International Journal of Academic and Applied Research (IJAAR)
ISSN: 2643-9603
Vol. 4, Issue 6, June – 2020, Pages: 32-40

Epidemiology of Gastrointestinal Helminth Parasites of Sheep in Abeche Area, Ouaddai State, Chad

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Abstracts: *Gastrointestinal helminth parasites of sheep remain one of the main constraints to sheep production in Chad as they cause reduction of animal productivity by reduction of body weight and milk yield. An epidemiological study was carried out to determine the prevalence, distribution and intensity of gastrointestinal helminth parasites of sheep and the effect of seasonal and climatic factors as disease determinants in Abeche area of Ouaddai State, Chad, from March 2015 to February 2016. Total of 1981(1466 males and 515 females) pre-slaughtered sheep faecal samples and 40 gastrointestinal tracts (GIT) of slaughtered sheep of different ages were randomly collected from Abeche abattoir and tested for the presence of gastrointestinal helminth parasites in different seasons. The effect of seasonal and climatic factors on the prevalence and intensity of gastrointestinal helminth parasites infections were determined. Faecal examination for GIT parasites eggs, revealed overall prevalence of (43.2%),while males showed slightly higher prevalence (43.3%) than females (42.9%), with overall mean total faecal egg count (TFEC ±SE) of 555.75±37.98. Female sheep showed significant ($P \leq 0.01$) higher overall mean (±SE) of TFEG as compared to males. The seasonal overall prevalence of GIT helminth parasites based on faecal egg detection was observed to be highest (64.5%) in hot wet and lowest in hot dry (25.3%) seasons. Rainfall, relative humidity and temperature are the main climatic factors associated positively with the seasonality and distribution of gastrointestinal helminth parasites. Eighty percent of sheep were found infected with adult gastrointestinal helminth parasites. The helminth parasites observed were Haemonchus contortus, Oestertagia oestertagia, Trichostrongylus colubriformis, Strongyloides papillosis, Nematodirus spathinger, Bonustomum trigonocephalum, Trichuris ovis, Oesophaostomum columbianum, Moniezia expansa, Paramphistomum cervi and Dicrocoelium dendreticum. The study showed that nematodes, trematodes and cestodes were prevalent in the area with high prevalence in hot wet season, hence the need for deworming programme during the rainy season.*

Keywords: Sheep, GIT Helminth Parasites, prevalence, Ouaddai, Chad.

Introduction

Sheep play a vital role in rural economies through the provision of meat, milk, household income, manure and skins (Ardo and Bitrus, 2015). Chad owns huge number of ruminants having high contribution for meat and milk consumption and generates cash income from export of live animals, meat and skins. In spite of the presence of this huge ruminant populations, it fails to optimally exploit this resources due to number of factors such as recurrent drought, infrastructure problems, rampant animal diseases, poor nutrition, poor genetic potential of animals, traditional system of husbandry and management, shortage of trained manpower and lack of government policies for prevention and control of animal diseases (Mopate and Issa, 2008).

Gastrointestinal helminth parasite infections are worldwide problem for both small and large scale farmers, but their impact is greater in sub- Saharan Africa due to the availability of a wide range of agro-ecological factors suitable for diversified host and parasites species development (Almalaik *et al*., 2008). Economic losses caused by gastrointestinal parasites include losses through lowered fertility, involuntary culling, reduction in food intake, low weight gain, low milk production, treatment and control measures costs and mortality in heavily parasitized animals (Kumsa and Wossene, 2006).The most serious economic consequences of gastrointestinal helminth parasites based on the overall numbers of worms, of genera and species present, general level of pathogenicity and widespread distribution. In State of Ouaddai, Chad no previous work has ever been conducted on the prevalence of gastrointestinal parasites in sheep, since the sole Graber's study in 1965 on the helminthes of ruminants. Therefore, there is limited information or reports about the prevalence of gastrointestinal helminth parasites of sheep in the study area.

The current study was performed to determine the prevalence and species identification of GIT helminth parasites infecting sheep, over a consecutive 12 months study period and to evaluate the seasonal and climatic factors associated with prevalence rate and parasite intensity, enabling to design feasible and strategic control of gastrointestinal parasites infection of small ruminants in the study area.

