Abomasal nematodes of small ruminants of Ogaden region, eastern Ethiopia : prevalence, worm burden and species composition

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SUMMARY

A study was carried out to determine the prevalence, species composition and worm burden of abomasal nematodes of small ruminants of Ogaden region slaughtered at Elfora export abattoir. A total of 196 abomasums of animals (114 sheep and 82 goats) were examined according to standard procedures. An overall prevalence rate of 91.2% and 82.9% Haemonchus species was recorded in sheep and goats, respectively. Likewise, an overall prevalence of 37.7% and 40.2% Trichostrongylus axei was recorded in sheep and goats, respectively. Statistically significant (p < 0.05) difference in prevalence and average worm burden was noted between months of study for both abomasal nematodes. Majority of sheep and goats harboring adult abomasal nematodes were with light to moderate degree of infection whereas only small proportions were with heavy degree of infection. Adult male Haemonchus worms collected from sheep were identified as 95.1% H. contortus, 3.4% H. placei and 1.2% H. longistipes. Similarly, male Haemonchus recovered from goats were identified as 96.5% H. contortus, 3.0% H. placei and 0.5% H. longistipes. The study revealed the coexistence and sympatry of communities of two or three Haemonchus species in a single small ruminant host, suggesting occurrence of Haemonchus species circulation among heterologous hosts sharing the same pastures that should be considered in the control strategy of the parasite.

Keywords : sheep, goat, abomasum, Haemonchus, Trichostrongylus, prevalence, worm burden, Ogaden.

Introduction

Although Ethiopia possesses the highest number of livestock population in Africa, with an estimated 23.6 million sheep and 23.3 million goats, the productivity of this livestock is generally lower than the African average [7]. Sheep and goats, requiring little inputs, play vital role in rural economy through provision of meat, milk, blood, cash income, accumulating capital, fulfilling cultural obligations, manure, and contribute to the national economy through the export of live animals, meat and skins [5].

Helminth infections in domestic ruminants are of major importance in many agro-ecological zones in Africa and had the highest index as an animal health constraint to the poor keepers of livestock worldwide through losses due to reduced weight gains and growth rate, reduced nutrient utilization, lower meat, wool and milk production, involuntary culling, cost of treatment and mortality [3].

Gastrointestinal nematodes are recognized as a major constraint to both small and large-scale small ruminant production in developing countries, leading to significant economic losses [22]. The abomasal nematode Haemonchus contortus is particularly important and causes severe anaemia and death in severely infected animals [3]. PERRY [22] identified haemonchosis as one of the top ten constraints to sheep and goat rearing in east Africa.

Review of the available literature in Ethiopia strongly suggests that helminthosis has nationwide distribution and is also considered as one of the major setbacks to livestock productivity incurring huge indirect and direct losses in the country. TILAHUN [25] and GEZAHEGN [14] indicated that helminthosis is responsible for causing an estimated

RéSUMÉ

Prévalence, espèces et charge parasitaire ennématoïdes dans l’aboma-
sum des petits ruminants de la région d’Ogaden (Éthiopie de l’Est)

Une étude a été mise en oeuvre afin de déterminer la prévalence, les espè-
ces et la charge parasitaire en nématodes dans l’abomasum des petits rumi-
nants de la région d’Ogaden, abattus l’abattoir d’Elfora, agrée pour
l’exportation. Un total de 196 abomasum on été examinés selon des procé-
dures standard (114 moutons et 82 chèvres). Pour les espèces d’Haemon-
chus, une prévalence générale de 91,2% et 82,9% a pu être observée chez les
moutons et les chèvres respectivement. De même, une prévalence de 37,7%
et 40,2% a été observée pour Trichostrongylus axei chez les moutons et les
chèvres, respectivement. Une différence statistiquement significative
(p<0,05) dans la prévalence et la charge parasitaire moyenne a pu être notée
en fonction de la période de l’année, et ce pour les deux nématodes de l’abo-
amasum. La majorité des moutons et des chèvres porteurs des formes adultes
des parasites présentaient un degré modéré d’infestation, seule une faible
proportion des animaux étudiés étaient fortement infestés. Les mâles adultes
d’Haemonchus ont été identifiés comme H. contortus (95,1%), H. placei
(3,4%) et H. longistipes (1,2%). De la même façon, les espèces et leur pro-
portions respectives sont similaires pour les caprins. Cette étude a mis en
évidence la coexistence possible de 2 ou 3 espèces d’Haemonchus chez un
môme hôte, suggérant que le passage possible du parasite à des hôtes hétéro-
logues places sur les mêmes pâturages doit être pris en considération dans les
stratégies de contrôle de ces parasites.

