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Prevalence and Dynamics of Some Gastrointestinal Parasites of Sheep and Goats in Tulus Area Based on Post-Mortem Examination

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Abstract: The gastrointestinal tracts of 79 sheep and 161 goats were obtained from abattoir of Tulus locality in South Darfur State in western Sudan from March, 2006 to February, 2007 and examined for the presence of gastrointestinal parasite. Seven nematode species (99.8%) and *Monieza expansa* (0.2%) in sheep beside, eight nematode species (99.9%) and *Monieza expansa* (0.1%) in goats were identified. In sheep the nematodes were, in order of prevalence: *Haemonchus contortus* (53.4%), *Strongyloides papillosus* (26.2%), *Trichostrongylus colubriformis* (14.7%), *Cooperia pectinata* (3.1%), *Oesophagostomum columbianum* (2.2%), *Skrjabinema ovis* (0.3%) and *Trichuris globulosa* (0.1%) while, in goats were: *Strongyloides papillosus* (26.5%), *Haemonchus contortus* (26%), *Trichostrongylus colubriformis* (24.4%), *Skrjabinema ovis* (11.6%), *Oesophagostomum columbianum* (9.9%), *Gaigeria pachyscelis* (1%), *Trichuris globulosa* (0.6%) and *Cooperia pectinata* (0.1%). The intensity of the parasite infections was light to moderate. The mean worm burden was 497.3 and 472.4 for sheep and goats, respectively. The total worm burden was least during the dry season and increased gradually during the rainy season. Total worm burden was shown to have association with season and sex in goats but not in sheep while no association was observed between total worm burden and age of the animals in both sheep and goats. The effect of climatic factors on worm burden revealed a significant positive correlation with rainfall and relative humidity but not with temperature.

Key words: Epidemiology, small ruminants, postmortem, gastrointestinal parasites

INTRODUCTION

Gastrointestinal parasites are a world-wide problem for sheep and goats. The economic impact of these parasites on animals industry is great. The most serious economic consequences of gastrointestinal parasites based on the overall number of worms, number of genera and species present, general levels of pathogenicity and wide spread distribution (Rickard and Zimmerman, 1992). However, most of the economic losses are due to sub-clinical effects and although not immediately noticed by the owner, theses can be substantial (Larsen, 2002). In recent study, Tibbo (2006) found that parasitic infection of sheep and goats are major factors responsible for economic losses through reduction in productivity and increased mortality.

Many researchers have reported parasitic infections in sheep and goats in the Sudan (Ahmed and El Malik, 1997; Omer *et al*., 2003; Mohammed and Atta El Mannan, 2003; Ismail *et al*., 2004) where, parasitic diseases are increasingly recognized as an important cause of reduced productivity.

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Little is known about the prevalence and distribution of gastrointestinal parasites infesting small ruminant in South Darfur State. This study performed to provide basic data on the presence and seasonal distribution of gastrointestinal parasites in sheep and goats of South Darfur in the study area.

MATERIALS AND METHODS

Study Area

The survey was undertaken at Tulus abattoir in South Darfur State in western Sudan from March 2006 to February 2007. The area laying in savanna zone between the latitude 11-12° North and longitude 24-25° East (Fig. 1). The average annnal rainfall is 541.1 mm. Rainfall from May or June to October results in seasonal swamps or small rivers. The area characterized by its solid clay and sand soil. The people in the area work in mixed crop-livestock form of cultivation. The area has large livestock population which spreads in its all parts. The nomadic system is dominated in rearing animals at the area where animals are grazing and watering on communal areas.

Study Animals

The abattoir investigation was carried out during the period from March 2006 to February 2007. The common breeds were Desert sheep and goats, Fulani sheep and their crosses. The animals were 1 to 4 years of age from both sexes. A total of 240 gastrointestinal tracts (GITs) were collected to search for adult worms.

Parasitological Techniques

Post-Mortem Worm Recovery

All 240 gastrointestinal tracts (79 sheep and 161 goats at of 20 GITs per month) brought from Tulus abattoir were subjected to adult worm counts as described by Hansen and Perry (1994). The abdomen of each animal was opened and double ligatures separating abomasum, small intestine and large intestine were placed to avoid mixing of the contents. Any of the three parts of GITs was washed separately. Any part was opened over a bowl in which the contents were caught.

