

## EPIDEMIOLOGY OF GASTROINTESTINAL HELMINTHIASIS OF RIFT VALLEY GOATS UNDER TRADITIONAL HUSBANDRY SYSTEM IN ADAMI TULU DISTRICT, ETHIOPIA

Etana Debela

Department of Animal Production and Rangeland Management  
Awassa College of Agriculture, Debub University, PO Box 5  
Awassa, Ethiopia, E-mail: aca@telecom.net.et

**ABSTRACT:** The prevalence, mean intensity, relative density of helminth species and the effects of environmental factors, sex and maturity of host on seasonal dynamics in relative density of helminthes ova in Rift Valley goats were investigated from July 1997 to June 1998. Ten nematode and three cestode species were identified. *Haemonchus contortus* was the most prevalent followed by *Strongyloides papillosus* and *Trichostrongylus* sp. with prevalence rate of 66.5%, 36.1% and 30.4% and mean intensities and relative densities of 1139.9, 503.7, 434.8 and 344.9, 82.8, 60.1, respectively. *Moniezia expansa* showed 32.2% prevalence rate and 545.2 and 79.6 mean intensity and relative density, respectively. Mixed infestation was common to Rift Valley goats. About 2.8%, 6.2%, 15.8%, 21.6% and 23.7%, of the examined goats harbored multiple infestations varying from five to one species, respectively. Maturity and sex of hosts influenced seasonal variations in relative density of helminthes species. Female hosts harbored higher relative densities ( $p < 0.005$ ,  $r^2 = 0.91$ ) than male hosts and young hosts harbored significantly higher ( $p < 0.0001$ ,  $r^2 = 0.95$ ) than adult ones. The egg output in July was significantly different ( $p < 0.0001$ ) than other months except in June. The results show that mixed parasite infestation was common in goats. The highest peak of helminthes egg densities coincided with the big rainy season followed by the short rainy season. Therefore, the use of appropriate treatment before and after the rainy season could be a useful strategy to alleviate the problem. Moreover, more attention is needed for young and female goats, as they are the most affected groups.

**Key words/phrases:** Eggs, epidemiology, mean intensity, relative density, Rift Valley goats, traditional husbandry

### INTRODUCTION

Goats are among the most widely kept animals in Ethiopia and they are kept in a wide range of production systems. Ethiopia has an estimated population of 17 million goats (FAO, 1987). According to Janke (1982), 38% are in arid, 22% in semi-arid, 5% in sub-humid and 35% in highland areas of Ethiopia. Parasites are known to hamper small ruminants' production and productivity in Ethiopia. Several authors (Dayne and Graber, 1974; Graber, 1975; 1978; Bekele Mamo *et al.*, 1981; Gebrekiros Asegede, 1981; Bekele Mamo

*et al.*, 1982; Brooke Lemma, 1983; Tekelye Bekele *et al.*, 1987) described the situation of ovine helminthiasis in Ethiopia but no information is available so far on goats' helminthiasis. It is reasonable to check the quantitative and qualitative aspects, seasonal dynamics and the effect of environmental factors, maturity and sex of the host on relative density of gastrointestinal parasites in goats than extrapolating result from sheep to goats and knowledge of these variables would be useful in formulating an appropriate measure of control.

## MATERIALS AND METHODS

### *Description of the study area*

The study was conducted in Adami Tulu district, which is located at 160 km south of Addis Ababa. The area has bimodal rainfall pattern. The short rainy season is from April to May and the main rainy season is from June to August. The average short rains range between 200–300 mm, whereas the average big rains vary between 500 and 600 mm. The area is a dry savanna with scattered acacia trees and bushes with high average annual temperature (EMA, 1988).

Livestock raising seems to be an age-long production system followed by crop production in the area. The major component of livestock are cattle and goats which are managed under traditional husbandry system in permanent settlements where there is some crop residue for fodder and in good proximity to Lake Zway for watering every day or every other day. Goats feed mainly on Acacia pods during the dry months. Kids are commonly managed together with adult goats and no regular cleaning of pellet is performed. Goats in the area commonly follow the same route and site for grazing and watering. Previous studies indicate that veterinary services are inadequate in the area (Hailu Yohannes, 1994).