Materials and Methods

Study area

Chad is landlocked country located in the heart of Central Africa, and borders Libya to the North, Sudan to the East, Niger to the West, Cameroun and Nigeria to Southwest and Central African Republic to the South (Figure 1). It lies between latitudes 8^0- 24^0 North and longitudes 14^0-24^0 East (Mopate and Issa, 2010). The climate is desert in the north, poor savannah type in the middle and rich savannah type in the south of the country. The State of Ouaddai lies between the latitudes 13^0 -15^0 North and longitudes 20^0 - 23^0 East. The Ouaddai State has a total human population of 721166 (Anon, 2009). The main activities of the population are agriculture and rearing animals. Livestock population in Ouaddai State was estimated as 529629 cattle,111873 sheep, 219486 goats,177541camels, 9832 horses and 59001donkeys (Anon, 2016). The most important breeds of sheep are desert, ambororos (Fulani) and kirdimis (dwarf). After the troubles of war in Darfur States of western Sudan in recent past years, *Hamari* breed of sheep has been introduced into the area.

The State has an annual rainfall of 600 mm in the southern part and 400 mm in the middle and northern parts (Mopate and Issa, 2008). It has an altitude of 450 to 1100 meters above sea level (Provincial development office Abeche, 2010).

Figure (1). The map of Ouaddai State - Chad

Faecal samples collection and examination

During the study period that extended from March 2015 to February 2016, faecal samples were randomly collected from the rectum of 1981 (1466 males and 515 females) sheep brought from different parts of the country before slaughtering at Abeche abattoir for local consumption. The collected faecal samples were placed in a clean dry leakage-proof plastic cups, carefully labeled with animal species, age, sex and date of the collection, then immediately transported to the laboratory of the National Institute of Science and Technology of Abeche for faecal examination. When the examination delayed the samples were preserved in 10% formalin and examined later.

Quantitative and qualitative examinations of parasites eggs were performed by Mac-Master Method and flotation techniques as described by Soulsby, (1986); Hansen and Perry, (1994).

The collection and identification of adult gastrointestinal tract parasitic worms:

A total of 40 gastrointestinal tracts (GITs), samples (24 males and 16 females) were randomly collected from sheep slaughtered at Abeche abattoir. Directly after the opening of the abdominal cavity of slaughtered animal, all the gastrointestinal contents were removed away, double ligated to separate the abomasum from the small intestines at one end and at the junction between the small and the large intestines on the other end. The removed organs were transported to the laboratory of the National Institute of Science and Technology of Abeche for processing. Each of the three parts of the (GIT) was separated, cut open, and the contents were powered over a bowl. The inner walls of the organs were washed thoroughly under a stream of water and the mucous membranes were rabbled carefully with the fingers for removal of any adhering worms. From the content of each part of (GIT), 200 ml was transferred to a wash jar (one liter volume) covered with a sieve of 40 meshes per linear inch while mixing thoroughly. The wash jar was then filled with water, inverted and shaken repeatedly until most of the fluid and faecal colouring matter was removed. Up to 50 ml of water was added to the wash jar and then poured into Petri dishes and the worms were collected, counted and preserved in a solution of 10% formalin and identified later using dissecting microscope according to Hansen and Perry, (1994).

Data Analysis:

Data presentation was performed using SPSS computer programme (Microsoft version No. 21, USA). Data was analyzed using one sample T-test and correlation coefficient. Numbers of eggs and worms recovered were transformed to geometric means to normalize the data, and inference was made accordingly.

Results

Out of 1981 sheep faecal samples examined, 856 (43.2%) were found positive for GIT helminth parasites eggs. The prevalence rate in 1466 male and 515 female sheep was (43.3%) and (42.9%) respectively. Seasonally, the overall prevalence rate based on faecal eggs detection was found highest (64.5%) in the hot wet and lowest (25.9%) in the hot dry seasons (Table1).

The findings of the study showed that 790 (39.9%) and 2(0.1) of sheep were infected with (GIT) nematodes and trematodes as a single infection respectively, 30 (1.5%) as mixed infection with nematodes, cestodes and trematodes, 23(1.2%) with nematodes and trematodes and 11(0.6%) with nematodes and cestodes.

Table (1). Seasonal prevalence of GIT Helminth parasites in sheep at Abeche abattoir, Ouaddai State, Chad during the study period (March 2015 to February 2016) based on faecal egg count.