Mots-clés : mouton, chèvre, abomasum, Haemonchus, Trichostrongylus, prévalence, charge parasitaire, Oga-
den.
annual loss of US$ 400 million to the Ethiopian meat industry and the export of livestock to foreign markets.

In Ogaden region livestock represent the pillar of the economy and plays a vital role in livelihood of the farming communities [23]. Of the endoparasites, the abomasal nematode *H. contortus* is incriminated as the dominant cause of parasitic gastroenteritis and exerts a severe economic toll in sheep and goats of Ethiopia. On the contrary most studies on small ruminants for Ogaden region are scanty and unpublished and have basic limitations both in scope and coverage. Therefore comprehensive information on regional or national basis on this widely distributed, most pathogenic and economically very important abomasal nematodes such as *H. contortus* can be used as a baseline data to design sound helminth control strategy. The present study was therefore aimed at determining the prevalence, species composition, and worm burden of abomasal nematodes of small ruminants of Ogaden region in Ethiopia.

**Materials and methods**

**STUDY AREA**

The study was conducted on sheep and goats of Ogaden region that were slaughtered at Elfora Export abattoir based at Debre Zeit town. Ogaden, the origin of the study animals, is located at 9°20’ N in the eastern part of Ethiopia and is one of the semiarid parts of the country. During the study period Ogaden receives an average rainfall ranging from 250-600mm and have a mean temperature ranging from 25-35°C with an average altitude of 1200 m above sea level [6].

**STUDY ANIMALS AND SAMPLE COLLECTION**

From August 2003 to March 2004 a total of 114 sheep and 82 goat abomasums were examined and used to determine prevalence, species and monthly worm burden of abomasal parasites. The age of the animals ranges from 1–5 years. The abomasum was removed from the abdominal cavity and ligated at both ends and immediately taken to the laboratory of veterinary parasitology of faculty of veterinary medicine for appropriate examinations. From the total sheep and goats examined 32 sheep and 24 goats abomasums were used for studying monthly distribution of mucosal larvae (L₄) of *Haemonchus* species. In addition a minimum of fifteen adult male haemonchus worms per abomasum were recovered from a total of 76 sheep and 55 goats for identification of species of *Haemonchus* based on morphometrics of male spicules as described by Jacquet [18].

**ABOMASAL WORM RECOVERY, IDENTIFICATION AND COUNT**

A total of 114 and 82 respective abomasums of sheep and goats were collected from Elfora export abattoir during the study period. Classical procedure as described in MAFF [19] and Hansen and Perry [16] was employed for abomasal worm recovery, counting and species identification. The abomasum was opened along its greater curvature the contents filtered through sieve of 250μm aperture that can retain larvae therein. The abomasal contents were washed into a bucket up to a total volume of 2 litters from which an aliquot of 200ml was transferred to a labeled graduated beaker and preserved in 10% formalin. A sub sample of 20ml was taken into a petridish for examination of abomasal worms under stereomicroscope. For those positive abomasal samples the number of worms were determined by multiplying 20ml(aliquot) X 100(factor) and the degrees of infection was categorized as light (1- 500 *Haemonchus* and 1-1000 *T. axei*), moderate (501-1500 *Haemonchus* and 1001-10,000 *T. axei*) or heavy (greater than 1500 *Haemonchus* and greater than 10,000 *T. axei*) as described by Hansen and Perry [16].

Mucosal larvae (L₄) recovery, identification and counting was performed according to the standard technique of Williams incubation technique in saline solution as described in Wood [27] and Urquhart [26] by incubating the washed abomasal mucosa surface down in saline solution at 40°C for 4 hours and poured into 38 μm then the residue is examined under microscope for mucosal larvae (L₄).

**IDENTIFICATION OF SPECIES OF HAEMONCHUS**

The species of *Haemonchus* were identified according to the method developed by Jacquet [18], which is a rapid, easy and permits identification of all species of *Haemonchus*. The method is very useful in the study of sympatric populations comprising two or three species of *Haemonchus* and utilizes a discriminate function (DF) that combines three different morphometric measures on male spicules: total length (TL), distance from the hook to the tip of the right spicule (THR) and distance from the hook to the tip of the left spicule (THl) were measured using a calibrated ocular micrometre under a compound microscope.