### *Parasitological techniques*

Fecal samples were collected from the Ampullae recti of 499 Rift Valley goats. The degree of infestation was measured by egg counting and results were expressed as egg per gram (EPG) feces. Helminthes ova identifications were done based on illustrations given in Soulsby (1968). The age (as young and adult) and sex of the animals were recorded during fecal sample collections.

### *Data analysis*

Important variables were calculated as prevalence (percentage of hosts infested); mean intensity (mean number of helminth eggs per infested host) and relative density (mean number of eggs per host examined). These ecological terminologies were adopted from Margolis *et al.* (1982). The data

were analyzed using ANOVA, Statistical Analysis System (SAS, 1996). Tukey's Standard Range (HSD) Test was used for mean comparison. Meteorological data were obtained from Adami Tulu Research Centre.

## RESULT

### *Prevalence, mean intensity and relative density of helminthes egg*

The eggs of helminth species identified are shown in Table 1. From a total of 499 goats, 262 (104 female and 158 male) young and 237 (143 female and 94 male) adults examined, 45.5% (n=227) were infested by different helminth species. About 59.6% young female, 52.5% adult female, 47.5% young male and 22.8% adult male were infested by different helminth species. Thirteen helminth species (10 nematodes and 3 cestodes) were identified. The most frequent among nematodes were *Haemonchus contortus* (65.5%), *Strongyloides papillosus* (36.1%), *Trichostrongylus sp.* (30.4%), whereas *Moniezia expansa* (32.2%) was the most prevalent among identified Cestodes. In this survey, about 2.8%, 6.2%, 15.8%, 21.6% and 23.7%, of the examined goats harbored multiple infestations varying from five to one species, respectively.

Table 1. Prevalence, mean intensity and relative density of helminthes species identified from feces of Rift Valley goats.

Helminth species	No. of host infested	Overall Prevalence (n=499)	Prevalence among infested (n=227)	Mean intensity	Relative density
<i>Haemonchus contortus</i>	151	30.3	66.5	1139.7	344.9
<i>Strongyloides papillosus</i>	82	16.4	36.1	503.7	82.8
<i>Trichostrongylus sp.</i>	69	13.8	30.4	434.8	60.1
<i>Trichuris sp.</i>	11	2.2	4.9	827.3	18.0
<i>Nematodirus sp.</i>	14	2.8	6.2	550.0	15.4
<i>Chabertia ovina</i>	25	5.0	11.0	344.0	17.2
<i>Bunostomum trigonocephalum</i>	27	5.4	11.9	403.7	21.8
<i>Oe. venulosum</i>	14	2.8	6.2	185.7	5.2
<i>Ost. circumcincta</i>	47	9.4	20.7	319.2	30.1
<i>Marshallagia marshalli</i>	40	8.0	17.6	75.0	6.0
<i>Moniezia benedeni</i>	20	4.0	8.8	90.0	3.6
<i>Moniezia expansa</i>	73	14.6	32.2	545.2	79.6
<i>Avitellina sp.</i>	9	1.8	4.0	244.4	4.4

*Haemonchus contortus* ranked the highest with mean intensity and relative density of 1139.7 and 344.90, respectively. Even though the prevalence of *Trichuris sp.* was the lowest (4.9%), it is second after *Haemonchus contortus* in its mean intensity (827.3). The rest of the species of helminth eggs showed similar and steady intensity pattern, which fell between 75.0 and 550.0. The relative densities of *Strongyloides papillosus*, *Moniezia expansa* and *Trichostrongylus sp.* were 82.8, 79.6 and 60.1, respectively.

