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Internal and external parasites of camels (*Camelusdromedarius*) slaughtered at Addis Ababa Abattoir, Ethiopia

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A cross-sectional study was undertakento estimate the prevalence of internal and external parasites of camels slaughtered at Addis Ababa abattoir, Ethiopia. A total of 384 of camels originating from Borena and Metehara areas were examined during the study period and all (100%) of them were found to harbor at least two parasite species. In this study,the prevalence of tick, gastrointestinal parasites, *Cephalopinatitillator*,Hydatid cyst, and *Sarcoptesscabiei var. cameli*were 100, 95.6, 68.2, 65 and 35.4%, respectively. The gastrointestinal parasite's ova/oocyte identified include*Strongylus* species, *Trichuris*species, *Strongyloides*species and coccidiaat prevalence of 78.1, 47.1, 44.5 and 25.3%, respectively. Of the total 1347 pooled samples of tick collected from 40 randomly selected camels.*Rhipicephaluspulchelis*, *Rhipicephalusevertsievertsi*, *Hyalomma dromedary, Amblyommagemma*,*Amblyommavariegatum* and *Boophilusdecolaratus*were identified at a proportion of 53.90, 21.01, 13.66, 7.5, 3.19 and 0.74%, respectively. The average tick burden from half body region of camels was 33.7 ± 6.24 (range 26 to 53).In general, this study indicates that parasites are still the major problems hindering the productivity and health of camels, hence implementation of strategic control measures and further studies are recommended to reduce the effect of parasites on camel health and productivity.

Key words: Abattoir, Addis Ababa,Ethiopia, camel,*Cephalopinatitillator*,gastrointestinal parasite,*Hydatid cysts*,*Sarcoptesscabiei*var.*cameli*,tick.

INTRODUCTION

Camels are an important source of milk, meat and their dung is used for fires. They are also used for riding and transport purpose. In Ethiopia, camels are exported mainly to Egypt and Sudan, and are also slaughtered for meat consumption duringritual occasions (Dirie and Abdurahman, 2003).Despite the fact that, camels provide lots of socio-economic advantagesand are the preferred domestic animal species in the ever-changing climate, so far it was neglected by researchers and development planners(Bekele, 2010).

Severalendo and ectoparasites have been identified as the major problems affecting the health, productivity

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andperformance of camels (Anwar and Khan, 1998; Parsaniet al., 2008; Bekele, 2010). Among ectoparasites of camel, mange mites caused by *Sarcoptesscabiei var. cameli* (Parsaniet al., 2008; Dinkaet al., 2010;Awolet al., 2014) and various species of ticks (Richard, 1979; Melaku and Fisseha, 2001; Lawalet al., 2007; Parsaniet al., 2008; Dinkaet al., 2010; Kiros et al., 2014) have been reported. In addition, camel is also known to be infected with various helminthes and protozoan parasites like coccidia (Rechard, 1979; Anwar and Khan, 1998; Melaku and Fisseha, 2001; Parsaniet al., 2008; Bekele, 2010). Nasopharyngeal myiasisand hydatidosis are also major problems of camels (Zumpt, 1965; Burgemeisteret al., 1975; Hussein et al., 1982; Higgins, 1985; Pandevet al., 1986; Wubet, 1987; Musa et al., 1989; Njorogeet al., 2002).Most of the studies conducted in Ethiopia on camels are limited to the eastern part of the country (Wubet, 1987; Zelalem, 1994; Abebe, 2001; Zeleke and Bekele, 2004; Dinkaet al., 2010) and do not cover the whole country. Therefore, this study was carried outto estimate the prevalence and identify the genus level or species diversity of internal and external parasites of camels of Borena and Kereyu origins slaughtered inAddis Ababa abattoir, Ethiopia (Figure 1).

