Article

Gastrointestinal nematodiasis in dromedary camels at Qassim region, Saudi Arabia: prevalence, hematology and treatment outcomes

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Abstract

A cross-sectional study was carried out in Qassim region, central of Saudi Arabia to determine the prevalence of gastrointestinal nematodes in dromedary camels, estimate the hematological changes associated with such infestation in addition to study the efficiency of albendazole and ivermectin in the treatment of infested animals. Among 1195 examined camels, the prevalence of gastrointestinal nematodes was 7.28%. Gender had no significant effect on the disease prevalence where the prevalence was 7.53% in females and 5.88% in males. On the other hand, age had a significant (p = 0.0001) effect on the prevalence where lower prevalence was recorded in camels under three years (3.18%) compared to those over three years (9.94%). Camels infested with gastrointestinal nematodes showed observable signs only in young camels while adult animals appeared clinically normal and rarely showed clinical signs. The signs observed in young camels were in the form of emaciation in spite of good appetite, pale mucous membranes and weakness. Hematological examination revealed a significant decrease in the erythrocyte counts (p = 0.0001) and hemoglobin concentration (p = 0.001) in infested camels compared with the healthy controls. Concerning the treatment outcomes, albendazole either alone or in combination with ivermectin twice with 2 weeks interval gave 100% cure rate both clinically and parasitologically. However, treatment-using ivermectin alone gave only 93.33% parasitological cure. It can be concluded that the prevalence of gastrointestinal nematodiasis is less prevalent in Qassim region, Saudi Arabia and the age factor has a significant effect on the prevalence but the sex factor has no effect. In addition, albendazole either alone or in combination with ivermectin is the drug of choice in the treatment of gastrointestinal nematodiasis in dromedary camels in this region.

Key words: Camels, Nematodes, Prevalence, Hematology, Treatment.

1. Introduction

In tropical and subtropical countries, parasitic infestation represents a major constraint for livestock production where, it directly or indirectly affects the production by reducing animal fertility and work capacity, decreasing food consumption, and decreasing body weight gain and milk production, and lead to mortality in heavily parasitized animals [1].

Adverse and difficult environmental conditions in the areas where camels are raised especially in dry seasons lead to decrease the availability of food for these animals and subsequently resulted in lower their resistance and make them easily vulnerable to diseases [2, 3].

Among the parasites that infesting dromedary camels, nematodes are found to be the most prevalent [4, 5, 6]. Camels can be infested by
nematodes, which may be specific for camels as *Haemonchus longisipes*, *Nematodirus Mauritanicus*, *Nematodirus dromedarii* or by other nematodes common for other hosts like sheep and goats as *Trichostrongylus prololurus*, *Tichostronglus vitrinus*, *Ostertagia mongolica*, *Nematodirus spathiger*, *Oesophagostomum venulosum* [7, 8].

Diagnosis of gastrointestinal parasites in animals is mainly based on epidemiological and clinical examinations while laboratory examination of fecal samples for the detection of eggs or larvae in the feces is the confirmatory tool [9].

In tropical and subtropical regions, resistance to modern broad-spectrum anthelmintics, which used in the treatment of gastrointestinal nematodes is a reality of rapidly increasing dimensions on many farms especially for *Haemonchus contortus* [10]. So this study was conducted to determine the prevalence of gastrointestinal nematodes in dromedary camels at Qassim region, central of Saudi Arabia, estimate the hematological changes associated with such infestation, also the efficiency of albendazole and ivermectin in the treatment of such infestation was studied.

2. Materials and Methods

2.1. Animals

A number of 1195 camels of different ages and sex were used in this study. These camels were managed extensively together with other livestock.

2.2. Epidemiological examination

Some epidemiological parameters including prevalence, gender and age predisposition were estimated [11].

2.3. Clinical examination

All examined camels were subjected to complete clinical examination [12].

2.4. Hematological examination

Two blood samples were collected from 10 camels parasitologically positive for nematode eggs and showed sever clinical signs and from 10 camels parasitologically free on tubes containing Ethylene Diamine Tetra Acetic acid (EDTA) as an anticoagulant. Complete blood counts were estimated using VetScan HM6, ABAXIS.