**DATA ANALYSIS**

Microsoft Excel soft ware was used to store all the data and analysis of simple statistics. Soft ware program called Stata 2003 version and SPSS 11.5 for windows were used for data analysis. The prevalence of abomasal parasites, monthly worm burdens and value of mucosal larvae were all compared by ANOVA. When P value is less than 0.05 the presence of significant difference is considered. Mean, confidence interval, percentage value, standard deviation and standard error were all used when appropriate to compare and describe abomasal parasites in both host species.

**Results**

**ABOMASAL NEMATODES PREVALENCE, BURDEN AND SPECIES**

Out of the total 114 sheep abomasums examined an overall prevalence rate of 92.9% of abomasal nematodes was
recorded. Two genera of abomasal nematodes were identified from sheep with prevalence of 91.2% \textit{Haemonchus} spp and 37.7\% \textit{T. axei} (Figure 1). On the other hand out of the total 82 goat abomasums examined an overall prevalence rate of 90.2\% of abomasal nematodes was recorded, with specific prevalence of 82.9\% \textit{Haemonchus} and 40.2\% \textit{T. axei} (Figure 2). Statistically significant (P<0.05) difference was noted in the prevalence of both abomasal nematodes in different months of the study period. In both host species other genera of abomasal nematodes like Teladorsagia weren’t encountered...

In the present study the monthly average worm burden of \textit{Haemonchus} in sheep was highest in August (1433.1) and lowest in December (388.9) as indicated in (Table I). \textit{T. axei} burden in sheep was highest in August (638.5) and the least in December (44.4). As for goats burden of \textit{Haemonchus} is highest in December (914.5) but lowest in March (450.0) whereas \textit{T. axei} was highest in December (572.7) and lowest in March (210.0) as indicated in (Table II). As it can be seen from (Tables I and II) sheep were generally more heavily infected than goats. The worm load of \textit{Haemonchus} species showed statistically significant (P < 0.05) difference among months of the study period in both host species.

Of those animals harboring haemonchus spp 55.8\% sheep and 66.2\% goats were with light degree of infection, 36.5\% sheep and 30.9\% goats were with moderate degree and the rest 7.7\% sheep and 2.9\% goats were with heavy degree of infection (Table III). As for \textit{T. axei} 83.7\% sheep and 81.8\% goats were with light degree, 16.3\% sheep and 18.2\% goats were with moderate degree of infection and no animal was found with heavy infection of \textit{T. axei} (Table III).

The contribution of the mucosal larvae (L\textsubscript{4}) stage to the overall total worm burdens of \textit{Haemonchus} species in sheep and goats were 5.0\% and 5.3\% respectively (Figure 3). Statistically insignificant (P > 0.05) difference was observed between different months of the study period both in sheep and goats.

<table>
<thead>
<tr>
<th>Month</th>
<th>No of sheep examined</th>
<th>\textit{Haemonchus}</th>
<th>T. axei</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>95% CI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UB</td>
<td>LB</td>
</tr>
<tr>
<td>August</td>
<td>13</td>
<td>1433.1</td>
<td>1067.2</td>
</tr>
<tr>
<td>September</td>
<td>14</td>
<td>1020.0</td>
<td>598.3</td>
</tr>
<tr>
<td>October</td>
<td>16</td>
<td>867.5</td>
<td>625.8</td>
</tr>
<tr>
<td>November</td>
<td>10</td>
<td>934.0</td>
<td>497.6</td>
</tr>
<tr>
<td>December</td>
<td>9</td>
<td>388.9</td>
<td>168.5</td>
</tr>
<tr>
<td>January</td>
<td>18</td>
<td>495.7</td>
<td>320.6</td>
</tr>
<tr>
<td>February</td>
<td>14</td>
<td>522.9</td>
<td>335.8</td>
</tr>
<tr>
<td>March</td>
<td>20</td>
<td>416.0</td>
<td>264.6</td>
</tr>
</tbody>
</table>

\text{CI: confidence interval, UB: upper bound, LB: lower bound}

\text{Table I: Monthly mean worm burden and 95% confidence interval of Haemonchus and T. axei in sheep (n=114)}
Of the 1159 mature male Haemonchus worms collected from sheep 1102 (95.1%) \textit{H. contortus}, 46 (3.4%) \textit{H. placei} and 17 (1.5%) \textit{H. longistipes} were identified. Likewise from goats of the 841 adult male \textit{Haemonchus} collected 812 (96.5%) \textit{H. contortus}, 25 (3.0%) \textit{H. placei} and 4 (0.5%) \textit{H. longistipes} were identified (Table IV). Statistically significant difference wasn’t observed in the proportions of the three Haemonchus species between sheep and goats ($P > 0.05$). \textit{H. contortus} was identified as the dominant species as it was harbored by 100% sheep and 100% goats on the other hand \textit{H. placei} infected 28.9% sheep and 34.5% goats whereas \textit{H. longistipes} infected 14.5% sheep and 5.4% goats (Table IV).

