Occurrence, Intensity and Parasite Composition of Gastrointestinal Helminth Parasites in Walia Ibex (Capra walie) at Semien Mountains National Park, Natural World Heritage Site, Northern Ethiopia

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Abstract: Across-sectional study was conducted from November 2010 to August 2012 to determine the prevalence, intensity and parasite composition of gastrointestinal (GI) helminth parasites in free-ranging Walia ibex (Capra walie) at the Simen Mountains National Park (SMNP), northern Ethiopia. A total 167 fresh faecal samples were collected from the ground and examined using standard parasitological procedures to recover helminth eggs/larvae. The overall prevalence of helminth infection was 85.62% of which 85.02% presented nematodes and 7.18%cestodes. Coccidian oocysts were also detected. Trematode species (ssp) were not recovered. The commonly detected nematodes by larval identification were Trichostrongylus spp., Cooperia spp., Strongyloides spp., Ostertagia spp., Haemonchus spp., Bunostomum spp., Nematodirus spp., Oesophagostomum spp., Dictyocaulus spp., Muellerius spp. and Protostrongylus spp. Trichris spp., Ascarids spp. and Moniezia spp. eggs were also detected. Multiple parasitic infections were common (78.43%). The host range of many of the helminths found in the Walia ibex is broad and could serve as a potentially stable source of infection to domestic animals such as sheep, goats and cattle. So further studies on seasonal dynamics and transmission patterns between wildlife and domestic animals are required to design the appropriate worm control strategies.

Key words: Prevalence • Helminth • Walia Ibex • SMNP • Ethiopia

INTRODUCTION

Wildlife and livestock contribute significantly to the economies of most sub-Saharan African countries. The wildlife sector in Africa is worth US $7 billion with an annual growth rate of 5%. It is thus a major contributor to the continental gross domestic product. In East and southern African countries, the consumptive and non-consumptive utilization of wildlife is a significant foreign exchange earner. In Kenya, tourism accounts for 30% of foreign exchange earnings [1].

Parasites and infectious diseases of wildlife are a major threat to conservation of endangered species [2]. Thus, there is a great need for studies documenting the prevalence of parasites among endangered species in the wild [3].

Most free-living organisms harbour parasites of several species [4], which can adversely affect their health, fecundity and foraging and may also modify host behaviour to facilitate parasite transmission [5]. Parasitism has been shown to directly affect both the evolution and ecology of hosts through processes such as sexual selection [6] or parasite-mediated competition, which can lead to a reduction in population size, or the extinction of one host [7].

From a conservation point of view, parasitological studies are important to understand ways of infection and the potential transmission of parasites between species, both native and introduced. In addition, the degree of parasitic infections and the type of parasites are measures used to assess the health of a population and can be linked to dramatic changes in population. In order to assess and manage the effect of parasites on population dynamics, it is essential to evaluate their incidence and prevalence in wild populations [8, 9].

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Transmission of pathogens at the wildlife-livestock interface can occur in both directions and may therefore pose a threat to either agriculture or conservation. The disease interface between wildlife and livestock is not usually a direct physical interaction or even sharing of the same space at the same time but an indirect contact; through the soil, forage and water with which another animal has recently been in contact and has left bodily discharges, such as faeces, urine, saliva, or ocular or nasal discharge, or through shared insect vectors or intermediate hosts [10]. The endangered Walia ibex (Capra walie) is the most distributed ungulates of the genus Capra found in the SMNP. Capra walie occupies a narrow habitat niche and is vulnerable to human disturbances such as habitat loss, illegal hunting, disease and competition from livestock [10,11]. However, there is no information in the literature about the parasitic infection of Walia ibex. Therefore, the present study has the following general and specific objectives:

**General objectives:** to determine the prevalence, intensity and species composition of gastrointestinal helminths parasites in Walia ibex at SMNP, Northwest Ethiopia.

**Specific Objectives:** To determine the prevalence and intensity of GI helminthes infection in Walia ibex at SMNP, to identify the species of gastrointestinal helminthes parasites infecting Walia ibex and o obtain parasitic baseline data on Walia ibex to provide reference data.