MATERIALS AND METHODS

Study area

This study was conducted at Addis Ababa abattoir enterprise, Akaki branch, Ethiopia. All camels slaughtered were originated from the Borana(semi-arid) and Kereyu(arid) areas of Ethiopia. Borana is located at approximately 600 km South of Addis Ababa at an altitude of 500 to 2500 m above sea level. It has an annual rainfall of 450 to 650mm in bimodal pattern with long rains expected between March and May and the short rains between October and November. Kereyu is located at about 250 km East of Addis Ababa at 80° 54 E longitude and altitude of 930 m above sea level.It has an average annual rainfall of 504mm. The mean annual maximum and minimum temperature are 32.40 and 18.5°C, respectively (NMSA, 1999).

Studymethodology

Studytype and animals

Cross-sectional study was undertaken, from November to April, on 384 camels to assess the prevalence and species/genus level composition ofinternal and external parasites of camels slaughtered at Addis Ababa abattoir. The number of camels slaughtered varied from 7 to 11 each day. The abattoir was visited two days a week. All camels slaughtered during the time of visitwere examined and sampled without discrimination of their age, sex, body condition and origin.

Data collection

General physical examination was conducted on each camel in the lairage. All data regarding the age (based on dentition), sex, body condition (hump structure) and origin of camels were recorded appropriately(Schwartz and Dioli, 1992; CACIA, 1995).

Fecalsample collection and examination

Fresh fecal samples were collected directly from the rectum of slaughtered camels. Each samplewas placed and codedappropriately in universal bottles, and transported using ice box into parasitology laboratory of College of Agricultural and Veterinary Medicine, Addis Ababa University. The collected samples wereexamined using simple sedimentation method for trematodes eggs and floatation method for eggs of nematodes, cestodes and coccidianoocysts(Soulsby, 1982; Urquhart et al., 1996).

Sample collection and identification of tick and mange mite

All visible adult ticks were collected from half-body regions (on right side) of camels. Ticks were collected in labeled plastic bottles containing 70% ethanolfrom 40 randomly selected camels. Skin of suspected camels affected by mange was scraped until capillary bleeding and the scraping waspreserved in a labeled bottle containing 10% formalin. Both tick and skin scraping samples were taken into parasitology laboratories of College of Agricultural and Veterinary Medicineof Addis Ababa Universityand College of Veterinary Medicine of Mekelle University.Identification of tickswas performed using the keys of Okello-Onenet al. (1999) and Walker et al. (2003). Identification of mites was carried out with the help of morphological characteristics after processing with 10% KOHsolution (Soulsby, 1982;Urquhart et al., 1996).

Examination of *Cephalopinatitillator* and hydatidcyst

After slaughtering, camel heads were dissected and gross examination was performedon the nasal cavity, frontal sinuses, turbinate bones and nasopharynx for the presence of *Cephalopinatitillater*larvae. Liver, lungs and heart of slaughtered camels were grossly examined and palpated for the presence of hydatidcyst. The contents of hydatid cysts were examinedafter aspiration using syringe and incision.

Data analysis

The data was entered into Microsoft excel spreadsheet and coded appropriately. For data analysis, SPSS version 16 was used. In this data analysis, descriptive statistics was used to determine the prevalence of parasites in camel. The chi-square test was also used to determine the existence of any association between the infection and the risk factors like age, origin, body condition score and sex. In all cases, 95% confidence intervals and$P<0.05$were set for significance.

RESULTS

Out of the 384 camels examined,all (100%) of them were found to harbor two or more of the parasite species. In this study, four species of the gastrointestinal (GIT) parasite, six species of tick, one species of mite, hydatid cyst and *C.titillator*larvae were identified.The preva-lence of tick,GIT parasite, *C.titillator,*hydatic cystand mange

mite infestation were 100,95.6, 68.2, 65 and 35.4%, respectively (Table 1).

