Prevalence of Gastrointestinal Helminths in Sheep from White Nile State, Sudan

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ABSTRACT

This study was carried out during November 1997 to October 1998 to determine the species and prevalence of gastrointestinal helminths from White Nile State, which is a major sheep production area in the Sudan. These sheep were slaughtered at Omdurman Central Abattoir and were designated for export. A total of 507 faecal samples and 30 gastrointestinal tracts were collected at random and processed, using microscopic coprological examination, faecal culture and postmortem examination. Mixed helminth infections were found common in 93.3% of gastrointestinal tracts examined. Nematode infections were the commonest, reaching 90.0% of the examined animals. *Trichostrongylus colubriformis* was the predominant nematode species with an infection rate of 86.7% followed by *Haemonchus contortus* with a prevalence of 76.6%. Other identified nematode species were *Cooperia pectinata*, *Oesophagostomum columbianum*, *Strongyloide spapillosus*, *Trichuris globulosa* and *Skrjabinema ovis* with frequencies of 50%, 36.7%, 66.7%, 26.7% and 6.7%, respectively. Cestodes were recovered in 80% of the gastrointestinal tracts. The identified species were *Stilesia globipunctata*, *Avitellina centripunctata*, *Moniezia expansa* and *Moniezia benedeni* The most prevalent cestode was *S. globipunctata* followed by *A. centripunctata* with frequencies of 66.7% and 60.0%, respectively. The study indicated that nematodes may be involved in causing significant losses in sheep production in the Sudan. The results revealed involvement of some potentially pathogenic forms such as *T. colubriformis* and *H. contortus*. In this study, four helminth species are reported for the first time in the White Nile State. These are *Trichuris globulosa*, *Skrjabinema ovis*, *Stilesia globipunctata* and *Avitellina centripunctata*.

Key words: Prevalence; gastrointestinal; helminthes; sheep; Sudan

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INTRODUCTION
Sudan has a sheep population estimated to be 52 million (BSAR, 2010). Sheep are raised in different parts of the country for their meat, milk and skins. Exports of live sheep and mutton significantly contribute to the national income from foreign exchange exceeding US$ 109 million annually (ARSSC, 1998). Helminthic parasites are known to prevail in the country (El Badawi et al., 1978; Atta El Mannan, 1983). Information about this group of parasites in sheep in Sudan is relatively scanty. The aim of this study was to provide basic information regarding helminthic parasites infecting sheep. Such information is believed to be essential for planning of any effective control program.

MATERIALS AND METHODS

Sampling

Faecal samples and whole gastrointestinal tracts were taken from sheep of 1 to 2 years old slaughtered at Oumdurman Central Abattoir during November 1997 to October 1998. These animals were intended for export and, according to the Exporting Companies, they originated from Kosti city, White Nile State, Sudan.

Faecal examination and faecal culture

A total of 507 faecal samples were immediately collected after slaughtering from the recta sheep. These samples were examined by Willis' technique (Soulsby, 1982) and a standard sedimentation technique. Identification of eggs was performed according to Soulsby (1982) and Thienpant et al. (1986). Worm egg counts were performed using the modified McMaster technique (Anon, 1977). Samples containing strongyle/trichostrongyle and Strogyloides papillosus eggs were cultured. From each sample about 100 third infective stage larvae (L₃) were identified according to keys by Dunn (1978) and Anon (1977, 1986).

Examination of the Gastrointestinal Tract

A total of 30 intact guts were examined. Double ligatures were applied to separate different organs (rumen, abomasum, small and large intestines). Each organ was separated, placed in a tray, opened with pairs of scissors and washed as described by Hansen and Perry (1994). Nematodes were collected, identified and counted using the keys by Dunn (1978), Gibbons, Khalil (1982) and Soulsby (1982). Cestodes and trematodes were identified following the keys of Dunn (1978) and Soulsby (1982).

Climatic Data
Meteorological data for the years 1990–1998 for Kosti city (White Nile State) were obtained from the Meteorological Centre in Khartoum. The year is divided into three distinct seasons namely winter (November–February), summer (March–June) and rainy season (July–October).

