The prevalence of parasitic infections among slaughtered animals in mechanical abattoir

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Abstract

Gastrointestinal parasites, such as helminths and protozoa, are abundant parasitic agents of livestock, particularly ruminants. The current study aims to determine the prevalence rate of parasitic infections in large ruminate animals slaughtered in the mechanical abattoir in Alexandria governorate, Egypt. The prevalence was identified through the records of parasitic infections detected in the fecal matter of large ruminate animals in addition to the recorded postmortem examination findings. Three hundred sixty-four slaughtered large ruminant animals were selected, labeled, and subjected to fecal sampling and postmortem examination. Each fecal sample was tested by three different techniques; the formalin-ether concentration, Ziehl-Neelsen hot-stained, and saturated saline flotation to diagnose all parasite types. One hundred thirty positive cases (35.71%) were determined during the fecal sample examination, and 76 cases (20.87%) were found in postmortem examination. Formalin-ether processing of fecal samples yielded the highest number of pathogens; *Entamoeba* species were detected in 98 fecal samples (26.69%), and *Fasciola* species eggs were detected in 14 samples (3.84%). The postmortem examination revealed *Fasciola hepatica* and *F. gigantica* in 13 animals (3.57%), mixed lung and liver hydatid cysts in 32 animals (8.79%), whereas liver hydatid cysts only were identified in 15 animals (4.12%). Finally, Sarcocystosis infection was detected in 3.57%. In conclusion, the parasitic infections of large ruminant animals are a leading cause of pathogenicity in large animals, leading to economic losses. Prevention and control measures must be implemented by mechanical abattoirs according to the hazard analysis critical control point system.

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Introduction

Gastrointestinal parasites, including helminths and protozoa as coccidian protozoan parasites, are adversely affect the health, vigor, reproduction and performance of livestock with no reciprocal benefit (1). Also, it's a common hazard to large ruminant animals, which may decrease meat and milk production in developing countries (2). These parasites present an alarming risk to public and environmental health due to the zoonotic impact on the public associated with an increased case fatality in both humans and animals (3). Numerous indirect as using fluorescence - lectin kit technique in the diagnosis of nematodes eggs because they are distinguished by their speed, efficiency and accuracy and direct laboratory techniques, along with the animal's geographic location, clinical history, and symptoms, are the cornerstone for parasitic infection diagnosis in livestock (4,5).

The parasitic infections detected on postmortem inspection in abattoirs lead to partial or total condemnation of the infected carcasses. Meat producers are responsible for notifying health and welfare officials of their farm strategy utilizing the HACCP system and International Organization for Standardization ISO 2200 to reduce production losses throughout their portion of the supply chain (6). Inspection is a vital service for producers as it provides them with the necessary information to develop and implement their animal health plan for reducing and controlling parasitic infections (7).

The prevalence of parasite postmortem in the mechanical abattoirs of Egypt was reported briefly by Mohammed in 2020, aiming to estimate the parasitic infection in Alexandria and Northern and Southern areas in Egypt, including Qena and Aswan abattoirs. This study found that the percentage of parasitic cysts in Alexandria abattoir is 0.31%, while in Aswan abattoir, the percentage was 2.23%. In Alexandria abattoir, the Fasciola infection percentage was 0.29% versus 14.50% in Aswan abattoir and 0.54% in Qena abattoir (8). In Ismailia, a city in the middle of Egypt, the total prevalence of parasitic infection is 9.35% among slaughtered cattle and buffalos in the municipal abattoir. The inspection of cattle carcasses revealed that the prevalence of *C. bovis* and hydatid cyst is 0.58% and 0.49%, respectively. Meanwhile, the prevalence of *C. bovis* in buffaloes' carcasses was 0.18% and 1.50% for hydatid cysts. 20.34% of the examined buffaloes' carcasses have been infected with *Sarcocystis macro* cysts, Fascioliasis in the liver with a prevalence of 3.23%, which is relatively higher than cattle (1.46%) which are more difficult to develop observed clinical signs in cattle. Moreover, it was found that the rumen of 168 buffalos was harboring *Paramphistomum* spp (9,10).