**MATERIALS AND METHODS**

**Study Area:** The study was conducted at a wildlife conservation area, SMNP, North Gondar Zone, Amhara Regional State, northwestern Ethiopia, in six conveniently selected habitats. The SMNP is located at the northern edge of the central plateau of Ethiopia. It is about 123km northeast of Gondar town and about 885km away from Addis Ababa. Covering a total area of 412km²of the Simen Mountains water shade, its geographic location extends 13° 9’57” to 13°19’58”N latitude and from 37°54’48” to 38°24’43”E longitude. The annual mean temperature range from 18°C at 2600 to -2°C at 4400 m.a.s.l. altitude. The current population of Walia ibex is estimated to be 951 [11,12].

**Study Population:** The study population included Walia ibex. Each group/herd of Walia ibex observed at each grazing site was composed of different age groups and both sexes. A total of 167 fresh faecal samples were collected from the ground during the entire period of the study from 6 conveniently selected grazing and resting sites/grounds.

**Study Design:** A cross-sectional study design was used to determine the prevalence, intensity and parasite composition of GI helminthes in Walia ibex, based on parasitological surveys. Simple random sampling technique was used to collect each sample from the recently defecated faeces.

**Sampling and Examination Procedures:** When a group of walia ibex was observed at each grazing site and after the study group vacated an area; the area was searched for fresh fecal samples. Only fresh whole pellets judged to be from the particular species under observation were collected from the ground with strict sanitation using gloved hands. Only pellets group at least 50cm or more apart were considered to be independent samples. The maximum number of samples collected during this type of sampling never exceeded the number of individuals in the group so as to reduce the probability of any single individual being sampled more than once, based on results of sampling studies of domestic ungulates that suggest that between10 and 20 fecal samples provide a reliable assessment of herd infection rates [13-17].

The samples were put in sterile plastic bottles, labeled and cooled at 4°C using a cool box and ice packs and transported to the Parasitology laboratory of Faculty of Veterinary Medicine, University of Gondar. The fecal samples were stored at 4°C until processed and subjected to floatation, sedimentation, Baermann, McMaster and culture tests [8, 18].

Nematode and cestode ova and coccidian oocysts were identified microscopically (10x and 40x) by their, color, shape and contents [8]. Third-stage larvae (L3) of nematodes were identified at genus level based on standard criteria [8, 17]. Intensity analyses included only strongyles.

**Parasite Egg Identification:** The sedimentation and floatation techniques as described by Soulsby [8] were used to detect the presence of eggs and larvae of helminths in the samples. The presence of coccidian oocysts was also recorded. No attempt was made to differentiate between eggs of different strongyle species but all other helminth eggs were identified to genus level.
Fig. 1: The map that depicts the location of the study area, SMNP

**Faecal Egg Count:** To quantify parasite egg output in host feces, a modification of the McMaster fecal egg counting technique was used [8, 17]. Intensity analyses included only strongyle eggs. Eggs floated to the surface of the counting chambers. The slide was then examined with 10X magnifications to identify and count all eggs inside the ruled squares. The number of eggs observed in each chamber were added together and multiplied by a dilution factor of 50 [9, 18-19] to get the number of eggs/gram of faeces (EPG). Levels of nematode infection were extrapolated from severity index defined by Soulsby [8] and Hanson and Perry [18] where sheep are said to have low, moderate and severe nematode infection if their faecal egg counts are less than 800, 800 to 1200 and more than 1200, respectively. The presence of oocysts and *Moniezia* spp. ova was also recorded.

**Larval Identification:** Since it is not possible to distinguish strongyle eggs of different species morphologically, a minimum of 15-20 grams pooled positive faecal samples were mixed thoroughly and cultured for 10-14 days at 20-25°C to allow the development of L3s, which may be collected by means of the Baermann procedure [17,18]. Genera were identified according to Soulsby [8]. One hundred and seventy-two L3 were randomly picked up under a stereomicroscope and identified according to the identification key of MAFF [17] and Soulsby [8] based on specific morphological traits.

**Data Analysis:** Descriptive statistics were used to analyze the prevalence and mean EPG of the helminth egg count. The Chi-square ($\chi^2$) test was used to measure relationships between the prevalence of different genera of helminthes parasites in the faecal pellet groups. Differences were considered significant at $P<0.05$.

