

An Abattoir-based study on helminths of slaughtered camels (*Camelus dromedarius*) in Aswan Province, Egypt

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Abstract

Gastrointestinal parasitic infection is a prime cause of failures in camel production. This study was conducted to ascertain the prevalence of gastrointestinal helminths of camels in Aswan district, Egypt. Besides, the prevalence of helminthiasis in camel was also evaluated considering age, gender, and rearing system. For such reason, a total of 110 dromedaries (*Camelus dromedarius*) in the Draw abattoir, Aswan province were screened for the presence of gastrointestinal helminths by postmortem examinations between December 2018 to November 2019. Twenty-four animals (21.82 %) were found to be infected with one or more species of gastrointestinal helminths. *Moniezia expansa*, and *Stilesia globipunctata*, emerged as the most prevalent species (29.2%), with *Avitellina centripunctata* also being common (20.83%). Whereas, *Moniezia benedeni*, was present at low infection rates (12.5 %). Furthermore, the only recorded trematode worm was *Paramphistomes* spp. (8.33%). Gender variations revealed significant ($P \leq 0.05$) differences among examined camels. Oppositely, age and seasonal dynamics had no significant differences with the highest peak in the winter season (33.3%). The current prevalence indicates the necessity of using an anthelmintic drug for increasing the health and productivity of camels.

Keywords: Abattoir, Camels, Helminths, Prevalence, Risk factors.

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Introduction

Egyptian camel has a high economic value by providing meat, milk, and wool as well as transportation and labor. Due to its physiological features, the camel is the most suitable domestic mammal for use in harsh climatic conditions. They are also used as racing animals and for other leisure activities in the Arab world (wakil et al., 2016).

Helminthiasis of camels is one of the chief causes of impaired milk and meat production, decreases in performance, or even death. Some camel parasites also represent a threat to human health. Moreover, the gastrointestinal helminth parasites adversely affect the nutritional status of the animals (Irfan, 1984). The signs of the helminth fauna of the digestive tract of camelids are numerous; the most typical ones are loss of weight, gastritis and/or enteritis, diarrhea, anemia and death (Dakkak and Ouhelli, 1987). Among the significant obstacles of the camel population production, is the trematode (flake) and cestode (tapeworm) parasites that contribute to detrimental worm burdens in the animals.

Epidemiological analysis of the parasites that infect various livestock is essential to formulate effective control plans and to avoid economic losses caused by parasitic disorders. Furthermore, few postmortem studies have been conducted on gastrointestinal (GI) helminths of Egyptian camels (Ahmed et al., 2013) and worldwide (Anwar and Hayat 1999; Al-Rawashdeh et al., 2000; Abdl El-Maogood, 2001; Bekele, 2002). Hence, the current study was designed to provide preliminary information on the prevalence rates, seasonal abundance and species of helminths, along with the associated risk factors.

Materials and Methods

I) Study area

The study was conducted in Aswan city, which is found at a latitude of 24° 5' 20.18" N and a longitude of 32° 53' 59.39" E during a period of one year from December 2018 to November 2019. Aswan is famously known for its beautiful Nile Valley scenery, important archaeological sites and peaceful atmosphere.

II) Study animals

A total of 110 camels (*Camelus dromedarius*) were screened for the presence of gastrointestinal helminths through postmortem analysis. During the sampling gender, age, month dynamics, and the rearing type were recorded.

III) Necropsy and parasitological analysis

After the carcass was opened, the various parts of the gastrointestinal tract of one-humped camels (*Camelus dromedarius*), including esophagus, stomach, intestinal tract and caecum were detached by ligation and transferred to the parasitology laboratory, Faculty of Veterinary Medicine, South Valley University in a clean icebox. Each portion was cut longitudinally, and the mucosa was brushed carefully for the presence of any attached worms. Additionally, the digestive tract contents were washed using tap water and further sieved using a tea strainer to remove undesirable particles. The washings of viscera were completely screened by the aid of the hand lens to find the helminths. The recovered worms were picked up with forceps, washed several times in distilled water, kept in physiological saline, and then preserved in 10% formalin for further detailed analysis and identification. The collected trematodes and cestodes were washed, pressed between two slides, fixed,

stained with Carmine alum solution, dehydrated in ascending grades of alcohol, and then identified. Species identification was done according to the principles described by Soulsby, (1982) and Kaufmann, (1996).