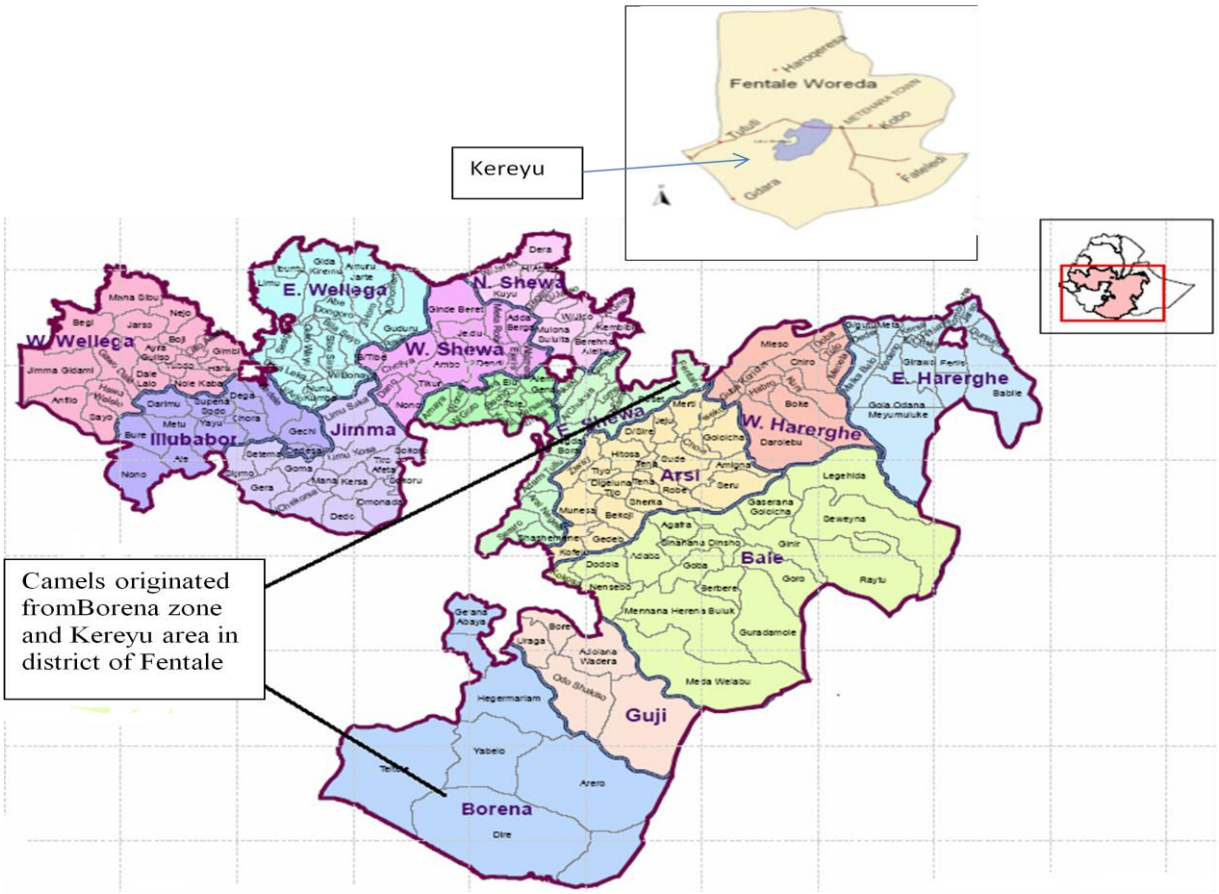

Figure 1. Zones of Ethiopia Map, showing the origin of camels (Borena and Kereyu) slaughtered at Addis Ababa abattoir.(Pantuliano and Wekesa, 2008; Kasa et al., 2011;Kasaye et al., 2013).

Table 1. The prevalence of tick, *Cephalopinatitillator,* hydatid cysts*, Sarcoptesscabiei var. cameli* and GIT parasites in camels slaughtered at Addis Ababa abattoir, Ethiopia.

Parasite	Number of infected camels	Prevalence (%)
Tick	384	100.0
Cephalopinatitillator	262	68.2
Hydatid cysts	250	65.0
Sarcoptesscabiei var. cameli	136	35.4
GIT parasites	367	95.6
Coccidia	97	25.3
*Strongyloides*spp.	171	44.5
*Strongylus*spp.	300	78.1
*Trichuris*spp.	181	47.1

GIT: Gastrointestinal.