In other countries than Egypt, the postmortem prevalence of parasites was reported in previous studies by Tembo *et al.* 2015. For instance, in Tanzania abattoirs, hydatid cyst prevalence was reported to be 10.5%; however, there was a high incidence of Fasciola 30% (11). In Iran abattoirs, Pezeshki reported that; the prevalence of *E. granulosus* parasite's larva stage or hydatidosis disease which is a remarkable silent zoonotic helminthic malady infection in intermediate hosts warm-blooded vertebrates as cattle and sheep which is 2.25% and 2.48%, respectively and what is worth to mention the definitive host includes carnivores such as the canidae and felidae families such as dogs, foxes and hyenas, according to a survey created for the period 2015 - 2018, (12,13) The overall prevalence in Pakistan during the period 2000 - 2020 is 18.1%, with the highest infection in sheep 53.5%, followed by goats 44.9%, cows 21.3%, buffaloes 16.8%, and cattle 12.7% (14,15). In slaughtered sheep and goats in Amol abattoir, Mazandaran, northern Iran, the prevalence rate of *Fasciola* spp was 6.6% (16,17). The infection rates of the Fasciola parasite in sheep in Jeddah, Saudi Arabia, is higher among the imported sheep 1.19% than local slaughtered sheep 0.27% in the period 2019-2020 (18,19).

In Egypt, the premortem prevalence of parasitic infection in Sharkia Governorate as the Delta area in Egypt was examined by Fawzi *et al.* who reported that the overall prevalence of gastrointestinal parasites in cattle is 18.6%, with *Trichostrongylus* spp. 41.9% being the most frequently observed parasite, followed by Strongyloides spp. 35.2%, and *Cooperia* spp. 8.7% is the less frequent type of parasite (20). In Dir Lower- Pakistan, the premortem prevalence of parasitic infection among a total of 40 farms of large ruminant animals is higher in buffaloes 63.55% (75/118) than cows 55.61% (109/196) (21). The current study was designed to screen the frequency of parasitic infections among large ruminant animals by examining their fecal matter using three different techniques and performing a postmortem examination of the butchered animals which tested positive for parasitic infections at the mechanical abattoir in Alexandria, Egypt.

Materials and methods

Study setting

The present study was conducted at the mechanical abattoir for meat in Abd-El Kader Area -El-Ameria District- Alexandria Governorate (31.2°N, 29.91667°E) from June to October 2021.

Study design and target animals

This cross-sectional study evaluated 364 slaughtered large ruminants, including cattle and buffaloes. The animals included 64 females aged over 6 years and 300 males aged over 2 years or weighted greater than 400 Kg, according to the regulation of the Agriculture Minister of Egypt published in 1986 and updated in 2018.

Ethical consideration

The present research was reviewed and ratified by the High Institute of Public Health (HIPH) (References Number: 409, Date: 11/12/2017).

Sample size calculation

Approximately 2000 large animals are delivered monthly to the mechanical abattoir in Abd-El-Kader area. Previous investigations to detect parasitic infections were completed in the municipal abattoir at Ismailia governorate, which reported that the total prevalence of parasitic infections was 9.35% (9) with a precision of 5 and α of 5%, we determined that 364 fecal samples are required to complete the present study accurately.

Data collection

Data including sex, species, sources, origin, water source, and nutrition of examined animals were collected by a survey on the included animals and fed into data analysis.

Animal labels

All animals in the present study were labeled with a plastic serial number in their ear. The exact number was labeled in the plastic cubs used to collect the fecal samples.

Postmortem examination was selectively performed on the animals that tested positive for parasites. Then, the results of fecal matter and postmortem examinations were compared.

Fecal matter examination

Before being slaughtered, the fecal specimens were obtained from the rectum of large ruminant animals, collected into labeled hygienic laboratory cubs with permanent marking pens, and sent for examination at the parasitology laboratory of HIPH, Alexandria University. The fecal specimens were divided into 3 equal parts to be tested with 3 different methods. The first part was tested by the formalin-ether concentration technique, followed by the separation of a part of the sediment to screen for helminth eggs and protozoan cysts significantly to determine the pathogenic stage of *Entamoeba* species and stained with iodine wet mount which developed after a huge leap done by Antonie van Leeuwenhoek by invention the simple microscopy then preparations of the formalin-ether concentrate to count the number of nuclei if it is up to 4 or less. The second part was stained by Ziehl-Neelsen hot technique for diagnosing intestinal apicomplexan protozoa parasites. The third part was examined by saturated saline flotation technique to detect light protozoa oocysts. Detecting any parasite by any of these techniques was considered a positive case (22,23).