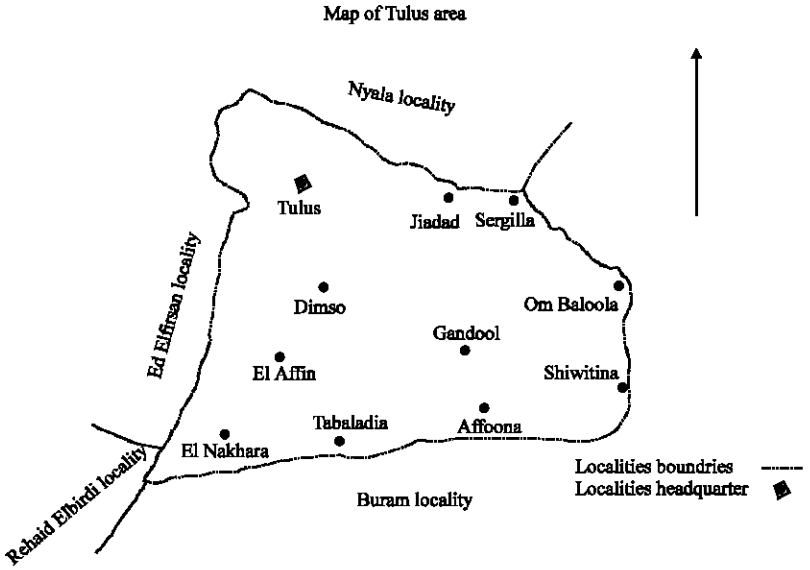

Fig. 1: The map of the study area

The wall washed thoroughly under a stream of water (2-3 L) and the mucous membrane rubbed carefully with the fingers to remove any worms adhering to it. Two hundred milliliter of contents of any parts was transferred to the wash jar while mixing thoroughly in 5 steps of 40 mL per each by using plastic container. The wash jar was then filled with water. After inverted the jar it was shacked until the most of the fluid is shaken out. This process was repeated until all faecal colouring material is removed. Up to 50 mL of water was added to the wash jar in order to pour the volumes into Petri dishes and the worms counted. The total number of worms counted in a 200 mL sample is then multiplied by 5 per any liter to give the number of worms present in the part concerned. The collected worms were then preserved in a solution of 70% Ethanol+30% Glycerol for further identification using dissecting microscope according to Hansen and Perry (1994).

Climatic Data

Meteorological data for the year were obtained from the Ministry of Aviation Meteorological Authority Station of Nyala. Monthly mean minimum and maximum temperatures and relative humidity were obtained. Monthly rainfall rate was obtained from Tulus agricultural office.

Statistical Analysis

Data presentation was performed using SPSS computer programme (Version No. 10). Numbers of worms recovered were transformed to geometric means to normalize the data and inference was made accordingly (t-test and correlation).

RESULTS

Out of 79 sheep and 161 goats examined for postmortem examinations, 75 (94.9%) and 136 (84.5%) of sheep and goats were found infected with one or more genera of GIT nematode parasites and *Monieza expansa*, respectively. Animals had, in most cases mixed infection. The nematode parasites identified for sheep were: *Haemonchus contortus* (53.4%), *Strongyloides papillosus* (26.2%), *Trichostrongylus colubriformis* (14.7%), *Cooperia pectinata* (3.1%), *Oesophagostomum columbianum* (2.2%), *Skrjabinema ovis* (0.3%) and *Trichuris globulosa* (0.1%) while, the identified species for goats were: *Strongyloides papillosus* (26.5%), *Haemonchus contortus* (26%), *Trichostrongylus colubriformis* (24.4%), *Skrjabinema ovis* (11.6%), *Oesophagostomum columbianum* (9.9%), *Gaigeria pachyscelis* (1%), *Trichuris globulosa* (0.6%) and *Cooperia pectinata* (0.1%), (Table 1-5). The intensity of the nematode infections was light to moderate in most animals. The overall mean worm

Table 1: Monthly mean worm burden (±SE) of *Haemonchus contortus* in male and female sheep and goats recorded during the survey period (March, 2006-February, 2007)

	Sheep		Goats	
Months	Male	Female	Male	Female
January	0.0	0.0	120.0±10.0	56.0±25.70
February	0.0	0.0	12.0±12.0	102.2±34.30
March	10.0	0.0	33.3±33.3	26.3±23.50
April	0.0	0.0	100.0±40.0	31.3±15.50
May	0.0	533.0±533.0	33.3±28.5	143.8±45.00
June	0.0	40.0	0.0	135.7±49.50
July	188.0±60.40	636.3±293.8	152.9±77.9	110.0±60.00
August	330.4±937.9	785.0±485.0	60.0±26.1	984.0±734.2
September	585.0±315.7	392.0±221.5	115.0±63.6	100.0±59.20
October	60.0	158.6±47.10	405.0±405	82.5±39.30
November	0.0	40.0±40.00	107.5±81.4	123.3±47.40
December	0.0	10.0	317.5±187.5	66.7±33.30
Overall mean	521.8±156.6	332.7±108.1	111.4±28.3	136.9±44.20