Ticks were observed on all (100%) of the examined camels (Table 1).Of the total 1347 pooled hard ticks collected from the half body region of 40 camels,*Rhipicephaluspulchelis*, *Rhipicephalusevertsievertsi*, *Hyalommadromedary,Amblyommagemma*,*Amblyommavariegatum* and *Boophilusdecolaratus*were identified at a proportion of 53.90, 21.01, 13.66, 7.5, 3.19 and 0.74%,

respectively (Table 4). The average tick burden from half body region of camels was 33.7±6.24 (range 26 to 53). In addition to tick infestation, 136 (35.4%) of the examined

Table 2. The distribution of tick, *Cephalopinatitillator,* hydatid cysts*, Sarcoptesscabiei var. cameli* and GIT parasites infestation among age, sex, origin and body condition score in camels slaughtered at Addis Ababa abattoir, Ethiopia.

Risk factor	Category level	No.	Number of infected camels (%)							
			Ticks	*Cephalopina titillator*(%)	Haydatid cysts (%)	*Sarcoptesscabei var. cameli*	*Coccidia*spp (%)	*Strongylodies* spp.	*Strongylus*s pp.	*Trichuris*spp.
Body condition score	Fatty	28	28 (100)	17 (60.7)	17 (60.7)	13 (46.4)	12 (42.9)	11 (39.3)	17 (60.7)	17 (60.7)
	Good	14	14 (100)	97 (66.9)	94 (64.8)	54 (37.2)	35 (24.1)	70 (48.3)	109 (75.2)	65 (44.8)
	Thin	95	95 (100)	72 (75.8)	58 (61.1)	26 (27.4)	18 (18.9)	39 (41.1)	78 (82.1)	37 (38.9)
	Moderate	116	116 (100)	76 (65.5)	81 (69.8)	43 (37.1)	32 (27.6)	51 (44.0)	96 (82.8)	62 (53.4)
	P-value		-	0.29	0.538	0.210	0.71	0.656	0.45	0.79
Origin	Borena	363	363 (100)	249 (68.6)	237 (65.3)	128 (35.3)	91 (25.1)	161 (44.4)	285 (78.5)	171 (47.1)
	Metehara	21	21 (100)	13 (61.9)	13 (61.9)	8 (38.1)	6 (28.6)	10 (47.6)	15 (71.4)	10 (47.6)
	P-value		-	0.522	0.752	0.792	0.719	0.77	0.445	0.964
Sex	Male	61	62 (100)	45 (72.6)	38 (61.3)	20 (32.3)	14 (22.6)	25 (40.3)	48 (77.4)	31 (50.0)
	Female	322	322 (100)	217 (67.4)	212 (65.8)	116 (36.0)	83 (25.8)	146 (45.3)	252 (78.3)	150 (46.6)
	P-value		-	0.422	0.491	0.570	0.596	0.467	0.883	0.622
Age (year)	5-8	85	85 (100.0)	48 (56.5)	54 (63.5)	39 (45.9)	28 (32.9)	50 (58.8)	60 (70.6)	35(41.2)
	9-12	132	132 (100.0)	98 (74.2)	93 (70.5)	41 (31.1)	30 (22.7)	48 (36.4)	106 (80.3)	70 (53.0)
	>12	167	167 (100.0)	116 (69.5)	103 (61.7)	56 (33.5)	39 (23.4)	73 (43.7)	134 (80.2)	76 (45.5)
	P-value		-	0.21	0.7	0.66	1.88	0.05	0.163	0.199

At 95% confidence interval.

camelshad mange mite infestation and only *Sarcoptesscabiei var. cameli* was identified from all of the collected skin scraping samples (Table 1).

The GIT parasites ova/oocyte identified during the study period include *Strongylus*species, *Trichuris* species, *Strongyloides*species and coccidia at prevalence of 78.1, 47.1, 44.5 and 25.3%, respectively (Table 1). No trematode and cestode ova were identified. In general, there was no significant difference in the prevalence of parasites between/among the different risk factors (Table 2).