Postmortem carcass examination

Postmortem examination included systematic visual examination, palpation, and sharp incisions of the carcass and all organs. Any pathological changes related to parasitic lesions were detected and recorded. *Fasciola hepatica* and *F. gigantica* adult worms, hydatid cysts in the liver and lungs, liver abscesses due to *Entamoeba* pathogenic species, muscle cysts including Sarcocystosis, and rumen flukes as *Paramphistomum* species were all examined and recorded. All lesions were diagnosed by veterinarians in the abattoir according to the Egyptian law of the General Authority for Veterinary Services, Egypt.

Data analysis

Collected qualitative data were analyzed by SPSS version 22 through applied prevalence calculation of parasitic infection among different variables. The prevalence percentage is related to the risk factors. The association between risk factors and infection status was determined using the Pearson chi-square test (x^2) and Fisher's test or Monte Carlo test. The odds ratio (OR) was calculated to determine and assess risk factors.

Results

Fecal matter examination

A total number of 130 positive cases (35.71%) out of 364 cases were detected by 3 different techniques. The most prevalent protozoan infection was *Entamoeba* species (98 cases, 26.92%) found in pathogenic cysts (by counting the number of nuclei that should be up to 4 to consider it as a positive case). The most prevalent helminth was the *Fasciola* species egg (14 cases, 3.84%). The staining technique Ziehl-Neelsen hot method only detected *Cryptosporidium* species oocyst in 7 cases (1.92%) (Table 1).

Table 1: The prevalence of gastrointestinal parasites based on the fecal matter examination

Type of Parasites	Frequency	Percent
Entamoeba species (pathogenic) cyst	95	26.09
Entamoeba species (nonpathogenic) cyst	5	1.37
Blastocyst species oocyst	1	0.27
Cryptosporidium species oocyst	7	1.92
Fasciola species egg	13	3.57
Fasciola species egg + *Entamoeba* species (pathogenic) cyst	1	0.27
Ascaris species egg	1	0.27
Paramphistomum species egg	2	0.54
*Schistosoma*mansoni egg+ *Entamoeba* species (pathogenic) cyst	1	0.27
Blantidium coli cyst+ *Entamoeba* species (pathogenic) cyst	1	0.27
Trichostrongylus species egg	3	0.82
Total	130	35. 71

The prevalence of parasitic infections among slaughtered animals was comparatively analyzed against non-modified risk factors. The analysis of gender risk factors revealed that infections were higher among females than males 39.1 and 35%, respectively with statistical insignificance (x^2 = 0.379, P = 0.538) and OR of 0.840 CL 95% (0.482-1.464). Also, the analysis of animal species revealed that the infection was higher among buffaloes than cattle 49.2 and 20.5%, respectively, with a statistical significance (x^2 = 32.653, P = 0.000) and OR of 0.26 CL 95% (0.167-0.423). The analysis of the animal source was particularly insightful; it was found that the infection rate among rural animals was 43.9% compared to 26.9% in urban animals. This difference has a statistical significance (X^2 = 11.516, P = 0.001) and OR of

2.132 CL 95% (1.372-3.314). The analysis of the animal's origin revealed that the infection rate among local animals was higher than imported and mixed ones (45.6%, 25%, and 14.3%, respectively) with a statistical significance (X^2 = 17.654, P = 0.000) and OR of 0.199 CL (0.023-1.683) (Table 2).

The prevalence of parasitic infection was comparatively analyzed against modified risk factors. The comparative analysis of farm water supply demonstrated that the infection rate in animals where water was supplied through the canal was higher than in those farms where the water was supplied through a governmental pipe bore (44.9% versus 25%) with a statistical significance (X^2 = 15.6, P = 0.000) and OR of 2.444 CL 95% (1.561-3.828). The comparative analysis of animal nutrition revealed that the animals fed through indigenous farm feed had a higher infection rate than those fed with readily purchased feeds with a statistical significance (X^2 = 5.163, P = 0.023) and OR of 1.68 CL 95% (1.072-2.634). Comparative analysis in terms of the presence of a dog on the farm revealed no statistical significance with (X^2 = 0.029, P = 0.865) and OR of 1.041 CL 95% (0.653-1.659) (Table 3).