IV) Statistical analysis

Statistical significance differences were assessed with a Chi-square test using a statistical package program (Sigma Plot version 11.0). Statistical significance was considered with P values < 0.05.

Results

I) Survey finding

The results of this study showed that 24 out of 110 screened camels (*Camelus dromedarius*) were infected with one or more types of gastrointestinal helminths at varying levels, constituting an overall infection rate of 21.82%. The helminths recovered from the tested samples belonged to four cestodes (*Moniezia expansa*, *Moniezia benedeni*, *Stilesia globipunctata*, *Avitellina centripunctata*) and one trematode (*Paramphistomes* spp., immature stage) as depicted in Table (1). Additionally, the same Table displayed the distribution pattern of the recovered species. *Stilesia globipunctata* and *Moniezia expansa* were the most prevalent

helminths (29.2%) in camel than other species identified. No nematode species were recovered in the current survey.

A significant difference (p=0.05) was observed between the presence of helminths species and the gender of surveyed camels. The higher rate of infection (54.55%) was recorded in female animals as compared to their male counterparts (18.2%) as shown in Table (2). Conversely, the host age was found to be an insignificant factor for the prevalence of GIT parasites with helminths being detected frequently in age categories of <3 years than the older age category. Also, the same table concluded that the prevalence regarding the type of rearing system. From this table, it was found that the higher infection rate value was recorded in free-grazing camels as compared to those receiving a concentrate feeding type. However, this difference was found to be non-significant.

Currently, the highest peak of infection rate was recorded in the winter season, followed by spring, whereas the lowest value was observed during the autumn season as illustrated in Table (3). However, there is no significant association between seasonal variations and the occurrence of gastrointestinal parasitic infections in camels.

Table 1. Distribution pattern of the recovered helminths

	Helminths	Site	Prevalence%	Helminth burden
Trematode	<i>Paramphistomes</i> spp. (early migrating juvenile flukes)	Abomasum	2 (8.33)	8-35
	<i>Stilesia globipunctata</i>		7 (29.2)	20-200
Cestodes	<i>Moniezia expansa</i>	Small intestine	7 (29.2)	4-10
	<i>Moniezia benedeni</i>		3(12.5)	3-7
	<i>Avitellina centripunctata</i>		5 (20.83)	10-120
	Total		22(91.66)	
	Overall		24 (21.82)	

Table 2. Percentages of helminth infections in camels relative to age, gender, and rearing

Risk factor	Total No.	Infected	Prevalence %	P-value	
Gender	Male	99	18	18.2	0.005
	Female	11	6	54.55	
Age	Young (<3y)	52	14	26.9	0.219
	Adult (>3y)	58	10	17.2	
Rearing system	Concentrate	52	9	17.31	0.278
	Grasses	58	15	25.9	

Table (4) displayed and summarized the distribution pattern of the recovered helminth species regarding age groups, gender, seasonal dynamics, and rearing system, individually.

Table 3. Seasonal dynamics of the recovered helminths species in screened camels

Season	No.	Infected (%)	P value
Winter	30	10 (33.30)	0.181
Spring	30	7 (23.30)	
Summer	27	5 (18.52)	
Autumn	23	2 (8.70)	
Total	110	24 (21.81)	

II) Morphological analysis

The morphological features of the recovered helminths were clarified in Figs (1-3).

Discussion

Parasitic diseases have got a unique significance as they cause high morbidity and huge economic losses in the terms of reduced wool, meat and milk production, stunted growth, and mortalities (Gupta, 2006).

Finding in the current survey revealed that the overall occurrence of gastrointestinal helminth infection in camels in Draw abattoir, Aswan province was 21.82%. This figure was not corroborated with the previous reports done by El-Salahy et al., (2000); Abd ElMaogood, (2001) and Ahmed et al., (2013) that showed a high prevalence of helminths infection in Egyptian camels with a percentage of 60%, 90.4% and 50.02%, respectively. Previous worldwide studies found a higher occurrence of parasitic infections as in Indian and Iranian camels, 37.8% and 81.3% (Kumar et al., 2001, Anvari-Tafti et al., 2013). These variations in infection rate might be contributed to the breed differences and host susceptibility in relation to hygiene and managerial factors. Additionally, it might be attributed to the lack of anthelmintic treatment and lack of veterinary care (Koinari et al., 2013, Sugun et al., 2015). Currently, the prevalence of cestodes and trematodes was 91.66% and 8.33%, respectively. Similarly, the present results were supported by the previous reports of Anwar and Hayat (1999).