Season	Male			Female			Total		
	No. examined	No. positive	%	No. examined	No. positive	%	No. examined	No. positive	%
Hot dry	420	100	23.8	120	40	33.3	540	140	25,9
Hot wet	536	349	65.1	194	122	62.9	730	471	64,5
Cold dry	510	186	36.5	201	59	29.4	711	245	34,5
Total	1466	635	43.3	515	221	42.9	1981	856	43.2

N.B.: Hot dry = summer (March, April, May and June). Hot wet = autumn (July, August, September and October. Cold dry = winter (November, October, January and February).

The species-specific prevalence of the encountered (GIT) helminth parasites in male and female sheep in different seasons of the year was shown in Table (2). The intensity of infection for the detected (GIT) helminth parasites based on total faecal egg count (TFEC) mean (±SE) in male and female sheep in different seasons of the year was shown in Table (3). The species of (GIT) helminth parasites identified were *Haemonchus contortus, Oestertagia oestertagia, Trichostrongylus colubriformis, Strongyloides papillosis, Nematodirus spathinger, Bonustomum trigonocephalum, Trichuris ovis, Oesophaostomum columbianum, Moniezia expansa, Paramphistomum cervi and Dicrocoelium dendreticum*.

The monthly and seasonal overall mean total egg count (TEPG) of GITs helminth parasites in male and female sheep were presented in Figures (2) and (3) respectively.

The seasonal prevalence (%) of GIT adult nematode, cestode and trematode species identified in sheep in Abeche abattoir, Ouaddai State, Chad during the study period was shown in Table (4) and Table (5).

Table (2). Species - specific prevalence (%) of GIT helminths encountered in sheep at Abeche abattoir, Ouaddai State, Chad, during March 2015 to February 2016 based on faecal egg count.

Seasons	NO. +Ve (Prevalence %)									
	Strongyle eggs		*Strongyloides papillosis*		*Trichuris ovis*		*Dicroceulium dendreticum*		*Moniezia expansa*	
	male	female	male	female	male	female	male	female	male	female
Hot dry	99(23.6%)	38(31.7%)	7(1.7%)	4(3.3%)	6(1.4%)	3(2.5%)		2 (1.7%)	4 (1%)	6 (5%)
Hot wet	345 (64.4%)	122(62.9%)	46(8.6%)	20(10.3%)	27(5%)	11(5.7%)	32 (6%)	9 (4.6%)	12(2.2%)	12(6.2%)
Cold dry	184(30.2%)	56(27.9%)	18(3.5%)	4(2%)	3(0.6%)	3(1.5%)	4 (0.8%)	6 (3%)	3 (0.6%)	5(2.5%)
Total	628(42.8%)	2I6(41.9%)	71(4.8%)	28(5.4%)	36(2.5%)	17(3.3%)	36 (2.5%)	17(3.3%)	19(1.3%)	23(4.6%)
Overall	844(42.6%),		99(5%)		53(2.7%)		53(2.7%)		42(2.1%)	

Table (3). The intensity (overall Mean ±SE) of GIT helminth infection in sheep at Abeche abattoir, Ouaddai. Chad during March 2015 to February 2016 based on total faecal egg count.

Seasons	Overall Mean ±SE									
	Strongyles eggs		*Strongyloides papillosis*		*Trichuris ovis*		*Dicroceulium dendreticum*		*Moniezia expansa*	
	Male	female	male	female	male	female	male	female	male	female
Hot dry	115.83 ±24.42	125.00 ±31.89	2.74±1.32	4.58±2.44	2.62±1.08	2.08±1.24	0.00	1.67±1.17	4.17±2.17	18.33±9.24
Hot wet	1115.11 ±101.40	1146.40 ± 200.03	18.19±3.17	29.38±7.37	8.77±1.86	6.70±2.79	9.61±1.93	7.99±2.92	34.33± 18.21	32.22±17.15
Cold dry	190.39 ±28.01	157.46 ±32.72	6.86±1.837	2.74±1.59	78± 0.54	1.99±1.36	2.16±1.22	5.72±2.64	20.29±8.92	62.69±45.02
Overall	507.13 ± 40.77	522.43 ±79.59	9.82± 1.38	13.20± 2.95	4.23±,79	3.79±1.21	4.26±0.83	5.63±1.53	20.80±7.37	40.87± 18.83

Table (4). Seasonal prevalence (%) of GIT adult nematode species identified in slaughtered sheep at Abeche abattoir, Ouaddai State, Chad during March 2015 to February 2016.