Table 2: The prevalence of parasitic infection based on the fecal matter examination among large animals according to non-modified risk factors of animals

Non-modified risk factors		Total N = 364	Positive N = 130		x^2	P	(OR)
			No	%			
Animal sex	Male	300	105	35	0.379	0.538	0.84 (0.482-1.464)
	Female	64	25	39.06			
Animal species	Cattle	171	35	20.46	32.653	0.000*	0.265 (0.167-0.423)
	Buffalo	193	95	49.22			
Animal source	Rural	189	83	43.91	11.516	0.001*	2.132 (1.372-3.314)
	Urban	175	47	26.85			
Animal origin	Local	193	88	45.59	17.654^b	0.000*	0.199 (0.023-1.683)
	Imported	164	41	25.00			
	Mixed	7	1	14.28			

x^2 = Chi-square, P= significant difference <0.050, b= Monte Carlo, OR: odds ratio.

Table 3: The prevalence of parasitic infections based on the fecal matter examination among large animals according to different modifiable risk factors

Modifiable risk factors		Total N = 364	Positive = 130		x^2	P	OR
			No.	%			
Water source	Canal	196	88	44.89	15.6	0.000	2.444 (1.561-3.828)
	pipe	168	42	25			
Animal nutrition	Farm made	121	53	43.80	5.163	0.023	1.68(1.072-2.634)
	purchased	243	77	31.68			
Farm dog	Yes	110	40	36.36	0.029	0.865	1.041(0.653-1.659)
	No	254	90	35.43			

x^2 = Chi-square, P= significant difference <0.050, OR: odds ratio.

Postmortem examination

The total number of positive cases of parasitic infection detected by postmortem examination was 76 (20.87%). Mixed lung hydatid with liver hydatid cases was detected in 32 cases (8.79%), and liver hydatid only was detected in 15 cases (4.12%). Common liver trematode adult worms, either Fasciola hepatica or *F. gigantica*, were detected infrequently (2.47% and 1.09%, respectively). Finally, the prevalence rate of macro Sarcocystosis infection (detected in the trachea) among animals enrolled in this study was 3.57% (Table 4).

Comparatively analyzed against the non-modified risk factors revealed that; the prevalence of mixed lung hydatid and liver hydatid infections among large animals, demonstrating that all non-modified risk factors were statistically significant (P = 0.000). Given that all odds ratio values are less than one, all non-modified risk factors were considered protective. The prevalence of liver hydatid infection in large animals revealed that all non-modified risk factors (animal sex, animal species, animal source, and animal origin) presented statistically significant differences (P = 0.000). However, sex and species were considered higher risk factors than other factors (Figure 1). The prevalence of *Fasciola hepatica* (adult worm) infection was comparatively analyzed against animal species, source, and origin and was shown to have statistically significant differences except for animal sex, where the difference was statistically insignificant. Only the animal source was a higher risk factor with an OR of 1.054 CL 95% (1.018-1.091). No statistically significant differences were found in the prevalence of liver *F. gigantica* (adult worm) infection except for animal sex differences and the animal's source and origin. The trachea muscle Sarcocystosis infection percentage among large animals indicated that all factors demonstrated statistically significant differences except for animal sex and species, which increased the relative risk (Table 5-9) (Figure 2).

Table 4: The prevalence of parasitic lesions based on postmortem examination among large animals

Parasites	Frequency	Percent
Mixed infection	32	8.79
Hydatid cyst	15	4.12
F. hepatica	9	2.47
F. gigantica	4	1.09
Sarcocystosis cysts	13	3.57
Paramphistomum	2	0.54
Ascaris lumbricoides	1	0.27
Total	76	20.87