### Table II: Monthly mean worm burden and 95% confidence interval of in Haemonchus and \textit{T. axei} in goat (n=82).

<table>
<thead>
<tr>
<th>Month</th>
<th>No of goat examined</th>
<th>Haemonchus</th>
<th>\textit{T. axei}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>95% CI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UB</td>
<td>LB</td>
</tr>
<tr>
<td>October</td>
<td>7</td>
<td>751.4</td>
<td>598.2</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>572.3</td>
<td>325.1</td>
</tr>
<tr>
<td>December</td>
<td>11</td>
<td>914.5</td>
<td>185.6</td>
</tr>
<tr>
<td>January</td>
<td>15</td>
<td>574.7</td>
<td>303.3</td>
</tr>
<tr>
<td>February</td>
<td>16</td>
<td>528.8</td>
<td>295.9</td>
</tr>
<tr>
<td>March</td>
<td>20</td>
<td>450.0</td>
<td>263.2</td>
</tr>
</tbody>
</table>

**Table II**: Monthly mean worm burden and 95% confidence interval of in Haemonchus and \textit{T. axei} in goat (n=82).

### Table III: Proportion and Number of sheep and goats in Relation to Degree of Infection by adult abomasal Nematodes

<table>
<thead>
<tr>
<th>Abomasal Nematodes</th>
<th>Infection Category</th>
<th>Host Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>\textit{Haemonchus}</td>
<td>Light</td>
<td>Sheep</td>
</tr>
<tr>
<td></td>
<td>58 (55.8%)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>38 (36.5%)</td>
<td></td>
</tr>
<tr>
<td>Heavy</td>
<td>8 (7.7%)</td>
<td></td>
</tr>
<tr>
<td>\textit{T. axei}</td>
<td>Light</td>
<td>Goat</td>
</tr>
<tr>
<td></td>
<td>36 (83.7%)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>7 (16.3%)</td>
<td></td>
</tr>
<tr>
<td>Heavy</td>
<td>0 (0%)</td>
<td></td>
</tr>
</tbody>
</table>

**Table III**: Proportion and Number of sheep and goats in Relation to Degree of Infection by adult abomasal Nematodes

### Table IV: Occurrence of Haemonchus species in relation to the whole worm population and number of animals from which they are collected (S: sheep; G: goat).

<table>
<thead>
<tr>
<th>Sample size</th>
<th>H. contortus</th>
<th>H. placei</th>
<th>H. longistipes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemonchus spp identified (%)</td>
<td>N = 1159 (S)</td>
<td>95.1%</td>
<td>3.4%</td>
</tr>
<tr>
<td></td>
<td>N = 841 (G)</td>
<td>96.5%</td>
<td>3%</td>
</tr>
<tr>
<td>Number of positive animals (%)</td>
<td>N = 76 (S)</td>
<td>100%</td>
<td>28.9%</td>
</tr>
<tr>
<td></td>
<td>N = 55 (G)</td>
<td>100%</td>
<td>34.5%</td>
</tr>
</tbody>
</table>

**Table IV**: Occurrence of Haemonchus species in relation to the whole worm population and number of animals from which they are collected (S: sheep; G: goat).

### Discussion

This study revealed a very high overall prevalence of 92.9% and 90.2% of abomasal nematodes in sheep and goats, respectively in this semi-arid region of eastern Ethiopia. This was most probably due to the fact that sheep and goats of Ogaden region are managed under extensive pastoralism with high stocking density where large numbers of animals graze together during all months of the year, inadequate nutritional status and poor veterinary infrastructure and services of the area. The observed very high prevalence rate is inline with previous studies conducted by Solomon [23] who reported 90%, DONALD [9], and ABEBE and ESAYAS [1] reported more than 90% prevalence of abomasal parasites in the Eastern part of Ethiopia suggesting that the semi-arid Ogaden region is conducive environment for rampant abomasal nematodes of sheep and goats. This study showed the occurrence of infection of small ruminants of the area by abomasal nematodes during study months suggesting the existence of pasture contamination and the availability of infective larvae during months of the study period. This finding agrees with the previous works of TEKELYE [24] who reported severe ovine nematode morbidity throughout the year. Statistically significant difference in overall prevalence of abomasal nematodes (both Haemonchus and \textit{T. axei}) between sheep and goats ($P > 0.05$) wasn’t recorded suggesting that both species sharing the same environment are nearly equally susceptible to \textit{Haemonchus} spp and \textit{T. axei}.
The specific prevalence of Haemonchus spp 91.2% in sheep and 82.9% in goats is highly significant in view of the worldwide importance of Haemonchosis, which is regarded as being one of the most prevalent, pathogenic, with very high biotic potential, its prominent ability of emerging in anthelmintic resistance, unique survival strategy due to considerable biological and ecological plasticity and economically most important nematode with the ability of causing losses in most classes of animals. The observed high prevalence of Haemonchus spp in sheep and goats is in agreement with earlier studies conducted by BAYOU [4] 88.2% in Wellega, DEREGE [8] 80% in Wolloita Sodo, Genene [12] 83.9% in KOMBOLCHA, GETACHEW [13] 95.5% in Mekele and Abebe and Esayas [1] 96.5% in Eastern part of Ethiopia. Also Maingi [20] who reported Haemonchus as the most important parasite against which worm control is primarily targeted in Kenya and Fakae [10] who reported 77.8-100% prevalence rate in Nigeria.