Table 2: Monthly mean worm burden (±SE) of small intestinal nematode species in male and female sheep recorded during the survey period (March, 2006-February, 2007)

	Trichostrongylus colubriformis		*Cooperia pectinata*		*Strongyloides papillosus*	
Months	Male	Female	Male	Female	Male	Female
January	0	135	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	0	0	0	0	0	0
May	0	48±48	0	0	0	2±2
June	0	0	10	0	0	0
July	3±3	33.8±33.8	0	26.3±26.3	15±9.5	101.3±49.9
August	74.3±46.9	60±60	55±44.1	30±30	480±230.3	37.5±37.5
September	150±65.7	189±131	98.8±82.9	33±33	1038.8±827.2	249±174.5
October	0	140.7±128.4	0	0	0	52.9±44.1
November	0	825±810	0	7.5±7.5	0	22.5±22.5
December	0	135	0	30	0	0
Overall mean	59.7±24.5	144.8±63.6	41.6±23.7	12.5±6.6	399.5±197.5	71.7±33

Table 3: Monthly mean worm burden (±SE) of small intestinal nematode species in male and female goats recorded during the survey period (March, 2006-February, 2007)

	Trichostrongylus colubriformis		*Gaigeria pachyscelis*		*Cooperia pectinata*		*Strongyloides papillosus*	
Months	Male	Female	Male	Female	Male	Female	Male	Female
January	22.5±22.5	168±88.7	0	1.5±1.5	0	0	7.5±7.5	197±126
February	57±57	160.6±81.4	3±3	1.7±1.7	0	0	3±3	10±5.6
March	0	0	0	0	0	0	0	0
April	0	0	0	0	0	0	0	0
May	45±45	18.1±8	0	10±6.8	0	1.3±1.3	6.7±6.7	53.1±31.8
June	0	67.1±32.7	0	36.4±24.9	0	0	630	97.9±39.8
July	45±28.7	610±610	0	0	0	0	191.4±113.8	60±60
August	13.8±6.3	110±69.3	0	0	0	0	503.8±148.5	71±30.6
September	0	50±30	0	0	0	0	82.5±45.2	50±33.9
October	105±105	170±108	0	0	0	5.6±4	570±555	535±265.1
November	1072.5±954.3	239.2±189.4	11.3±7.2	1.3±1.3	0	0	136.3±85.4	157.1±100.3
December	60±45	32.2±15.5	0	23.3±23.3	0	0	112.5±7.5	81.1±78
Overall mean	139.9±100.5	113.7±32.8	1.5±0.9	6.6±3.2	0	0.6±0.4	160.9±44.8	119.3±33.9

Table 4: Monthly mean worm burden (±SE) of large intestinal nematode species in male and female sheep recorded during the survey period (March, 2006-February, 2007)

	Oesophagostomum columbianum		*Trichuris globulosa*		*Skrjabinema ovis*	
Months	Male	Female	Male	Female	Male	Female
January	0	30	0	0	0	0
February	0	0	0	0	0	0
March	0	10	0	0	0	0
April	0	15	0	0	0	0
May	0	45±34.2	0	2±2	0	3±3
June	0	0	0	0	0	0
July	0	2.5±2.5	0	5±5	0	0
August	25.7±13.4	7.5±7.5	0	0	15±15	0
September	43.8±40.5	26±12.9	0	0	0	0
October	0	3.6±2.4	0	0	0	0
November	0	0	0	0	0	0
December	0	0	0	0	0	0
Overall mean	18.7±9.8	15.3±6.4	0	1±0.7	5.5±5.5	0.5±0.5

burdens being 497.4±108.9 and 477.7±66.3 for sheep and goats, respectively. *Haemonchus contortus*, *Strongyloides papillosus* and *Trichostrongylus colubriformis* were the most prevalent species of the parasites in the study area.

The mean value of Male/Female (M/F) ratio for 12 months was 0.4 for both sheep and goats. However, the highest M/F ratio (1 for sheep and 0.6 for goats) was recorded in March (Table 6). No significant positive or negative correlation was showed between M/F ratio and any of the climatic factors.