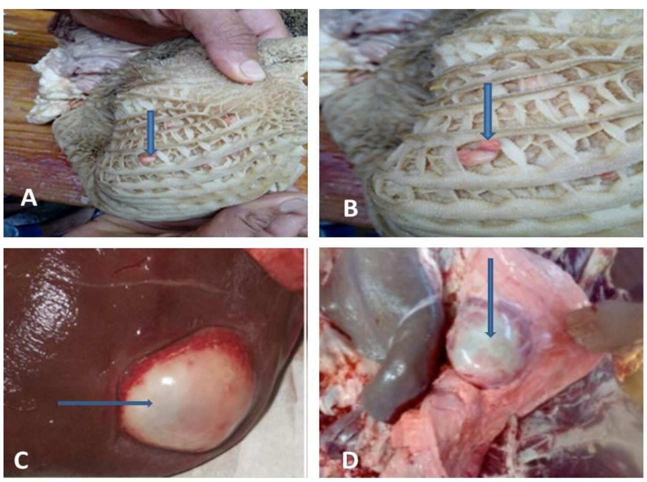

Figure 1: Adult worm of *Paramphistomum* in the rumen (A and B) and Hydatid cyst in the liver (C) and lung (D).

Concerning modified risk factors, the prevalence of mixed lung hydatid and liver hydatid infection among large animals demonstrated that; all modified risk factors were statistically significant (P = 0.000). Only the risk factor of the presence of a dog on farms was statistically insignificant, having an odds ratio of 47.25 CL 95% (11.047-202.095). The prevalence of liver hydatid infection among large animals exposed that; all modified risk factors presented statistically significant differences (P = 0.000). However, none of these factors was proven to increase the risk of hepatic hydatid infection. The prevalence of *Fasciola hepatica* (adult worm) infection showed that the differences were significant and posed an increased risk except for the presence or absence of a farm dog which was shown to be statistically insignificant. The prevalence of liver *F. gigantica* (adult worm) infection among large animals displayed that; all modified risk factors were statistically insignificant except for animal nutrition. All factors were determined not to increase the risk. The trachea muscle Sarcocystosis infection percentage among large animals revealed that all modified risk factors had statistically significant differences; however, none were shown to increase the relative risk (Figure 3).

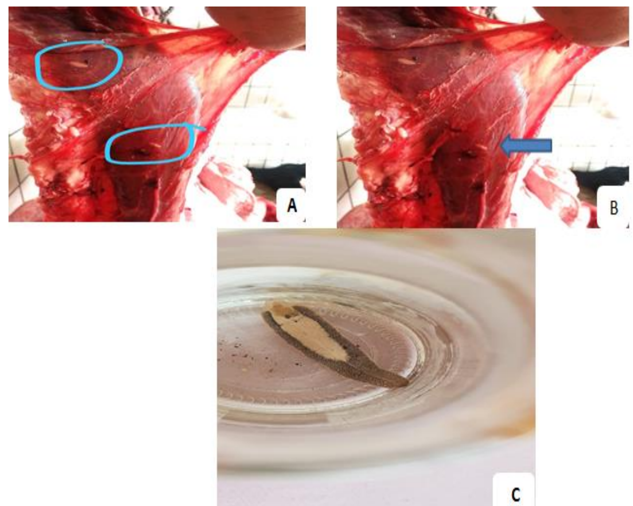

Figure 2: Sarcocystosis in muscle (A and B), and adult worm of *Fasciola gigantica* adult worm (C).

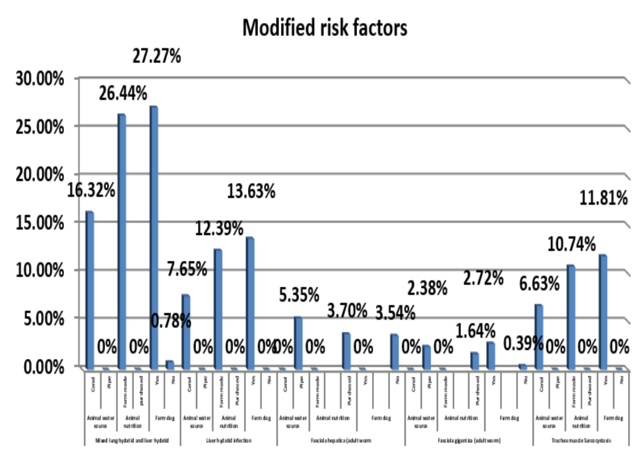

Figure 3: The prevalence of parasitic lesions in postmortem examination among large animals according to modified risk factors.