The overall contribution of the mucosal larvae 5.0% in sheep and 5.3% in goats to the total worm burden is without any statistically significant (P = 0.4826) difference during different months of the study period. A possible explanation of this finding may include the well known remarkable adaptability and biological plasticity of haemonchus in adverse climatic conditions during long dry seasons in tropical environments is complex especially in small ruminants as it can involve mixed survival strategies like inhibited fourth larvae in the abomasal content, inhibited fourth larvae in the abomasal mucosa and long survival of adult worms in the abomasum as reported by JACQUIET [18] in a study conducted in Mauritania. Hence more detailed annual studies should be carried out so as to elucidate the survival strategies of haemonchus in small ruminants of Ogaden region.

Even though it is generally considered that Teladorsagia circumcincta, also with the ability to survive adverse conditions, is commonly found where sheep and goats are raised it is surprising that this abomasal nematode was never encountered in the current study. This illustrates that sheep and goat flocks of Ogaden region have remained isolated from introductions of Teladorsagia infected small ruminants from other regions. This result contrasts the finding of Naol [22] who reported a respective prevalence of 19.4% and 20.5% Teladorsagia in sheep and goats in a study conducted in small ruminants of Awassa in south Ethiopia.

In the current study the observation on the identification of Haemonchus species in small ruminants disclosed the coexistence and sympatry of two or three Haemonchus species in a single sheep or goat host that share the same grazing pastures with zebu cattle and one humped dromedaries under field condition in Ogaden region in eastern Ethiopia. This finding suggests the occurrence of circulation of Haemonchus spp among heterologous domestic ruminant hosts in the area. In the study H. contortus was identified as the dominant Haemonchus spp both in sheep (95.1%) and goats (96.5%) suggesting that small ruminants are most susceptible and usual host of H. contortus than both H. placei and H. longistipes (Table IV). This result supports the work of Achi et al [2], GELAYE and ABEBE [11] and JACUIET et al [18, 19] all of which reported the dominance of H. contortus in small ruminants. The study also imply that small ruminants additionally could also host both H. placei and H. longistipes suggesting the presence of circulation and wide range of species of hosts for Haemonchus spp in domestic ruminants (Table IV). This extension of wide range of susceptible hosts could favor Haemonchus spp as the parasite is maintained by greater number of susceptible unusual hosts due to increased chance of ingestion of infective larvae and is in agreement with previous studies of JACQUIET [18], and who also reported H. contortus as the most dominant contributor of species composition followed by H. placei and least by H. longistipes contributing the smallest proportion of species composition. This finding in both sheep and goats suggest the
coexistence and circulation of *Haemonchus species* among different animal species of the study area particularly from cattle and camels that normally share the same grazing pasture favoring transmission of infection among hosts. Accounting only 3.5% in sheep and 3.0% in goats to the total number of worms studied *H. placei* infected 28.9% of sheep and 34.5% goat populations studied (Table IV). Likewise *H. longistipes* infected and recovered from 14.5% sheep and 5.5% goat populations but the proportion of this species within the total number of worms identified in sheep is 1.5% and only 0.48% in goats (Table IV). This finding is in agreement with Achi [2] in Northern Ivory Coast that reported similar result. This finding suggest the possible existence of a wide range of susceptible hosts that could serve as a means of survival strategies of Haemonchus species in the study area and the role of different host species as a source of infection for others species of animals should be taken into account while designing of management and control strategies against haemonchosis of small ruminants.

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**References**