**Statistical Analysis**

Data presentation was performed using Excel 97 computer program. Number of eggs and worms recovered were transformed to geometric means to normalize the data.

**RESULTS**

**Examination and Faecal Culture**

Faecal examination revealed presence of strongyle/trichostrongyle eggs throughout the year with the highest prevalence in September 99% (Table 1). The frequency of strongyle/trichostrongyle was 68%, 43.7% and 76.3% during winter, summer and rainy season, respectively. *Strongyloides papillosus* was prevalent throughout the year and the highest prevalence was in November 56% (Table 1). The rate of infection with this parasite was 34.7%, 7.8% and 26.7% in winter, summer and rainy season, respectively. *Trichuris* spp. infection was generally very low and the highest rate (3.9%) of infection was during summer. *Moniezia expansa* was prevalent throughout the year. The seasonal prevalence in winter, summer and rainy season was 16%, 3.9% and 10.9%, respectively. *Moniezia benedeni* was of low frequency (1.3%, 0% and 1.2 % during winter, summer and rainy season, respectively). *Paramphistomum* spp. were detected only sporadically with seasonal prevalence not exceeding 2.1%.

Total egg counts of strongyle/trichostrongyle, *Strongyloides papillosus* and *Trichuris* spp. were 99, 11 and 414 epg (egg per gram of faeces) in winter, summer and rainy season, respectively. This high output was mainly due to a rise in strongyle/trichostrongyle counts, which reached 398.1 epg in the rainy season. The pattern of egg output during various months was positively correlated with rainfall (Fig.1). Strongyle/trichostrongyle egg values started to increase in July to a mean of 21 epg coinciding with the increase in rainfall. The egg count continued to rise in August to 1253.1 epg reaching a peak in September (5174.6 epg). Egg count started to decrease in October to 1644 epg coinciding with drop in rainfall until it reached 15.7 epg in February with cessation of rain. The egg count for *S. papillosus* and *Trichuris* spp. was maintained at low levels throughout the different seasons.

Faecal culture of samples from sheep revealed presence of L3 of *Haemonchus contortus*, *Trichostrongylus* spp., *Cooperia* spp., *Oesophagostomum* spp. and *S. papillosus*. *H. contortus* larvae were the commonest with a frequency of 74.5% from the
positive samples. The frequency of *Trichostrongylus* spp., *Cooperia* spp., *Oesophagostomum* spp. and *S. papillosus* was 61.8%, 52.7%, 49.9% and 38.2%, respectively.

**Examination of the Gastrointestinal Tract**

Out of 30 gastrointestinal tracts examined, 28 (93.3%) harboured helminths. The rate of infection with nematodes, cestodes and trematodes was 93.3%, 80% and 6.7%, respectively. Seven species of nematodes were recorded. These were *H. contortus* from the abomasum, *Trichostrongylus colubriformis*, *Cooperia pectinata* and *S. papillosus* from the small intestines and *Oesophagostomum columbianum* and *Trichuris globulosa* from the large intestines. *Skrabinema ovis* was recorded from both the small and large intestines. The most prevalent species was *T. colubriformis* and the least was *S. ovis* (Table 2). Prevalence of nematodes during winter, summer and rainy season was 100%, 78.6% and 100%, respectively. Prevalence of individual species of nematodes reached its highest levels of infection during the rainy season.

The seasonal prevalence for cestodes was 100%, 71.4% and 85.7% during winter, summer and rainy season, respectively. One or more species of cestodes were identified in 24 (80%) of the examined gastrointestinal tracts. The species involved were *Stilesia globipunctata*, *Avitellina centripunctata*, *Moniezia expansa* and *Moniezia benedeni*. *S. globipunctata* was the most prevalent cestode (Table 2). Trematodes were identified in only 2 (6.7%) animals and they were *Paramphistomum cervi*. This helminth was only recovered during summer.