Seasons	No. examined	No. of infected animals (Prevalence %)							
		Haemonchus contortus	*Oestertagia oestertagia*	*Trichostrongylus colubriformis*	*Strongyloides papillosis*	*Nematodirus spathinger*	*Bonustomum trigonocephalum*	*Trichuris ovis*	*Oesophaostomum columbianum*
Hot dry	14	8 (57.1)	2 (14.3)	1 (7.1)	2(14.3)	0 (0.0)	0 (0.00)	2 (14.3)	5 (35.7)
Hot wet	16	13 (81.3)	5 (31.3)	5(31.3)	5(31.3)	2 (12.3)	2 (12.5)	4 (25.0)	8 (50.0)
Cold dry	10	4 (40.0)	2 (20.0)	1 (10.0)	(0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (20.0)
Overall	40	25 (62.5)	9 (22.5)	7(17.5)	7 (17.5)	2 (5.0)	2(5.0)	6 (15.0)	15 (37.5)

Table (5). Seasonal prevalence (%) of GIT adult cestode and trematode species identified in sheep in Abeche abattoir, Ouaddai State, Chad during March 2015 to February 2016.

Seasons	No. examined	***Moniezia expansa***	***Paramphistomum cervi***	
		No.+Ve Prevalence (%)	No. examined	No.+Ve *Prevalence* (%)
Hot dry	14	1(7.1)	14	4 (28.6)
Hot wet	16	5(31.3)	16	6 (37.5)
Cold dry	10	2(20.0)	10	2 (20.0)
Overall	40	8 (20.0)	40	12 (30.0)

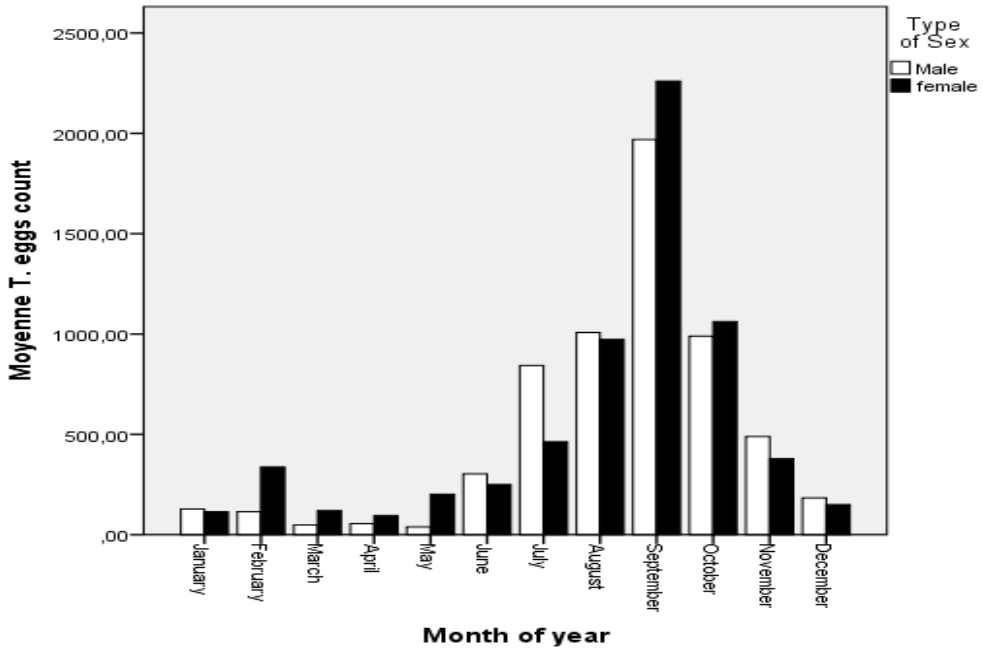

Fig. 2. Monthly overall mean total egg count (TEPG) of GIT helminth parasites of sheep in Abeche, Ouaddai state, Chad during March 2015 to February 2016