Maturity of host, host sex, rainfall, air temperature and relative humidity of the area influenced variations in relative density of helminthes egg during

the study period. Young goats showed higher relative densities than adults. Female goats produced higher helminthes egg densities than males. Increase in rainfall and relative humidity coincided with increase in egg densities whereas increase in air temperature resulted in low densities of helminthes egg output (Fig. 1).

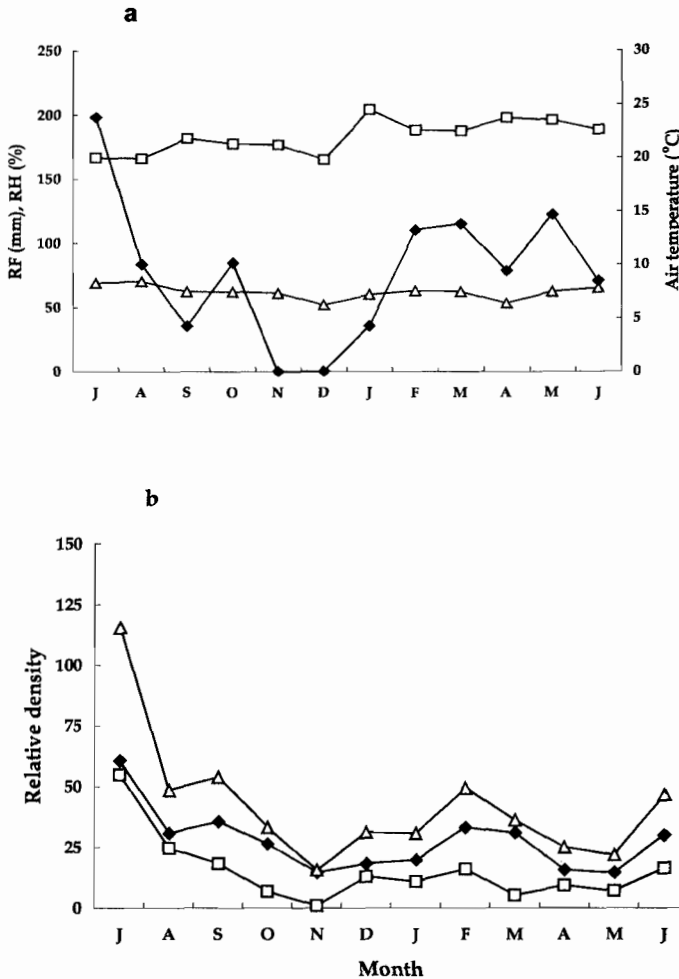


Fig. 1. The effect of environmental factors (□ = air temperature, ◆=rainfall, Δ=relative humidity) (a), and host maturity (Δ=overall, □=adult, ◆=young) (b) on variations in relative density of helminthes ova in the feces of Rift Valley goats.

The highest was in June (35.6), July (60.6), September (35.7) and August (30.8) for young ones and the least was during November (28.9), April (15.8) and May (14.8) (Fig. 1). The lowest relative densities in adult goats were observed during November-December, March and May. The highest relative densities

for adult goats were recorded during June and July. The higher relative densities in October, December, February and June were mainly due to *Haemonchus contortus*, *Strongylus papillosus* and *Moniezia expansa*.

Relative increase in overall relative densities of helminthes was observed during February and March. When the data were pooled according to season the egg count was not significantly different in June, August and October. However, the count was significantly different ( $p < 0.0001$ ) in July with other months except June.

The mean monthly relative density for females and males in relation to environmental factors is shown in Figure 2. Variations were observed in relative densities of helminth eggs. Female goats showed significantly higher relative densities ( $p < 0.0001$ ) than male goats. The overall higher peaks in relative densities were during June (81.0), July (146.8), August (71.6), September (58.4) and October (61.4). The egg output in July was significantly different ( $p < 0.0001$ ) from other months of the year. The least was in November, December, January and May in male goats.

#### *The effect of sex and maturity of host on mean relative density of individual helminth species*

The combined sex and maturity effect on relative density of helminthes is presented in Table 2. Variations in relative densities of individual helminthes were observed in relation to maturity and sex of the host. Female hosts harbored higher relative densities of helminthes than male hosts.