Seasonal worm count was 185, 37 and 653 during winter, summer and rainy season, respectively. Monthly mean worm counts started to rise in June coinciding with increase in rainfall (Fig. 2), reaching a peak in August. Worm numbers started to decrease, thereafter, with the decrease in rainfall. There was a clear seasonal influence on worm burden for most species with the highest burdens encountered in rainy season, relatively lowered in winter and reaching the lowest levels in summer (Table 3).

**DISCUSSION**

The results of the current study confirmed the presence of nematodes, cestodes as well as trematodes in sheep from White Nile State. The nematodes were the major groups of helminths parasitizing these animals. Of these, *T. colubriformis* and *H. contortus* were parasitizing more than 75% of sheep with moderate worm burdens. According to Pradhan and Johnstone (1972); Barker (1973); Coop *et al.* (1976) and Taylor and Pearson (1979) the pathological effects of these specific parasites on sheep include increased in permeability of blood vessels and leakage of proteins, reduction in food intake and body
weight gain, stunted bone growth, anaemia, emaciation, weakness and high mortality and morbidity.

Both high faecal output and high worm counts were recorded during the rainy season. This could be attributed to the suitability of environmental conditions of moderate temperature (28-31°C) and moisture (37.5-70%) providing optimum requirements for development of the infective nematode larvae (Pandey, 1990; Onyali et al., 1990; Agyei, 1991; Rahman, 1992). Both egg and worm counts decreased at the end of the rainy season and this might be due to the self-cure phenomenon as these animals have been sensitized for several months during the rainy season (Altaif et al., 1980; Altaif and Issa, 1983; Chaudhry et al., 1988) and subsequently lost their worm burdens. This decrease continued throughout winter and summer and was probably induced by dryness (Okon and Enyenih, 1977; Ogunsusi, 1979; Chiejina and Fakae, 1984; Chiejina et al., 1989; Connor et al., 1990). It is not surprising to find infection with *Trichuris globulosa* to remain throughout the year, as the eggs of these species are known to remain viable for long periods of time (several years) and this increase the chance of acquisition of infection.

Cestodes were less common than nematodes. The identified species were *S. globipunctata*, *A. centripunctata*, *M. expansa* and *M. benedeni*. The high prevalence of *M. expansa* during winter might be attributed to the availability of oribatid mites in pasture. In Argentina, Denergi and Alzued (1992) reported that the increase in the number of oribatid mites coincided with the increase in mean temperature and rainfall. Here in White Nile State, it may be inferred that oribatid mites occurred in high numbers in pasture during the rainy season. The mites ingest *Moniezia* eggs and the onchospheres take approximately four months to reach infective stage (Soulsby, 1982). Sheep ingest infected mites and the prepatent period is 37-40 days (Soulsby, 1982). Thus, the increase in frequency of *Moniezia* spp. is to be expected to occur during winter. *Paramphistomum cervi* had low frequency (6.7%) and appeared to have no importance in sheep of White Nile.

In the present study, four species of helminths were reported for the first time in sheep from White Nile State. These were *Trichuris globulosa*, *Skrjabinema ovis*, *Stilesia globipunctata* and *Avitellina centripunctata*. *T. globulosa* was reported previously from camels in this country (Eisa et al., 1979; Fadl, 1987). *S. ovis* was recorded in goats from eastern Sudan by El Gezuli et al. (1978) and in the Central region of the country by Atta El Mannan (1983). Earlier, Eisa (1963) and El Badawi et al. (1978) found *Avitellina* spp. in cattle from Upper Nile Province and from Western Provinces of the Sudan, respectively. Recently, Abdelnabi et al. (2011) reported the presence of *T. globulosa*, *S ovis*, *S. globipunctata* and *A. centripunctata* in sheep from Central Kordofan, Sudan.

It is concluded that nematodes may be involved in causing significant losses in sheep production in this country. This is evidenced by the involvement of some of the potentially economic helminths such as *T. colubriformis* and *H. contortus* and the high
prevalence of these specific parasites. The fact that worm burdens were mostly moderate suggests presence of chronic infections, which may precipitate continuous losses in productivity. It is imperative, therefore, that effective programs be constructed to control this group of parasites.