Table 5: Monthly mean worm burden (±SE) of large intestinal nematode species in male and female goats recorded during the survey period (March, 2006-February, 2007)

	Oesophagostomum columbianum		*Trichuris globulosa*		*Skrjabinema ovis*	
Months	Male	Female	Male	Female	Male	Female
January	22.5±22.50	48.0±22.3	7.5±7.5	0.0	640.0±640.0	3.0±3.00
February	106.0±96.20	92.8±41.0	10.0±4.5	0.0	36.0±36.00	351.1±267.0
March	230.0±176.9	68.1±23.8	6.7±3.3	5.0±2.7	0.0	0.0
April	55.0±15.00	70.6±19.7	0.0	6.9±3.9	0.0	52.5±52.5
May	0.0	56.9±19.3	0.0	10.0±4.9	421.7±341.4	1.3±1.30
June	15.0	86.4±40.5	0.0	1.4±1.4	0.0	13.6±11.3
July	7.1±4.20	57.5±42.5	2.9±2.9	0.0	10.7±10.70	0.0
August	15.0±8.70	43.0±34.5	2.5±2.5	3.0±3.0	0.0	3.0±3.00
September	3.8±3.80	2.5±2.50	0.0	3.8±3.8	25.0±25.00	63.8±63.8
October	70.0±70.0	16.9±9.60	0.0	0.0	0.0	0.0
November	15.0±8.71	38.8±23.2	7.5±4.3	0.0	63.8±63.80	11.3±10.0
December	15.0±15.0	20.0±9.00	0.0	0.0	90.0±90.00	0.0
Overall mean	44.7±19.2	51.2±7.70	3.7±1.1	2.4±0.7	85.5±42.90	45.8±28.1

Table 6: Monthly male/female ratio of GIT nematodes in sheep and goats recorded during the survey period (March, 2006-February, 2007)

	Male/Female ratio	
Months	Sheep	Goats
January	0.3	0.5
February	0.0	0.5
March	1.0	0.6
April	0.0	0.3
May	0.7	0.4
June	0.7	0.3
July	0.3	0.3
August	0.4	0.5
September	0.3	0.3
October	0.3	0.1
November	0.3	0.4
December	0.5	0.4
Overall M/F ratio	0.4	0.4

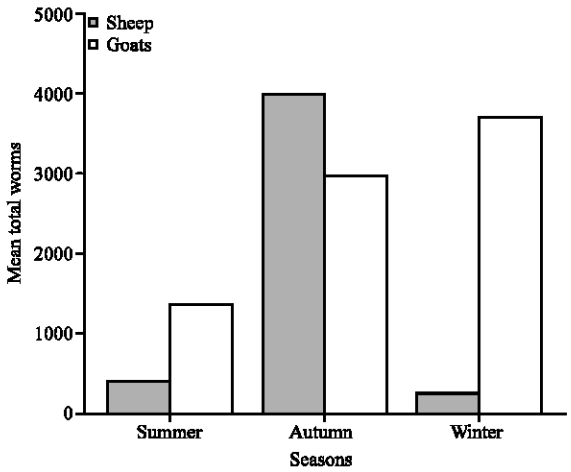

Fig. 2: Total worm burdens of GIT parasites in sheep and goats recorded for the different season during the survey period (March, 2006-February, 2007)

Total worm burdens showed a significant positive different with season and sex (r = 0.463* and r = 0.425*, respectively) in goats only (Fig. 2, 3) while no significant different was showed between

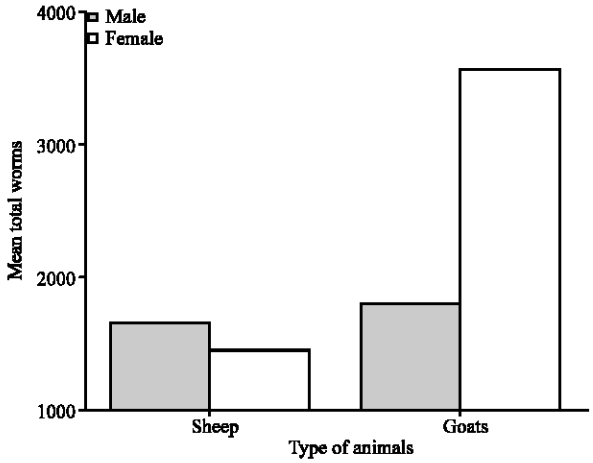

Fig. 3: Total worm burdens of GIT parasites recorded among sex of sheep and goats during the survey period (March, 2006-February, 2007)