C. titillator larvae were found in the nasal cavity, pharynx, turbinates and sinuses of 68.2% (n=262) camels (Table 1). Hydatid cysts were encountered in 65% (n=250) of camels (Table 1). Hydatid cysts of variable sizes (2 to 8 cm in diameter) were found in the lung, liver, and in both organs of the same animals at a proportion of 59.6% (n=149), 9.6% (n=24) and 30.8% (n=77), respectively. There was significant difference (P-value < 0.0001) in the localization of hydatid cysts between lungs and liver (Table 3). They were also varied in number from 2 to 7 on single organ. 62% of infected camels harbored only cysts that had calcified or yellowish material inside the capsule, but the rest (38%) harbored at least one cyst that had clear water like fluid inside the capsule.

DISCUSSION

The present study assesses the prevalence of internal and external parasites encountered on camels slaughtered at Addis Ababa Abattoir, Ethiopia. All (100%) had two or more of the parasite species. Similar studies conducted by Al-Ani etal.(1998)andSharrifetal.(1998)inJordan,Anwar

Table 3. Organ distribution of hydatid cysts in camels slaughtered at Addis Ababa abattoir, Ethiopia.

Organs affected	No. of affected camels	%
Lung only	149	59.6
Liver only	24	9.6
Lung and liver	77	30.8
Total	250	100

P-value < 0.0001.

Table 4. The proportion of tick species collected from 40 randomly selected camels slaughtered at Addis Ababa abattoir, Ethiopia.

Tick species	No. of ticks collected	Proportion (%)
Rhipicephaluspulchelis	726	53.90
Rhipicephalusevertsi-evertsi	283	21.01
Hyalomma dromedary	184	13.66
Amblyommagemma	101	7.50
Amblyommavariegatum	43	3.19
Boophilusdecolaratus	10	0.74
Total	1347	100.00

and Khan (1998) in Pakistan, Dia (2006) in Burkina Faso and Bekele (2010) in Southern Ethiopia also reported a higher prevalence of parasites in camel. This high prevalence of parasites could be related to rearing of camels in marginal areas where veterinary services are not available or very limited (Tefera, 2004).

In this study, tick infestation was detected in all (100%) of the examined camels. This result was supplementary to the findings of Al-Ani et al. (1998),Melaku and Fesseha (2001), Dia (2006), Bekele (2010) and Kiros et al. (2014). Of the total 1347 pooled samples of ticks collected from half body region of 40 randomly selected camels,*R.pulchelis*, *R.evertsievertsi*, *H. dromedary, A.gemma*, *A.variegatum* and *B.decolaratus* were identified at a proportion of 53.90, 21.01, 13.66, 7.5, 3.19 and 0.74%, respectively. The average tick burden in half body region of camels was 33.7±6.24 (range 26 to 53). Similar species of ticks and greater tick load per camel were also reported by Zeleke and Bekele (2004), Bekele (2010), Nazifi et al. (2011) and Kiros et al. (2014). In addition to feeding on animal blood, ticks also act as vector for diseases, causing tick paralysis, and direct damage to tissue, so that providing entry for opportunistic micro-organisms and fly larvae. Tick infestation also causes loss of appetite, leading to a reduction in growth rate and decreased productivity, and results in increased calf mortality (Schwartz et al., 1983; Hart, 1990; Nelson et al., 1977; Jabbar et al., 2007).

Gastrointestinal parasites weredetected in 95.6% (n=367) of the examined camels. The GIT parasites ova/oocyst identified during the study period were *Strongylus*spp., *Trichuris* spp., *Strongyloides*spp. and *coccidia* at prevalence of 78.1, 47.1, 44.5and 25.3%, respectively. These results agree with the findings of Richard (1979), Hussein et al. (1987), Al-Ani et al.(1998), Anwar and Khar (1998), Sharif et al.(1998), Agab and Abbas (1999), Bekele (2010), Bamaiyi and Kalu (2011) and Swai et al. (2011). The ova of cestode and trematode were not found in this study, even though Richard (1979), Anwar and Khar (1998), Sharif et al. (1998), Bekele (2010), Bamaiyi and Kalu (2011) and Swai et al.(2011) have reported these parasites from camels. Gastrointestinal parasites reduce the productivity and performance of camels, and also predispose them to other infection diseases. Gastrointestinal parasitism is generally associated with diarrhea, weakness, constipation and emaciation (Richard, 1979)