2.5. Faecal examination

Individual faecal sample was collected from each examined camel. Macroscopic and microscopic examinations were carried out. Direct smear, Concentration floatation technique, sedimentation technique and fecal egg counts were done for each sample [13]. Egg counts were done before treatment and again at 2 and 4 weeks post treatment.

2.6. Therapeutic trials:

Infested camels were divided into three groups. The first group (30 camels) was treated orally using albendazole 10% (*Endjat 10%* *Montajat Veterinary Pharmaceutical Co.*) twice with three weeks interval at a dosage rate of 7.5 mg/kg body weight (3.75 ml/ 50 Kg B.W). The second group (30 camels) was treated using ivermectin (*Ivermectin* *Saudi pharmaceutical industries*) as subcutaneous injection, twice with two weeks interval at a dose rate of 200 mcg/kilogram of body weight (1 ml/50 kg B. W.). The third group (27 camels) treated with both albendazole and ivermectin at the same dose and the same regime. Efficacy of the treatment was based on the reduction in the fecal egg counts 2 and 4 weeks post treatment.

2.7. Statistical analysis

Chi-Square and t-test were measured for the obtained data using the SPSS for Windows (Version 15.0, USA) statistical software program and probability (*P*-values) of less than 0.05 was considered significant.

3. Results

Out of the examined 1195 camels, the prevalence of gastrointestinal nematodes infestation was 7.28%. Owing to age predisposition, the prevalence in camel under three years was 3.18% and in camels over three years was 9.94% (Table 1).

![Table 1. Prevalence of gastrointestinal nematodiasis in relation to camels’ age](image)

<table>
<thead>
<tr>
<th>Age</th>
<th>Total camels examined</th>
<th>No. infested camels</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camels under 3 years</td>
<td>471</td>
<td>15**</td>
<td>3.18</td>
</tr>
<tr>
<td>Camels over 3 years</td>
<td>724</td>
<td>72</td>
<td>9.94</td>
</tr>
<tr>
<td>Total</td>
<td>1195</td>
<td>87</td>
<td>7.28</td>
</tr>
</tbody>
</table>

* Significant *p* = 0.0001

Concerning sex predisposition, the prevalence of gastrointestinal nematodes infestation was
7.53% among examined females and 5.88% among examined males (Table 2).

**Table 2.** Prevalence of gastrointestinal nematodiasis in relation to camels’ sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>Total camels examined</th>
<th>No. infested camels</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>1008</td>
<td>76</td>
<td>7.53</td>
</tr>
<tr>
<td>Males</td>
<td>187</td>
<td>11</td>
<td>5.88</td>
</tr>
<tr>
<td>Total</td>
<td>1195</td>
<td>87</td>
<td>7.28</td>
</tr>
</tbody>
</table>

Camels infested with gastrointestinal nematodes infestation (Table 3) showed only signs in young camels. Adult camels rarely showed clinical signs. The signs observed in young camels were in the form of emaciation in spite of a good appetite. Diarrhea was observed only in 20 young camels. Hairs were easily detached from infested animals. All infested camels have normal body temperature.

**Table 3.** Clinical signs in 87 nematodiasis infested camels (No 87).

<table>
<thead>
<tr>
<th>Signs</th>
<th>%</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>0/87</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Off food</td>
<td>0/87</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Weakness</td>
<td>70/87</td>
<td>80.45</td>
<td></td>
</tr>
<tr>
<td>Emaciation</td>
<td>60/87</td>
<td>68.96</td>
<td></td>
</tr>
<tr>
<td>Pale mucous membrane</td>
<td>70/87</td>
<td>80.45</td>
<td></td>
</tr>
<tr>
<td>Bottle jaw</td>
<td>2/87</td>
<td>2.29</td>
<td></td>
</tr>
<tr>
<td>Diarrhea</td>
<td>20/87</td>
<td>22.98</td>
<td></td>
</tr>
<tr>
<td>Indigestible food in the feces</td>
<td>15/87</td>
<td>17.24</td>
<td></td>
</tr>
<tr>
<td>Easily detached hairs</td>
<td>75/87</td>
<td>86.20</td>
<td></td>
</tr>
</tbody>
</table>

Hematological examination of examined healthy and diseased camels revealed a decrease in the erythrocyte counts and hemoglobin concentration in infested camels compared with the healthy controls (Table 4).