Table 5: The prevalence of mixed lung hydatid and liver hydatid n = 32 according to non-modified risk factors

Non-Modified Risk Factors		N examined 364	No +ve	%	X^2	P	OR
Animal sex	Male	300	17	5.66	20.77	0.000	0.196 (0.092-0.419)
	Female	64	15	23.43			
Animal species	Cattle	171	0	0.00	31.08	0.000	1.199 (1.126-1.277)
	Buffalo	193	32	16.58			
Animal source	Rural	189	32	16.93	32.48	0.000	0.831 (0.779-0.886)
	Urban	175	0	0.00			
Animal origin	Local	193	32	16.58	31.085	0.000	0.000
	Imported	164	0	0.00			
	Mixed	7	0	0.00			

X2 = Chi-square, ^ = Fisher's Exact Test, b =Monte Carlo Sig P = significant difference <0.050, OR: Odds Ratio.

Table 6: The prevalence of Liver hydatid n = 15 according to non-modified risk factors

Non-Modified Risk Factors		N examined 364	No +ve	%	X^2	P	OR
Animal sex	Male	300	17	0.00	0.000^		1.306 (1.141-1.496)
	Female	64	15	23.43			
Animal species	Cattle	171	0	0.00	13.861	0.000	1.084 (1.041-1.13)
	Buffalo	193	32	7.77			
Animal source	Rural	189	32	7.93	14.486	0.000	0.92 (0.883-0.960)
	Urban	175	0	0.00			
Animal origin	Local	193	32	7.77	13.861	0.000	0.000
	Imported	164	0	0.00			
	Mixed	7	0	0.00			

X2 = Chi-square, ^ = Fisher's Exact Test, b =Monte Carlo Sig P = significant difference <0.050, OR: Odds Ratio.

Table 7: The prevalence of *Fasciola hepatica* (adult worm) n = 9 according to non-modified risk factors

Non-Modified Risk Factors		N examined 364	No +ve	%	X^2	P	OR
Animal sex	Male	300	17	3.00	0.370^		0.97 (0.951-0.989)
	Female	64	15	0.00			
Animal species	Cattle	171	0	5.26	0.001^		0.947 (0.914-0.981)
	Buffalo	193	32	0.00			
Animal source	Rural	189	32	0.00	0.001^		1.054 (1.018-1.091)
	Urban	175	0	5.14			
Animal origin	Local	193	32	0.00	11.96^b	0.002	0.000
	Imported	164	0	5.48			
	Mixed	7	0	0.00			

X2 = Chi-square, ^ = Fisher's Exact Test, b =Monte Carlo Sig P = significant difference <0.050, OR: Odds Ratio.

Table 8: The prevalence of *Fasciola gigantica* (adult worm) n = 4 according to non-modified risk factors

Non-Modified Risk Factors		N examined 364	No +ve	%	X^2	P	OR
Animal sex	Male	300	17	0.00	0.001^		1.067 (1.001-1.136)
	Female	64	15	6.25			
Animal species	Cattle	171	0	0.00	0.126^		1.021 (1.000-1.042)
	Buffalo	193	32	2.07			
Animal source	Rural	189	32	0.00	0.124^		0.979 (0.959-1.000)
	Urban	175	0	2.28			
Animal origin	Local	193	32	2.07	4.062	0.194^b	0.000
	Imported	164	0	0.00			
	Mixed	7	0	0.00			

X2 = Chi-square, ^ = Fisher's Exact Test, b =Monte Carlo Sig P = significant difference <0.050, OR: Odds Ratio.

Table 9: The prevalence of trachea muscle Sarcocystosis n = 13according to non-modified risk factors

Non-Modified Risk Factors		N examined 364	No +ve	%	X^2	P	OR
Animal sex	Male	300	17	0.00	0.000^		1.255 (1.109-1.420)
	Female	64	15	20.31			
Animal species	Cattle	171	0	0.00	11.945	0.001*	1.072 (1.032-1.114)
	Buffalo	193	32	6.73			
Animal source	Rural	189	32	6.87	12.483	0.000*	0.931 (0.896-0.968)
	Urban	175	0	0.00			
Animal origin	Local	193	32	6.73	11.945	0.003*	0.000
	Imported	164	0	0.00			
	Mixed	7	0	0.00			

X2 = Chi-square, ^ = Fisher's Exact Test, b =Monte Carlo Sig P = significant difference <0.050, OR: Odds Ratio.