**Table 2. Mean relative density of helminthes egg with respect to sex and maturity.**

Helminthes species	Female Host			Male Host		
	Young	Adult	Mean	Young	Adult	Mean
<i>H. contortus</i>	129.9	51.6	90.8	45.0	50.0	47.5
<i>Strong papillosus</i>	59.1	34.8	47.0	45.1	20.9	33.0
<i>Trichostrongylus sp.</i>	36.0	31.4	33.7	43.0	24.0	22.0
<i>Trichuris sp.</i>	25.7	23.1	24.4	14.1	11.5	12.8
<i>Nematodirus sp.</i>	20.5	18.2	19.4	14.7	12.3	13.5
<i>Chabertia ovina</i>	16.2	12.7	14.5	10.2	6.6	8.4
<i>B. trigonocephalum</i>	24.8	3.2	14.0	30.7	3.2	17.0
<i>Oe. venulosum</i>	24.1	45.2	20.5	16.8	3.0	24.1
<i>Ost. circumcincta</i>	32.7	28.4	25.7	18.6	14.2	21.3
<i>M. marshalli</i>	4.2	4.2	4.2	2.4	2.4	2.4
<i>Moniezia benedeni</i>	2.4	1.8	2.1	1.9	1.4	1.7
<i>Moniezia expansa</i>	75.4	53.3	64.4	53.3	31.3	42.3
<i>Avitellina sp.</i>	7.6	7.2	7.4	5.5	3.9	4.1