Host gender was found to be a significant factor with respect to gastrointestinal parasite infection. Even though the number

Table 4. Percentages of helminth infections in camels relative to age, gender, rearing

Risk factor	Parasite	Sex		Age		Season				Rearing system	
		Male (n=18)	Female (n=6)	(<3y) (n=14)	(>3y) (n=10)	Winter (n=10)	Spring (n=7)	Summer (n=5)	Autumn (n=2)	Concentrate (n=9)	Grass (n=15)
Trematode	<i>Paramphistomes</i> spp. (early migrating juvenile flukes)	0(0%)	2(33.3%)	0(0%)	2(20%)	1(10%)	0(0%)	1(20%)	0(0%)	2(22.2%)	0(0%)
Cestode	<i>Stilesia</i> <i>globipunctata</i>	6(33.3%)	1(16.7%)	2(14.3%)	5(50%)	3(30%)	2(28.6%)	1(20%)	1(50%)	2(22.2%)	5(33.3)
	<i>Moniezia</i> <i>expansa</i>	6(33.3%)	1(16.7%)	6(42.9%)	1(10%)	3(30%)	3(42.9%)	1(20%)	0(0%)	2(22.2%)	5(33.3)
	<i>Moniezia</i> <i>benedeni</i>	2(11.1%)	1(16.7%)	2(14.3%)	1(10%)	1(10%)	0(0%)	1(20%)	1(50%)	1(11.1%)	2(13.3%)
	<i>Avitellina</i> <i>centripunctata</i>	4(22.2%)	1(16.7%)	4(28.6%)	1(10%)	2(20%)	2(28.6%)	1(20%)	0(0%)	2(22.2%)	3(20%)

of females slaughtered was lower than males, but female (54.55%) camels were found to be harboring by the parasite more than the male (18.2%) camels. This finding was in line with a previous review done by Bekele, (2002) who reported significantly higher prevalence in female (77.6%) than male (64.8%) camels and Swai et al., (2011), study on intestinal parasitic infection of camel in Tanzania, reported

68.1% in female and 46.9% in male. In contrast, Birhanu et al., (2014) found that male camels (64.7%) were found to be harboring by the parasite more than the female camels (55.04%). This could be due to physiological peculiarities of the female camels, which usually constitute stress factors thus reducing their immunity to infections (Wakelin, 1984).



Fig. 1. *Paramphistomum* spp. (Early migrating juvenile flukes): a) fresh specimens, b) stained whole-mount showing a simple intestinal caeca (arrow), no reproductive organ and acetabulum (A) (Scale bar =2mm)

The result of this study indicated that there was no statistically significant difference in the prevalence of GIT helminths in relation to the age groups. It revealed a higher prevalence in camels with <3 years and camels of more than 3-years-old had the lowest prevalence (17.2%). Likewise, the current finding was supported by the previous data done by Al-Hakak, (2018) who showed that the highest peak of gastrointestinal helminths within the age categories of 1-year– 3-years was 2.8% in Iraqi camels. In contrary to this result, the higher prevalence was observed in 6-10 years old (70%) followed by camels >10 years old (60.5%) (Swai et al., (2011). Such difference could be attributed to the development of resistance against helminths species with a gradual increase by age. Likewise, young animals are generally considered to be more susceptible to parasitic infection than adults due to immature active immunity and lack of adaptation in the young (Sohail et al., 2017).

The rearing system of the camel did not exhibit any significant effect ($P=0.278$) on helminthiasis. A higher prevalence was observed in camel reared in free-grazing system (25.9%) as compared to the camel of concentrate type feeding (17.3%). The cause of this variation may occur from the

difference in pasture, fodder, and environmental factors.

Concerning the seasonal dynamics, the effect of seasonal variation on the parasitic infection revealed that the highest prevalence was found in winter followed by spring, and then began to decline in autumn. In a similar study, Radfar et al., (2011) reported that the prevalence of parasitic infections during autumn and winter was significantly higher compared to summer. In another study conducted by Bana and Sultana (2009), autumn as a rainy season was observed to have the highest incidence, while the infection rate was moderate during spring and summer. In the rainy season, the higher prevalence of gastrointestinal helminths can be accredited to a number of favorable climatic conditions such as high relative humidity, rainfall, ambient temperature. These climatic conditions help inadequate growth and development of the intermediate host.