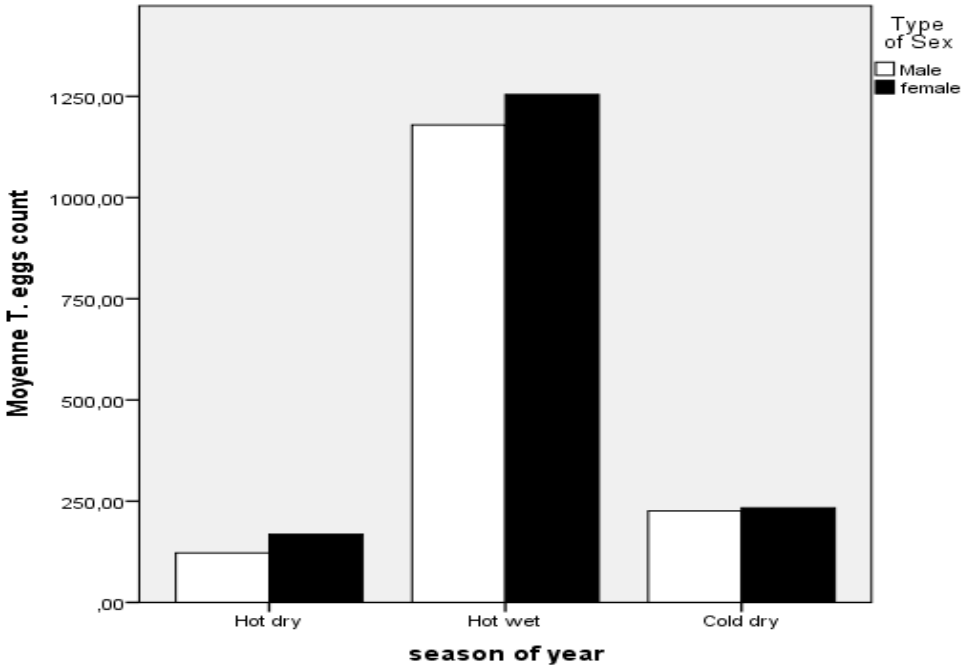

Fig. 3. Seasonal overall mean total egg count (TEPG) of GIT helminth parasites of sheep in Abeche, Ouaddai State, Chad during March 2015 to February 2016.

Discussion

The present study was focused on the epidemiology of GIT helminth parasites of sheep in Abeche area, Chad. The result of the study revealed an overall prevalence rate of (43.2%). This result is lower than those reported by Almalaik *et al.*(2008) in Sudan who found 54.8%, Ardo and Bitrus *(*2015) reported (96.1%) in Nigeria and Ntonifor *et al* (2013) reported prevalence of (73.1%) , but slightly higher than 40% that reported by Mohammed *et al* (2015) in Bangladesh. These variations in the prevalence rate may be due to techniques used for diagnosis or due to animal management systems and climatic differences in the study areas.

In this study male sheep were more infected (43.3%) than female (42.9%) and this is in line with Tareq *et al* (2014) in Iraq who reported (100%) in male and (90%) in female sheep, but in contrast with Raza *et al* (2014) in Pakistan who reported higher rate (79.5%)in female as compared to (73.6%) in male sheep. This may be attributed to the number of examined animals and the period of data collection.

The variations in the climatic factors in different seasons play an important role in the prevalence of gastrointestinal helminth parasites. The highest prevalence was observed in the hot wet season (64.5%) and the lowest in hot dry season (25.3%). This result is in agreement with Suleiman (2012), Almalaik *et al.* (2008) and Bashar *et al* (2002) in South Darfur, Sudan, Yaro *et al.*(2015) in Nigeria and Blackie (2014) in Cameroun. Although parameters such as type of pasture, animal weight and health status or local humidity and temperatures were not recorded, the rainfall and relative humidity appear to be the main factors associated with the GIT helminth parasites prevalence as high infection rate was observed in hot wet season and low prevalence in the hot dry season. This variation of prevalence indicated clearly that the environment of the dry season is unfavorable for the development and survival of the extra host stages of the GIT helminth parasites in the pasture and the survival of intermediate hosts in the environment (Soulsby, 1986).

The GIT helminth parasites identified in this study by faecal eggs count (FEC) were *Strongylse eggs, Strongyloides papillosis, Trichuris ovis, Moniezia expansa* and *Dicrocoelium dendreticum*, these species were also reported by Graber (1965) in Chad.