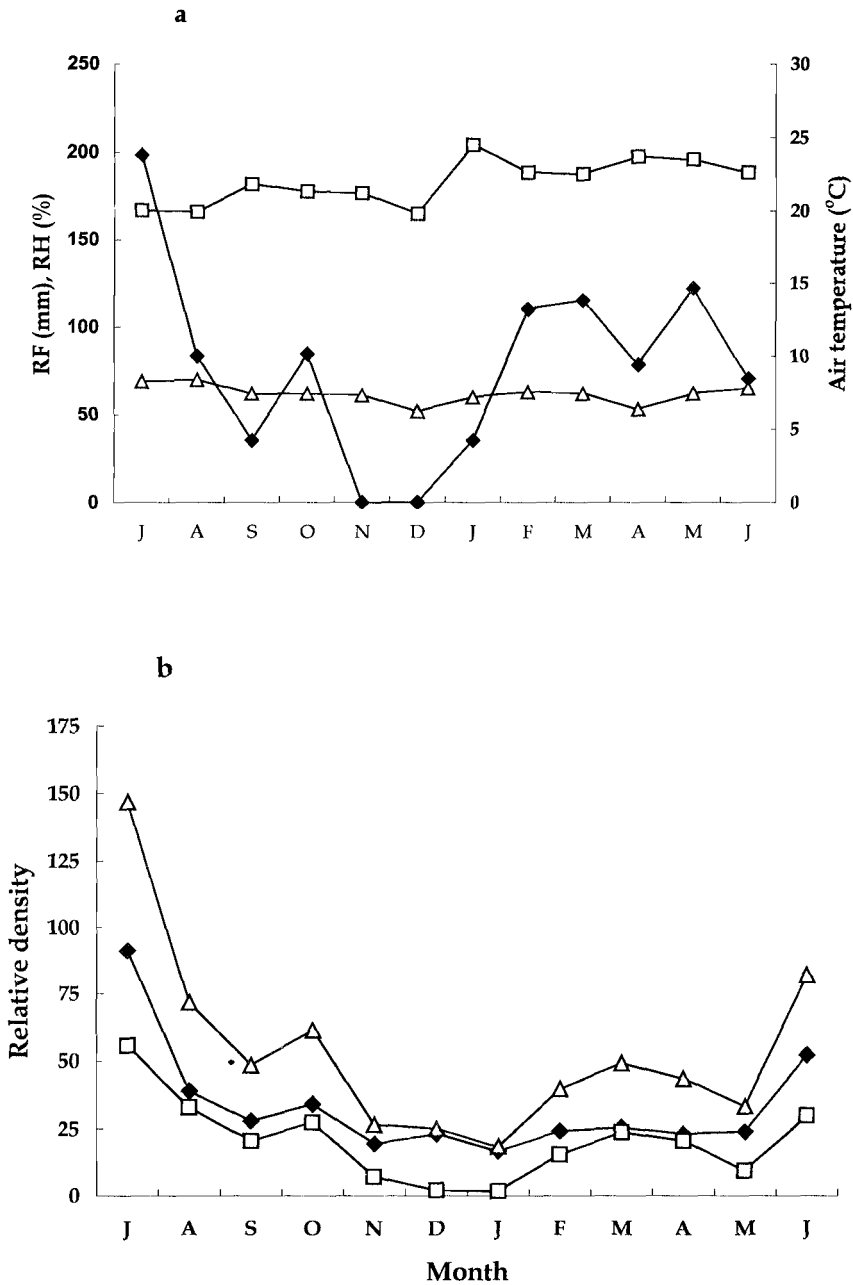


Fig. 2. The effect of environmental factors (□ = air temperature, ♦ = rainfall, Δ = relative humidity) (a), and host sex (Δ = overall, □ = adult, ♦ = young) (b) on variations in relative density of helminthes ova in the feces of Rift Valley goats.

## DISCUSSION

Gastrointestinal helminthes appeared to be common in Rift valley goats of Ethiopia. The results obtained in this study are similar with the findings of some authors elsewhere in Africa. Fakae (1990) reported the prevalence of *Haemonchus contortus*, *Trichostrongylus spp.*, *Strongyloides sp.*, *Moniezia expansa*, *Bunostomum trigonocephalum* and *Trichuris ovis* in small ruminants under traditional husbandry system in Nigeria as 87.1%, 63.8%, 18.8%, 6.0%, 4.3% and 3.5%, respectively. Elisabeth (1982) reported that the highest prevalence of *Haemonchus contortus* and occurrences of *Strongyloides papillosus*, *Moniezia expansa* and *Trichuris* in goats and their seasonal rise occurred after the onset of heavy rains reaching peak values in February and May.

Fabiyi (1970) surveyed 150 West African Dwarf (WAD) goats and found infestations by *Haemonchus* (89%), *Trichuris spp.* (56%) and *Strongyloides papillosus* (40%). Fabiyi (1973) defined the seasonal incidence of different species and revealed that worm burdens were highest during the rainy season such that *Haemonchus spp.* predominated during June to August and *Strongyloides papillosus* during June, July and in September again. The findings in this survey are in agreement with the findings of the above authors except some differences in prevalence rates, which could be attributed to differences in management and the fact that different responses of the same parasite species in different geographical zones are an attempt by the parasite to adapt to its particular environment (Gibbs, 1986).

Mixed infestations were also prevalent. In this survey, about 2.8%, 6.2%, 15.8%, 21.6% and 23.7%, of the examined goats harbored multiple infestations varying from five to one species, respectively. These results confirm the findings of Asanji and Williams (1987a) who reported that only 20% contained five species, 27.5% four species, 18% three species, 11.5% two species, and 10% one species and the rest six species. The phenomenon of infestation of a given host by multiple helminth species could be an indication of the level of the nutritional status of the host and veterinary animal health services provided to the farming community of the area and calls for corrective measures in feeding and veterinary health care.

The mean intensities and relative densities of some helminthes found during this survey were higher than what was reported by Asanji and Williams (1987b) and this could be because of the fact that goats under this study were usually congregated at watering points together with sheep and cattle of different classes and such husbandry methods and practices may cause re-infestation and probably transmission of some helminthes common to them. On the other hand, the moisture available from the Rift Valley lakes together with the surrounding temperature could also maintain persistence of some helminth larvae and eggs to be picked by goats during grazing and while resting under trees and around watering points.