Trematode worms in the current investigation were recorded from two camels out of 110 with a percentage of (8.33%). This infection rate was not corroborated with that observed by Ahmed et al. (2013) in Egypt (2.4%).

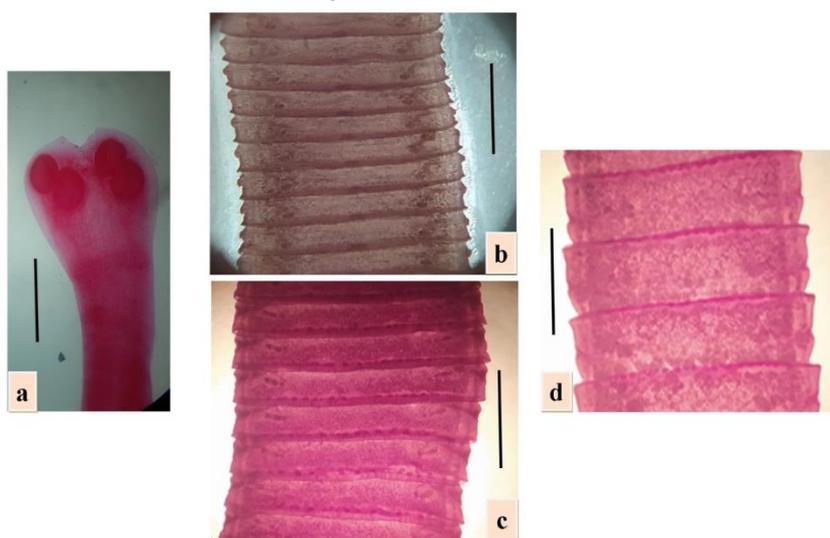


Fig. 2. *Moniezia* species, a) Scolex, b) *M. benedeni* mature segment, c) *M. expansa* mature segment and d) Gravid segment (Scale bar =4mm)

Several previous reports showed that no trematodes were detected during their studies as Abd El-Maogood, (2001) in Egypt and Borji et al., (2010) in Iran. Additionally, the only common species recovered was *Paramphistomum* spp.

The presence of paramphistomosis and difference in their prevalence is influenced by local climatic conditions presence or absence of water reservoirs, lakes, rivers and availability of suitable intermediate hosts Maqbool et al., (2002, 2003). Furthermore, an increased infection rate value of paramphistomosis in adult camels has been reported in the present study. This finding was in line with the reports of Keyyu et al., (2006) who found 75.2% prevalence in adults and 47.2% prevalence in young animals. These results differ from those of Juyal et al., (2003) 23.8%; and Shanila and Hafeez, (2005) 5.94%. The

relatively high frequencies could be associated with nutritional and climatic stress, such as altitude, rainfall, and temperature and livestock management system. As different herds of animals come in close contact at available communal watering and grazing sites (contact points) because of the feed scarcity, the establishment and spread of paramphistomosis were favored. Furthermore, adult animals were significantly more frequently affected than young regarding paramphistomosis because the young may not move to the grazing land (they stay around the house). Concerning the prevalence rates of intestinal cestodes observed in this study were nearly similar to the previous reports done in various regions of the world (Inas, 2003; and Bekele, 2002).