The result of faecal egg examination in this study revealed that the predominant gastrointestinal parasites in sheep (42.6%) were of Strongyle type. Similar findings were reported by Tareq *et al*.(2014) and Cernaska *et al*. (2005) who found prevalence of (92.0%) and (82.6%) in Iraq and Slovac respectively. In contrast, Ahmed *et al* (2015) reported as low as (13.02%) in Iraq. Similarly, Okorafor *et al* (2015) found (39.47%) in Nigeria and Tesfalem (2016) and Alemineh and Samue (2016) reported (27.9%) and (22.9%) respectively in Ethiopia.

Within Strongyle group identified in this study, *Haemonchus contortus* was being the most predominant Strongyle identified (62.5%), which is in line with Eke *et al* (2019) who reported that among the parasites detected, *Haemonchus spp.* had the highest rate of infection (25.6%) in Niger State, Nigeria.
As for *Strongyloides papillosis*, this study revealed an overall prevalence of 5% which was higher than findings of Suleiman (2012) in South Darfur, Sudan who reported the prevalence of (1.66 %), but lower than results of Ghada *et al* (2011) and Yousif (2010) in Sudan who reported the prevalence of (62.2%) and (24.5%) respectively. Okorafor *et al* (2015) reported the prevalence of (49.7%) in Nigeria.

In this study ,*Trichiris ovis* showed overall prevalence of (2.7%) which was similar to(2.79%) that mentioned by Ahmed *et al* (2015), but higher than results of Okorafo*r et al* (2015) and Yousif (2010) who reported prevalence of (1.32%) and (0.5%) respectively, while Ghada *et al*. (2011) found the prevalence of(11.77%) and (27%).

Moniezia expansa showed an overall prevalence of (2.7%) which was higher than findings of Suleiman (2012) who reported (0.58%) but lower than (25.5%) that reported by Yousif (2010). In this study *Dicrocoelium dendreticum* showed overall prevalence of (2.7%) but Sanchez-Andrade *et al* (2003) found the Prevalence of 6.7% in sheep in Italy.

These variations in prevalence between workers may be due to the different techniques of examinations, husbandry practices, anthelmintics use and genetic composition of the animals or climatic variations between the study areas.

In this study the infections with (GIT) helminth parasites (EPG) in sheep were observed as a single or mixed infection. The prevalence was 790 (39.9%) for nematodes alone, 30(1.5%) for mixed nematodes, cestodes and trematodes, 23(1.2%) for nematodes and trematodes, 11(0.6%) for nematodes and cestodes and 2(0.2) for trematodes alone. Raza *et al*, (2014), in Pakistan found an overall prevalence of (37.5%) for nematodes, (6.4%) for mixed infection with nematode and trematode, while mixed infection with all the three groups of helminth parasites were found in (19.1%) of the animals. Almalaik *et al*. (2008) in South Darfur, Sudan, reported that (11.9%) of sheep infected with GIT nematodes were found harbouring *Moniezia spp*, while (8.8%) of infected sheep were also found infected with both *Moniezia* and *Eimeria* species. The variation in the prevalence of mixed infections between the different studies may be due to the husbandry practices, anthelmintics use, climatic factors or different techniques used for examinations.

In this study significant ($P \leq 0.01$) difference of animal sex-specific prevalence was observed showing female sheep had higher mean TEPG than males. This result is in agreement with Alemineh and Samue (2016) and Tesfalem (2016). Meanwhile, Awizer *et al*. (2014), Ayana and Ifa (2015) and Sheikh *et al*.(2016) found no significant relationship between sex groups. The current study suggests that the predominance of infection in female than male animals may be influenced by many stress factors such as lactation, pregnancy and the farmers were more interested in deworming males than the females.

The study concluded that gastrointestinal helminth parasites were prevalent in the area with high prevalence in hot wet season. The authors recommend further survey studies in the study area and other contact areas in Chad and improving grazing management practices to minimize animals' overcrowdings in a limited area and application of deworming programme using effective anthelmintics to control the infection.

Acknowledgement

The authors would like to thank Director General of National Institute of Science and Technology of Abeche for funding the research and facilities provided. The cooperation and assistance provided by staff members of Abeche abattoir during the survey is highly appreciated.

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