According to Michel *et al.* (1979), age can affect the nematodes egg output and Albers *et al.* (1987) observed lower egg counts in older than in younger animals. Gibson and Parfitt (1972) reported that young lambs are unable to develop resistance to infection but this ability increases as they grow old. Manton *et al.* (1962) in their experiment on lambs of 10–12 months and 2–4 months of age with *Haemonchus contortus* showed that the older groups resisted whereas the younger ones contracted the infection. Asanji (1988) stated that the mean relative densities were significantly higher in young hosts and reached a high peak from August to December. The result obtained in this survey agrees with the above findings in that young goats showed higher relative densities than adult goats.

The sex of the host was found to be an influencing variable on the relative densities of helminthes species. Female goats harbor higher helminthes egg densities ( $p < 0.005$ ) than male hosts. The combined effect of sex and maturity of the host on relative density of helminthes egg also showed that female hosts harbor higher relative densities of helminthes than male hosts. Young goats harbor significantly higher egg load ( $p < 0.0001$ ) than adult ones. These results confirm the findings of previous studies (Reddington *et al.*, 1981; Asanji and Williams, 1987 a and b).

It is important to mention the extent of mixed infestation in goats, which could be attributed to low level of nutrition and weak status of animal health services given to the traditional farming communities in that particular region.

Based on the results it would be possible to conclude that (1) female goats carry higher helminth load than male goats, (2) young goats harbor more helminth eggs than adult ones and (3) mixed parasite infestation is common in goats. The latter is an indication of the weak status of animal health services and suboptimal nutritional level in the study area, which calls for corrective measures in feeding and dehelmination practices. The highest peak of helminth count was recorded during the big rainy season. The use of appropriate treatment before and after the rainy season could thus be a useful strategy to alleviate the problem. Moreover, more attention is needed for young goats below one year of age and for female goats, as they are the most affected groups.

#### ACKNOWLEDGEMENTS

My thanks go to the Ministry of Economic Development and Cooperation of Ethiopia for financing the project. I would like to express my gratitude to Dr. Fekadu Beyene and Dr. Adugna Tolera for their comment on the draft of the manuscript. I am also very grateful to Ato Marga Bayissa and Arega Getaneh for their help during sampling and identification of the parasites.