REFERENCES


Fig 1. Monthly strongyle/trichostrongyle mean egg count in sheep White Nile State and relationship with rainfall.
Fig 2. Monthly mean worm count in sheep from White Nile State and relationship with rainfall.
Table 1. Prevalence (%) of gastrointestinal helminths in sheep from White Nile State as shown by coprological examination.

<table>
<thead>
<tr>
<th>Month</th>
<th>Sheep examined</th>
<th>Positive animals</th>
<th>Prevalence (%) of parasites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Feb</td>
<td>40</td>
<td>28</td>
<td>55</td>
</tr>
<tr>
<td>Mar</td>
<td>14</td>
<td>7</td>
<td>42.9</td>
</tr>
<tr>
<td>May</td>
<td>49</td>
<td>26</td>
<td>49</td>
</tr>
<tr>
<td>Jun</td>
<td>40</td>
<td>18</td>
<td>37.5</td>
</tr>
<tr>
<td>Jul</td>
<td>124</td>
<td>61</td>
<td>45.2</td>
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<tr>
<td>Aug</td>
<td>65</td>
<td>58</td>
<td>89.2</td>
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<td>Sep</td>
<td>103</td>
<td>102</td>
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<tr>
<td>Oct</td>
<td>37</td>
<td>35</td>
<td>94.6</td>
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<tr>
<td>Nov</td>
<td>25</td>
<td>22</td>
<td>84</td>
</tr>
<tr>
<td>Dec</td>
<td>10</td>
<td>8</td>
<td>80</td>
</tr>
</tbody>
</table>

NA= Samples not available
1. *Strongyle/trichostrongyle*  
2. *Strongyloides papillosus*  
4. *Moniezia expansa*  
5. *Moniezia benedeni*  

Table 2. Prevalence of gastrointestinal nematodes and cestodes of necropsied sheep originating from White Nile State

<table>
<thead>
<tr>
<th>Species of parasites identified</th>
<th>Percentage of animals infected (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Trichostrongylus colubriformis</em></td>
<td>86.7</td>
</tr>
<tr>
<td><em>Haemonchus contortus</em></td>
<td>76.6</td>
</tr>
<tr>
<td><em>Cooperia pectinata</em></td>
<td>50.0</td>
</tr>
<tr>
<td><em>Oesophagostomum columbianum</em></td>
<td>36.7</td>
</tr>
<tr>
<td>Strongyloides papillosus</td>
<td>66.7</td>
</tr>
<tr>
<td>Trichuris globulosa</td>
<td>26.7</td>
</tr>
<tr>
<td>Skrjabinema ovis</td>
<td>06.7</td>
</tr>
<tr>
<td>Stilesia globipunctata</td>
<td>66.7</td>
</tr>
<tr>
<td>Avitellina centripunctata</td>
<td>60.0</td>
</tr>
<tr>
<td>Moniezia spp.</td>
<td>43.3</td>
</tr>
</tbody>
</table>

*Number of animals examined 30

### Table 3. Mean (±Df) seasonal worm burden of sheep from White Nile

<table>
<thead>
<tr>
<th>Season</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>43.0±9.7</td>
<td>48.0±12.8</td>
<td>4.0±5.8</td>
<td>5.0±4.9</td>
<td>13±9.2</td>
<td>1.0±1.0</td>
</tr>
<tr>
<td>Summer</td>
<td>3.0±8.3</td>
<td>4.0±13.2</td>
<td>1.0±3.3</td>
<td>2.0±4.8</td>
<td>6.0±12.0</td>
<td>1.0±1.7</td>
</tr>
<tr>
<td>Autumn</td>
<td>213±3.4</td>
<td>26.0±10.1</td>
<td>6.0±12.1</td>
<td>5.0±4.9</td>
<td>54±18.3</td>
<td>1.0±1.2</td>
</tr>
</tbody>
</table>

Df= Dispersion factor
1= Haemonchus contortus 6= Trichuris globulosa
2 =Trichostrongylus colubriformis 7=Skrjabinema ovis
3 =Cooperia pectinata
4 = *Oesophagostomum columbianum*
5 = *Strongyloides papillosus*