Discussion

Rural farms are common sites of origin for the animals sent to abattoirs for slaughter. These farms frequently lack the technology to safely dispose of fecal animal waste, leaving their barns with wet conditions conducive to the growth and recurrence of protozoal infections, including *Cryptosporidium* has direct life cycle which is completed in gut canal in one host. (24,25). Also, rural farms have a lack of provision for adequate aeration as well as a lack natural sunlight, which contributes to the ground floor of the animal housing becoming moist. When combined with inadequate removal of animal fecal material, it provides a breeding ground for protozoal infections. In the previous study by Thompson, the protozoan infection in the fecal matter was of little concern inside the farm or abattoir because most farmers were above 40 years old with little or no education. The farmers also did not seem to understand the information they were given regarding the procedures need to be taken to improve cattle performance or those needed to treat protozoan infections (26).

A previous study by Azhar *et al.* revealed that the helminths in buffaloes comprised 91.44% of infections. The parasitism in buffaloes includes more than one species of gastrointestinal parasites, but 47% of cattle were infected with gastrointestinal helminths. The prevalence of gastrointestinal helminthiasis varies worldwide, including physiological status, age, animal species, and climatic conditions (27). In the current study, the infection rate among rural animals was 43.9% compared to 26.85% in urban ones. The infection rate for animals of local origin was higher than for those imported or mixed origins 45.59, 25, and 14.28%, respectively. These results agree with Gunathilaka *et al.* in Gampaha District, Sri Lanka, who reported that the infection rate of gastrointestinal parasites is higher in rural areas, with a rate of 31.43%, compared to urban areas, with a rate of 9.32% (28).

The veterinarians who completed postmortem examination also disregarded the protozoan infections when the infection led to partial condemnation of the carcass due to the presence of liver abscesses from *Entamoeba* species infection which it has the ability to devour red blood cells by Erythrophagocytosis through the process of analyzing its plasma membrane (29,30). In the current study, the frequency of protozoan infections was lower than the normal range reported in other studies. This is likely due to the study period being from June to October, considered summer months. The infection rates are typically higher during the rainy season due to increased humidity and lower environmental temperatures (31). The present study discovered that the most common parasites recovered from the fecal matter of large animals slaughtered in abattoirs were *Entamoeba* cyst and *Fasciola* species eggs found in 26.92 and 3.84% of the cases, respectively.

Accordingly, the risk of protozoan infection contributing to *Entamoeba histolytica* is a zoonotic parasite and may cause severe disease in humans, unlike most zoonotic parasites, which are nonpathogenic to humans. Several factors that lower immunity may potentiate the virulence of *Entamoeba* spp. in humans (32). *Entamoeba histolytica* in cow dung may become infectious to handlers and farmers, especially if their animals drank water in rural areas which is likely to contain cysts in an infective stage. A recent study in France stated that the animals living in rural areas were more highly infected than those living in urban locations (33).

Also, the dogs in farms act as reservoir hosts for most intestinal protozoan infections. Among cattle suffering from diarrhea, the most common intestinal protozoan infection is *E Bovis*, with an infection rate of 36% (34). Feeding habits are also considered risk factors after the age of 6 months. Before this age, calves are udder feeding, lowering the risk of infection. A recent study in Indonesia reported that grazing habits and animal nutrition affected the infection rate. The animals eating farm-made food had a higher infection rate of 43.80% than animals whose food is made commercially 31.68%, which was statistically significant with an odds ratio of 1.68 CL (1.072-2.634) (35). Also, this study evaluated gender as a risk factor where the infections among male cattle are found to be more frequent than female for two reasons. First, the male animals are more voracious, which increases the likelihood of becoming infected. Second, bulls have an inferior immune system compared to female cows due to the effects of male hormones; this causes intestinal parasites to spread more quickly (36).