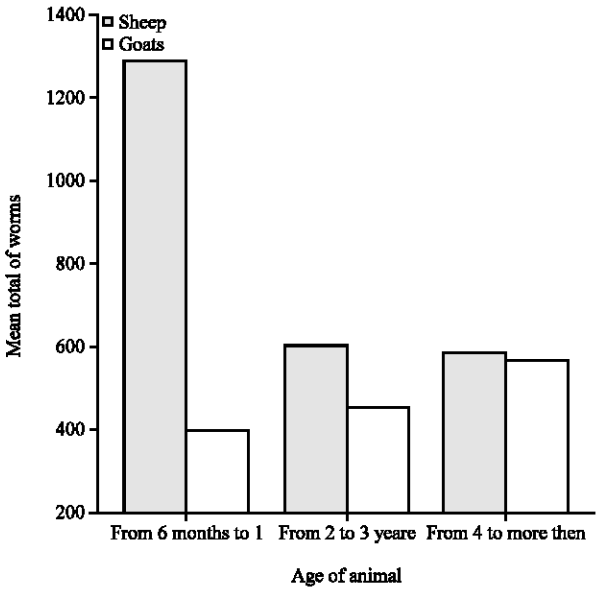

Fig. 4: Total worm burdens of GIT parasites recorded among age groups of sheep and goats during the survey period (March, 2006-February, 2007)

total worm burden and age of the animals in both sheep and goats (Fig. 4). Moreover, there was no significant different showed for total worm burden within months in both sheep and goats (Fig. 5).

Monieza expansa was found in 70.9 and 24.8% of sheep and goats examined, respectively.

The effects of climatic factors on the monthly worm burden of gastrointestinal parasites are shown in Table 7 and Fig. 6.

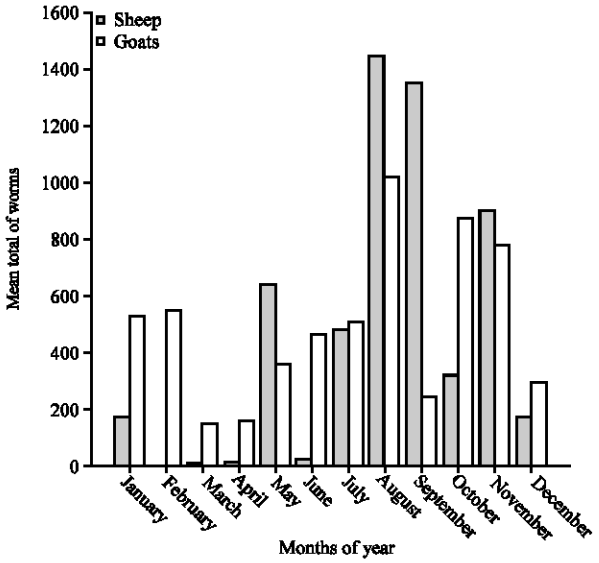

Fig. 5: Monthly total worm burdens of GIT parasites recorded from in sheep and goats during the survey period (March, 2006-February, 2007)

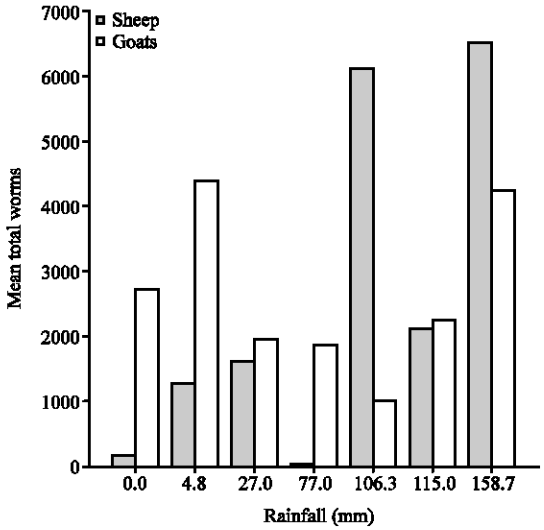

Fig. 6: Monthly total worm burdens recorded from sheep and goats and relationship with rainfall during the survey period (March, 2006-February, 2007)

Table 7: Climatic effects on the worm burden of GIT parasites in sheep and goats recorded during the survey period (March, 2006-February, 2007)