## REFERENCES

1. Albers, G.A.A., Gray, G.D., Piper, L.R., Barker, J.S.F., Le Jambre, L.F. and Barger, I.A. (1987). The genetic resistance and resilience to *Haemonchus contortus* infections in young Merino sheep. *Intern. J. Parasitol.* 17:1355-1363.
2. Asanji, M.F. and Williams, M.O. (1987a). A quantitative survey and seasonal dynamics of gastrointestinal helminth parasites of livestock in Kenya. *Bull. Anim. Hlth. Afr.* 35:191-199.
3. Asanji, M.F. and Williams, M.O. (1987b). Variables affecting the population dynamics of gastrointestinal helminth parasites of small ruminants in Sierra Leone. *Bull. Anim. Hlth. Prod. Af.* 35:308-313.
4. Asanji, M.F. (1988). Haemonchosis in sheep and goats in Sierra Leone. *J. Helminthol.* 62:243-249.
5. Bekele Mamo, Fiseha Geabreab and Shibru Tedla (1981). Observations on *Dictyocaulus filaria* in Welo and Arsi Administrative regions of Ethiopia. *Eth. J. Agric. Sci.* 3: 75-80.
6. Bekele Mamo, Shibru Tedla and Fiseha Geabreab (1982). Survey of gastrointestinal helminths in sheep slaughtered at the Addis Ababa abattoir, Ethiopia. *Eth. J. Agric. Sci.* 4:87-93.
7. Brook Lemma (1983). The epidemiology of *Fasciola* and some other nematodes in four ecological regions in Ethiopia. MSc Thesis, Addis Ababa University.
8. Dayne, P. and Graber, M. (1974). Principales helminthoses des animaux domestiques en Ethiopie. *Res. Elev. Med. Vet. Pays Trop.* 27:301-306.
9. Elisabeth, J.K. (1982). Seasonal incidence of helminths in sheep and goats in south Mozambique. *Veterinary Parasitol.* 11:317-323.
10. Ethiopian Mapping Authority (EMA) (1988). *National Atlas of Ethiopia*. Berhanena Selam Printing Press, Addis Ababa. 77 pp.
11. Fabiyi, J.P. (1970). An investigation into the incidence of goats' helminth parasites in the Zaria area of Nigeria. *Bulletin of Epizootic Diseases of Africa.* 18:29-34.
12. Fabiyi, J.P. (1973). Seasonal fluctuations of nematode infestations in goats in the savanna belt of Nigeria. *Bulletin of Epizootic Diseases of Africa.* 21:277-286.
13. Faka, B.B. (1990). The epidemiology of helminthosis in small ruminants under the traditional husbandry system in eastern Nigeria. *Veterinary Research Communications* 14:381-391
14. Food and Agriculture Organization of the United Nations (FAO) (1987). *FAO Production Yearbook* Vol. 41. Rome, Italy.
15. Gebrekiros Asegede (1981). The study of ovine helminthiasis in Awassa and the effect of control with Nilzan. MSc Thesis, Addis Ababa University. Ethiopia.
16. Gibbs, H.C. (1986). Hypobiosis in parasitic nematodes - An update. *Adv. Parasitol.* 25:129-174.
17. Gibson, T.E. and Parfitt, J.W. (1972). The effect of age on the development by sheep of resistance to *Trichostrongylus colubriformis*. *Res. Vet. Sci.* 13:529-535.
18. Graber, M. (1975). Helminths and helminthiasis of domestic and wild animals of Ethiopia. *Bull. Epiz. Dis. Afr.* 23:57-86.

19. Graber, M. (1978). Helminths and helminthiasis of domestic and wild animals of Ethiopia. *Inst. Elev. Med. Vet. Pays Trop.* 1:13-195.
20. Hailu Yohannes (1994). Resource use systems in the semi-arid areas of southern Shoa: A case study from Zway area. Result of a preliminary survey. Annual research report, Addis Ababa University, Awassa College of Agriculture.
21. Manton, V.J., Peacock, A., Poynter, R.D., Silverman, P.H. and Terry, R.J. (1962). The influence of age on naturally acquired resistance to *Haemonchus contortus* in lambs. *Res. Vet. Sc.* 3:308-314.
22. Margolis, L., Holmes, J.C., Esch, G.W., Kuris, A.M. and Schad, G.A. (1982). The use of ecological terms in parasitology (Report of an ad hoc committee of American Society of Parasitologists). *The Journal of Parasitology* 68:131-133.
23. Michel, J.F., Lancaster, M.B. and Hong, C. (1979). The effect of age, acquired resistance, pregnancy and lactation on some reactions of cattle to infection with *Ostertagia ostertagi*. *Parasitol.* 79:157-168.
24. Janke, H.E. (1982). *Livestock Production Systems and Livestock Development in Tropical Africa*. Kieler Wissenschaftsverlag Vauk, Kiel, Germany. 273 pp.
25. Reddington, J.J., Stewart, G.L., Kramar, G.W. and Kramar, M.A. (1981). The effect of host sex and hormones on *Trichnella Spiralis* in the mouse. *Journal of Parasitology* 67:545-548.
26. SAS (1996). *The Statistical Analysis System*. SAS Institute Inc., Cary, North Carolina.
27. Soulsby, E.J.L. (1968). *Helminths, Arthropods and Protozoa of Domesticated Animals*. 6<sup>th</sup> ed., Bailliere, Tindall and Cassel, London.
28. Tekelye Bekele, Mukasa-Mugerewa, E. and Scholtens, R.G. (1987). Seasonal changes in nematode fecal egg counts of sheep in Ethiopia. *ILCA Bulletin* 29:9-11.