Regarding the mixed lung hydatid and liver hydatid are a cosmopolitan zoonosis caused by the adult or larval stages of cestoda infection belonging to the genus *Echinococcus granulosus*, the current results agree with Ahmed *et al.* who reported that the hazard exists in farm dogs as both organs were left without hygienic biosafety elimination as recommended by the HACCP system regulation so hydatidosis has significant economic importance concerning mortality and morbidity and It is neglected disease in tropical areas (37). The life cycle of *Echinococcus granulosus* was completed using the farm dog as an incubator. It also revealed that sarcocystosis macrocyst infection is protozoan parasite belong to the phylum Apicomplexa, which obligatory parasite is needed two hosts to complete its life cycle, alternating between an intermediate hosts involved cow or buffalo and definitive hosts as predator comprised dogs or cats so infection in cow is 7.5%, but in buffalo, carcasses are 8.33% (38,39). As regards animal sex, the female has an infection rate of 9.69% compared to males at 7.09%, and the primary infected muscle is the esophagus, found in 76.3%. Then the infection rate in both tracheal muscles and tongue is 35.3% and 33.8%, respectively, and finally, the diaphragm muscles are involved in 18.71% due to the abundance of stray dogs and cats (40,41).

Prior studies have reported that gravid cows develop neutralized immunity due to pregnancy stress, which decreases immune response in female animals, leading to gravid females being more likely to become infected than males. Also, all livestock animals were administered triclabendazole orally every 2 months to eradicate fasciolosis of both *F. gigantica* and *F. hepatica*, which a predominant liver fluke disease of cattle, sheep, and other ruminants which lead to occurrence of jaundice due to liver failure and blockage of bile ducts. Albendazole was concurrently given orally for prophylactic treatment of intestinal helminths (42,43).

Conclusion

The HACCP system is essential for processing during animals' slaughter in abattoirs, aiming to control the spread of parasitic infections and correctly decide on the condemnation of carcasses.

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Conflict of interest

The authors declare that they have no conflict of interest.

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معدل انتشار العدوى الطفيلية بين الحيوانات المذبوحة في المسلخ الميكانيكي

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الخلاصة

تعد طفيليات الجهاز الهضمي، مثل الديدان الطفيلية والأوليات، عوامل طفيلية وفيرة للماشية، وخاصة المجترات. الهدف من الدراسة الحالية هو تحديد معدل انتشار العدوى الطفيلية في الحيوانات المجترة الكبيرة المذبوحة في المسلخ الميكانيكي بمحافظة الإسكندرية، مصر. تم التعرف على الانتشار من خلال سجلات العدوى الطفيلية المكتشفة في براز الحيوانات المجترة الكبيرة بالإضافة إلى النتائج المسجلة لفحص ما بعد الوفاة. تم اختيار عدد إجمالي يبلغ ٣٦٤ من الحيوانات المجترة الكبيرة المذبوحة، وتم وضع العلامات عليها، والتي خضعت لأخذ عينات براز، وفحص تشريح الجثة. تم اختبار كل عينة براز بثلاث تقنيات مختلفة؛ تركيز الفورمالين - الأثير، التعويم الملحي المشبع وصبغة زيل نيلسن، لتشخيص جميع أنواع الطفيليات. تم تحديد ١٣٠ (٣٥,٧١٪) حالة إيجابية خلال فحص عينة البراز و ٧٦ حالة (٨٧,٢٠٪) وجدت في فحص بعد الوفاة. أسفرت معالجة الفورمالين - الأثير لعينات البراز عن أكبر عدد من مسببات الأمراض؛ تم الكشف عن أنواع المتحولة في ٩٨ (٢٦,٦٩٪) عينة براز وبيض من نوع الفاشيولا في ١٤ عينة (٨٤,٣٪). كشف فحص ما بعد الوفاة عن الدودة الفاشيولا الناضجة بنوعيها في ١٣ (٥٧,٣٪) حيوانا مختلطة من أكياس الرئة والكبد العدارية في ٣٢ (٧٩,٨٪) حيوانا، بينما تم تحديد الأكياس العدارية للكبد فقط في ١٥ (١٢,٤٪) حيوانا. أخيرا، تم الكشف عن الإصابة بداء الساركوسيستوس في ٥٧,٣٪. في الختام، تعد العدوى الطفيلية للحيوانات المجترة الكبيرة سببا رئيسيا للإصابة بالأمراض في الحيوان الكبير، مما يؤدي إلى خسائر اقتصادية. يجب تنفيذ تدابير المنع والمراقبة بواسطة المجازر الميكانيكية وفقا لنظام تحليل المخاطر الحرجة لنقاط التحكم.