**RESULTS**

**Prevalence:** The prevalence of fecal pellets containing Osteragia eggs was 72% for the 89 groups of fecal pellets collected 6-8 June 1998 (Table 1). Out of the total 167 examined faecal samples, 142 (85.02%) presented nematodes and 12 (7.18%) cestodes (*Moniezia*) as single and mixed infections. A significant difference ($P<0.05$) was found in prevalence among nematode and cestode (*Moniezia*) parasites. A qualitative faecal worm egg analysis enabled to distinguish 6 types of nematode eggs,
whose morphology suggest they represent the genera strongyles (78.44%), Nematodirus (14.97%), Strongyloides (5.38%), Trichuris (4.19%), ascarids (Toxocara) (2.99%) and Moniezia (7.18%) eggs. Lungworms larvae and coccidian oocysts were also observed. No trematodes eggs were recorded in the study (Table 1).

Multiple parasitic infections (78.43%) were common than single ones (11.76%) and up to 4-5 different parasite species were found in the same individual sample. Out of the mixed infections, nematodes and cestode (Moniezia) mixed infestations were 11 (7.18%) while 109 (90.83%) mixed infections were formed between different nematode genera (Table 2).

**Larval Identification:** On coproculture, the genera of Trichostrongylus, Cooperia, Strongyloides, Ostertagia, Haemonchus, Bunostomum, Nematodirus, Oesophagostomum, Dictyocaulus, Muelleria and Protostrongylus were recovered. A significant difference (P< 0.05) was noted regarding the prevalence of various species of GI helminth parasites based on faecal culture. The most prevalent genus was, Trichstrongylus (35.42%) followed by Cooperia (13.14%) and the least were Oesophagostomum(1.14%) and lungworms (Table 4).

**Intensity Analysis:** The nematode eggs present were identified in general terms as strongyle-type eggs, since relevant nematode genera produce eggs that are similar in appearance and cannot be discriminated easily, except for the eggs of Nematodirus, Strongyloides, Ascaris and Trichuris species. Intensity analyses included only strongyle-type of eggs (Nematoda, Trichostrongylidae). The egg count per gram of faeces was used as a basis for the estimation of the intensity of strongyles infection. The mean EPG was 587.59±47.08. Individual EPG ranged from 100-3700 in infected faecal samples. The severity of infection in relation to EPG was low, moderate and severe in 77.44, 12.78 and 9.77% of the samples, respectively (Table 3). The degree of EPG in most of the study samples was low indicating the sub-clinical cases of gastrointestinal parasites with subsequent subsistent low degree of pasture contamination. The observed threshold level of egg numbers in this study may be regarded as low to moderate that mainly manifests as sub-clinical infections.

In 77.44% of the samples, the EPG was 50-800 eggs while 801-1200 and above 1200 was counted in 12.78 and 9.77% samples, respectively. About 9.02% of faecal samples had EPGs higher than 1000, the remainder having light to moderate infections (Tabel 3).
Table 5: Prevalence of GI helminthes in faecal samples of Walia ibex based on study sites in SMNP

<table>
<thead>
<tr>
<th>Site</th>
<th>No. samples examined</th>
<th>No. positives</th>
<th>$\chi^2$</th>
<th>P-value</th>
</tr>
</thead>
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<td></td>
<td></td>
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<tr>
<td>Buahit</td>
<td>37</td>
<td>24</td>
<td></td>
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<tr>
<td>Kechemo</td>
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<td>16</td>
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<td>0.005</td>
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<tr>
<td>Chenek</td>
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<td></td>
</tr>
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<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sherafit</td>
<td>10</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
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<td>133</td>
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DISCUSSION

The present study shows that the walia ibex in SMNP is a host to a range of intestinal helminth species, which include nematodes, cestodes and coccidian. The results of the current study show that gastrointestinal nematodes and coccidia as mixed or single infections are the major parasitic diseases. The overall prevalence of helminth infection was 85.62%. The main helminth parasites observed were strongyles. A low prevalence was obtained for tapeworms, although the low sensitivity of the fecal examination techniques in detecting cestode eggs could be the explanation to our results [20]. The lack of flukes in the current study provides evidence to back up the rarity of infection by this class of parasite [21,22].