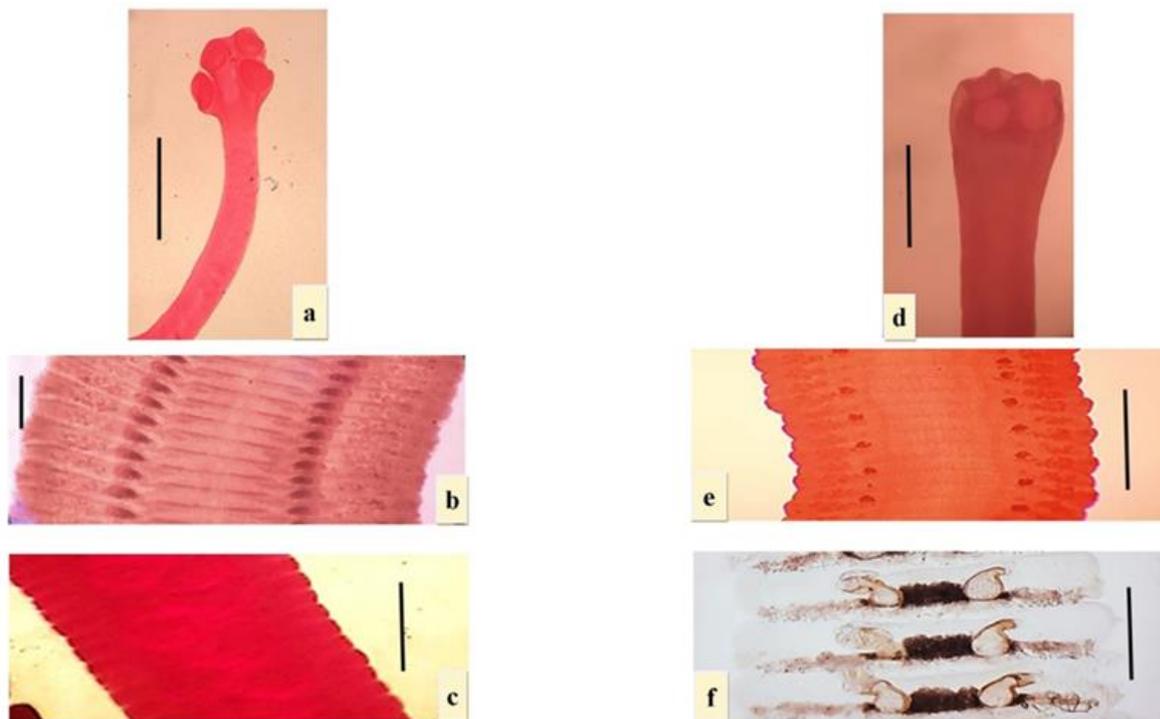


Fig. 3. a) *Avitellina centripunctata* scolex b) *A. centripunctata* mature segment, c) *A. centripunctata* gravid segment, d) *Stilesia globipunctata* scolex, e) *S. globipunctata* mature segment, f) *S. globipunctata* gravid segment (Scale bar =1mm).

According to our results, 29.2% of the dromedary camels were infected with *Moniezia expansa*. This figure was nearly similar to the previous review done by Tajik et al., (2011) who found that the infection rate in Iranian camels was 28%. Additionally, the prevalence of *M. expansa* in Egyptian camels was more than the reported prevalence of 3% in Iranian camels (Borji et al., 2010). On contrary, the current results were lower than what Al-Ani et al., (1998) found in Jordanian camels (33%).

The current results declared that the prevalence of *M. benedeni* in the screened camels was 12.5%. This rate was considered as lower than that the reports of Bekele (2002) in Ethiopian dromedaries 34%, but higher than camels in Iran 4% (Borji et al., 2010), and Pakistan 7.8% (Anwar and Hayat, 1999). A possible explanation for this difference is that the immunological stat of camel is different. The rates of infection by these tapeworms might be varied according to different reasons such as the age of animals. The severity and burden of infection by these tapeworms were revealed to be the highest in young camels (Maqsood, 1996), and this could go back to the fact that older camels have more efficient immune responses, due to recurrent attacks of worms, than that in young camels.

S. globipunctata which was detected in seven camels (29.2%) in the present study can cause growth retardation, septic peritonitis since it can perforate the small intestine actively and even death specifically in young animals (Gökçen and Adanır, 2013). The prevalence of this species was reported 19%, 5.5%, and 8.3% in Ethiopia (Bekele 2002), Pakistan (Anwar and Hayat, 1999) and Iran (Radfar et al., 2006), respectively. In a study conducted in Syria, *S. globipunctata* and *S. vittata* were found together (Kassouha, 2011). Additionally, it was reported to be

one of the most common cestodes in Iran (Sazmand and Joachim, 2017). The researcher believes that this high prevalence may be related to the large number of camels imported from Sudan.

Currently, *A. centripunctata* was recovered from the screened camels with an estimating overall prevalence of 20.3%. A variety of factors like grazing habits, level of education and economic capacity of the farmers, standard of management and anthelmintic used can influence the prevalence of helminths (Gadahi et al., 2009).

Conclusion

The current investigation provides baseline evidence about the attitude of GI helminths of camels in Aswan province, Egypt. Also, the current findings reflect a growing burden of gastrointestinal helminth infections at the abattoir level. Therefore, proper management, improved hygiene and regular deworming practices should be institutionalized for the prevention and control of parasitic infections in camels. Further studies about the pathological impact of the recovered helminths together with molecular phylogenetic taxonomy are highly recommended.

Conflict of interest

None of the authors has any conflict of interest to declare.

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