*C.titillator*wasfound on 68.2% of camels. This finding was in agreement with the result of Al-Aniet al. (1998) (74%) and Morsyet al. (1998) (71.7%), but higher than Al-Aniet al. (1998) (33%),Sharrifet al.(1998) (33%) and Bekele (2001) (52%).This variation in the prevalence of *C.titillator* infestation might be attributed to the different management systems and environmental condition that exist among those areas.*C.titillatar*has several impacts on respiratory function, feeding, health and productivity of the animals. Infested camels lose their appetite and show respiratory problem and abnormal behavior resembling cranial coenuriasis (Zumpt, 1965). Pathological lesions of the nasal sinuses and death of camels associated with secondary pathogenic bacteria and viral infections were also reported previously (Burgemeisteret al., 1975; Hussein et al., 1982; Musa et al., 1989; Al-Aniet al., 1991).

The prevalence of hydatidcyst recorded in this study was 65%. This resultwas higher than the findings of

Wubet (1987), Abdul-Salam (1988), Woldemeskel (2001), Ahmadi (2005), Bitsat (2009) and Mohammed (2010). The high prevalence in the present study could be due to the presence of high population of dogs which are closely associated with livestock in the field and barn as well as due to high population of wild carnivores in the area of the majority camels origin (Borena) (Balako, 1999) and due to lack of proper condemnation of organs infected with hydatidcyst in pastoral areas (Bekele, 2008). These facilitate easy access of infected organs to dogs and wild carnivores which are the principal definitive hosts and maintain the life cycle of the parasite. Hydatid cysts varied in number from 2 to 7 on single organ. They were also of variable sizes (2 to 8 cm in diameter) and found at the proportion of 59.6% in the lung, 9.6% in liver and 30.8% both in lung and liver of infected animals. However, the findings of Abdl-hafez et al. (1986), Kamhawi et al. (1995), Ibrahim and Craig (1998.) and Haridy et al. (2006) indicated a higher rate of liver infection than lung. 62% of infected camels harbored only calcified cysts but the rest (38%) harbored at least one non calcified cyst. This was in accordance with Abdl-hafez et al. (1986), Kamhawi et al.(1995), Chai et al.(1998), Sharrif et al. (1998), Ahmadi (2005) and Bitsat (2009).

Mange mite infestation was detected in 35.4% (n=136) of the examined camels. This result was higher than the report of Anwar and Khan (1998), Dinka et al. (2010) and Awolet al. (2014) who reported a prevalence of 13.4, 10.68 and 16.70%, respectively. Only *S.scabiei var. cameli* was identified. This species of mange was also reported by Al-Ani et al. (1998), Agab and Abbas (1999), Lawal et al. (2007), Bekele (2010), Dinka et al. (2010) and Awol et al. (2014). Sarcoptic mange caused by *S.scabiei var. cameli* is extremely contagious and serious problem in camels (Nayel and Abu-Samra, 1986; Pegram and Higgins, 1992; Parsani et al., 2008). It is also the second most important camel disease after trypanosomiasis (surra) in terms of its effect on production in camel herds across the world (Mochabo et al., 2005; Nayel and Abu-Samra, 1986). Sarcoptic mange is also of zoonotic nature. Camel owners are the main sufferers due to close association with camels (Parsani et al., 2008).

In general, this and others studies indicated that parasites are among the major constraints of camel health and production. Considering the existence of limited veterinary service in camel rearing areas, well integrated studies and appropriate control measure should be implemented to improve the health and productivity of camels. Furthermore, due to the zoonotic importance of hydatidosis and *S.scabiei var. cameli,*public awareness should be created to control these parasites.

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