At faecal examination, Strongyles, Nematodirus, Strongyloides, Trichuris, Ascaris, lungworms, Moniezia and coccidiawere prevalent in the study areas. The most prevalent parasite egg detected was strongyles with a prevalence of 78.44%. The second most prevalent genus recovered was Nematodirus, at 14.97% and Moniezia, at 7.18%. The most prevalent parasite detected was Oesophagostomum spp., with a prevalence of 85%. The second most prevalent genus recovered was Trichuris spp., at 46% and Strongyloides spp. at 44%. Trichostrongylus spp., which is a common parasite of ruminants, was identified at a prevalence of 22%.

Parasitism of Walia ibex with helminth parasites was wide spread. Most walia ibex were infected with several species of nematode, although infection with a single species of nematode did occur. The host range of many of the helminths found in the faecal samples of Walia ibex is broad and could serve as a potentially stable source of infection to domestic animals such as sheep and goats. Mean strongyle eggs (epg) and coccidian oocysts (opg) per gram feces were used as indicators of the numbers of these parasites in infected hosts (parasite intensity). Although the exact relationship between fecal egg counts and the number of adult parasites is unclear, egg counts can provide a valuable noninvasive means of assessing relative infection rates across groups of hosts [23, 24]. However, because a variety of factors influence the number of eggs emitted in feces, including host resistance, fecal output rate and differential parasite fecundity, analyses of epg and opg counts were restricted to the intra specific comparisons in this study. Prevalence of strongyle and coccidian infections among samples/hosts was calculated as the percentage of faecal samples infected with each parasite type out of the total number of samples examined. For parasite richness determinations, the presence of all eight recorded parasite types, including both directly and indirectly transmitted groups, was used to calculate two measures of parasite richness: the total number of parasite types per host species (total richness) and the number of parasite types per individual within a species(individual richness). In all cases, each fecal sample was treated as independent for calculation of parasitological variables for each host species or group within a host species.

This is the first study about the effect of helminth parasites affecting Walia ibex from SMNP, so the lack of coprological surveys makes more difficult the discussion of the results obtained in the current investigation.

Coccidial oocysts that were detected in 83.83% of all samples were sporadic and the burden was light. This parasite is probably not an important factor affecting the health of Walia ibex in the study area; whereas it can have a great importance in unsuitable condition and in young animals. However, they are sources of stress and weight loss to animals when they occur in large numbers. Out of Trichostrongylidae family the highest prevalence of infections showed nematodes of genus Trichostrongylus. Trichostrongylus spp. is commonly encountered in the faeces of wild and domestic ruminants [25].

CONCLUSION

In the light of the present results we consider that the infections caused by GI helminth parasites, are significantly common in the region of study, so that greater importance should be given to this situation. The elevated prevalence in Walia ibex underlines the need for the application of appropriate measure to the control of helminth parasites. It is possible that Walia ibex with gastrointestinal parasites can serve as a source of infection for other forest-dwelling species, as well as for domestic livestock and humans.
Recomendations: The relationship between domestic and nondomestic animal species needs further evaluation to assess the transmission of parasites between wildlife species and domestic species. The possibility of cross transmission of nematode parasites between Walia ibex and domestic sheep and goats should be investigated. The management of disease threats to endangered species needs to be considered as an integral component of the overall conservation plan. The host range of many of the helminths found in the faecal samples of Walia ibex is broad and could serve as a potentially stable source of infection to domestic animals such as sheep and goats. Therefore, issues concerning livestock management and conservation may arise. Anthelmintic drugs can be incorporated in blocks of mineral licks, which can be distributed in the range for wild animals. The frequency of application should be based on pasture-infective larvae contamination dynamics. Therefore, more epidemiological studies need to be undertaken so as to aid the management of disease threats to endangered species needs to be considered as an integral component of the overall conservation plan, subjected to careful scrutiny and provided with adequate financial and logistical support grazing habitats.

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REFERENCES