	Worm burden		
Climatic factors (monthly means)	Sheep	Goats	Total
Temperature	(-)	(-)	(-)
Rainfall	(+) r = 0.664**	(-)	(+) r = 0.341*
Relative humidity	(+) r = 0.657**	(-)	(+) r = 0.350*

-: Absence of significant correlation, +: Positive correlation, *p = 0.05, **p = 0.01

DISCUSSION

In the present study, sheep and goats slaughtered in Tulus abattoir were examined for gastrointestinal parasites by examination of gastrointestinal tracts. The earlier study reported seven genera of GIT nematodes in sheep and goats (Bashar *et al*., 2002), but the present study revealed eight species belong to eight genera. In the traditional management of animals in the study area, sheep and goats are grazed together, besides cattle and camels. This parasitological study has shown that they also share the same parasite species with different levels of infection. The same findings were reported by Le Riche (1973) and Tembely *et al*. (1992).

Haemonchus contortus reported as the most predominant parasite in South Darfur State by Ismail *et al*. (2004). The present study confirmed that *Haemonchus contortus* is the most predominant parasite of sheep and goats in Tulus area. However, *Haemonchus contortus* had the highest prevalence in sheep than in goats in the study area.

Although *Trichostrongylus* sp. was reported to has the lowest frequency of infections in comparison with other species (Ahmed and El Malik, 1997), results of this study indicated that this species is one of the most prevalent species in sheep and goats in the study area. Furthermore, the study indicated that *Strongyloides papillosus* also is one of the most prevalent species in sheep and goats. The highest prevalence of *Strongyloides papillosus* in goats may be due to increased resistance against *Haemonchus contortus* in these hosts.

Gaigeria pachyscelis infection in sheep was reported by Eisa *et al*. (1979) checklist of helminthes in the Sudan. In the present study, this parasite was found in goats only with low prevalence. The absence of infection in sheep with said parasite reported here could be attributed to movements of sheep from the higher rainfall regions in autumn, where the parasite thrives in a region with higher rainfall.

Cooperia pectinata in this study had a wide distribution among sheep than goats. It's known that this species occurs more commouly in cattle than in small ruminants. Therefore, cross-infection may happen when they share grazing.

Trichuris globulosa was reported previously from camel in Sudan (Eisa *et al*., 1979). In the present study, *Trichuris globulosa* infected goats with high rate than in sheep. These findings confirmed that the parasite transformed to these animals from camels, since most of goats in the study area reared with camels. In this study, *Skrjabinema ovis* recorded in goats with high rate than in sheep. Thus, *Skrjabinema ovis* is a common parasite of goats. This is in agreement with the earlier findings by Dunn (1978).

This study indicated that sheep had higher infection rates in sheep than goats; this could be linked with grazing habit of sheep. The same finding was reported by Teklye (1991) in Ethiopia and Waruiru *et al*. (2005) in Kenya. Moreover, the study particularly in goats indicated that adult and older animals bear high worm burden and that is in consistent with reports from Gambia (Fritsche *et al*., 1993) and Ethiopia (Fikru *et al*., 2006).

Present results revealed sheep zero worm burden in sheep during February, this may be due to self-cure phenomenon in these animals. These findings support the earlier studies conducted elsewhere (Ismail *et al*., 2004). The study indicated that age of the animals has no effect in the prevalence of the parasites in both sheep and goats. This finding is in agreement with earlier study in Kenya (Githigia *et al*., 2005). Total worm burden was shown to have association with season and sex in goats. These findings were in consent with study conducted recently (Ibrahim *et al*., 2008).

In the present study, the rainfall and relative humidity appears to be the main factors correlated with the seasonality of the GIT parasites distribution where temperature showed no significant positive or negative correlation with GIT nematodes in the study area. Thus, the lowest prevalence observed from December up to the end of summer indicated clearly the environment of the dry season

unfavourableness for the development and survival of the extra host stages of the GIT parasites. This observation is close to that found by Ismail *et al*. (2004) and Sissay (2007). Thus, the infection of GIT parasites observed in the study area during the dry season is due to accumulation of the GIT parasite infections from the previous autumn.

In the present study, damage in the intestinal mucosa was observed in most of the infected sheep and goats by *Trichostrongylus colubriformis* and *Strongyloides papillosus* beside, nodular forms in the intestinal wall in case of *Oesophagostomum columbianum* and haemorrhage in abomasal mucosa in case of *Haemonchus contortus* during examination of GI tracts. Therefore, significant economical losses in production are expected to occur in the study area.

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