**Table 4.** Haemogram in healthy and nematodiasis infested camels (mean ± SD).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Healthy camels (n=10)</th>
<th>Infested camels (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBCs (10⁶/µl)</td>
<td>11.61 ± 1.36</td>
<td>9.11 ± 0.54***</td>
</tr>
<tr>
<td>Hb g/dl</td>
<td>13.02 ± 1.31</td>
<td>10.09 ± 1.34**</td>
</tr>
<tr>
<td>PCV %</td>
<td>24.10 ± 1.56</td>
<td>26.82 ± 6.15</td>
</tr>
<tr>
<td>WBCs (10³/µl)</td>
<td>16.74 ± 2.39</td>
<td>18.38 ± 2.60</td>
</tr>
<tr>
<td>Neutrophils (10³/µl)</td>
<td>8.17 ± 1.90</td>
<td>8.55 ± 1.58</td>
</tr>
<tr>
<td>Lymphocytes (10³/µl)</td>
<td>2.23 ± 0.49</td>
<td>2.33 ± 0.55</td>
</tr>
<tr>
<td>Monocytes (10³/µl)</td>
<td>0.19± 0.22</td>
<td>0.10 ± 0.04</td>
</tr>
<tr>
<td>Eosinophils (10³/µl)</td>
<td>1.49 ± 0.93</td>
<td>1.83 ± 0.85</td>
</tr>
</tbody>
</table>

**RBC, red blood cells; WBC, white blood cells; Hb, haemoglobin concentration; PCV, packed cell volume.*** P < 0.0001          ** P < 0.001

**Table 5.** Treatment outcomes in diseased camels

<table>
<thead>
<tr>
<th>Treated group</th>
<th>No. treated camels</th>
<th>No. cured camels</th>
<th>Total No. cured (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>30</td>
<td>30</td>
<td>100</td>
</tr>
<tr>
<td>Second</td>
<td>30</td>
<td>28</td>
<td>93.33</td>
</tr>
<tr>
<td>Third</td>
<td>27</td>
<td>27</td>
<td>100</td>
</tr>
</tbody>
</table>

4. **Discussion**

It has been shown that camels are vulnerable at the same degree or even higher to the prevalent disease-causing agents compared with other livestock [25, 26, 27, 28] despite the old notion that they are resistant [14].

The prevalence of gastrointestinal nematode infestations in examined camels was 7.28%. Higher prevalence rates were reported in Iran by Radfar and Gowhari (5) who reported 64% prevalence; in Nigeria by Rabana et al. (15) who reported prevalence of 41% and Ukashatu et al. (16) who reported prevalence of 77.8%; in Ethiopia by Birhanu et al. (17) who recorded 55.5% prevalence and in Iraq by Fadhil and Al-Zubaidi (18) who reported prevalence of 28.15%. The lower prevalence recorded in present study compared to the previous studies may be attributed to the awareness of the people about the parasites and improvement of the veterinary service in Qassim region in addition to the usual use of some anthelmintics which used in the treatment of other diseases such as mange. The differences in the prevalence rates among different studies may be attributed to the host immunity, differences in the method of management in each area in addition to the differences in the climatic condition (5).
Camels are less liable to helminthic diseases compared to other animals due to their typical browsing habit camels [19, 20].

Concerning sex predisposition, a non-significant increase in the prevalence was recorded in female than male camels where it was 7.53% in females and 5.88% in males. Similar observations were recorded previously by Radfar and Gowhari (5); Rabana et al. (15); Demelash et al. (21); Muhomed et al (22) and Desta (23) who recorded non-significant differences in female compared to male camels. On contrary, Fadhil and Al-Zubaidi (18); Wakelin (24); Al-Hakak et al. (25) reported a significant increase in the disease prevalence in female than male camels and attributed this to the exposure of female camels to some physiological factors as parturition that can reduce their immunity to infestation (24). In an abattoir survey in Nigeria, Ukashatu et al. (16) found male camels were harboring parasites more than the female camels and referred this to the largest number of the slaughtered males compared to the low number of the slaughtered female.

Concerning age predisposition, a significant difference in the prevalence of the gastrointestinal nematode infestations was recorded between the different age groups where lower prevalence was recorded in camel under three years (3.18%) compared to camels over three years (9.94%). Similar observations were recorded previously by Demelash et al. (21); Muhomed et al (22) and swai et al. (26) who recorded a significant increase in the disease prevalence in adults than young camels. On the other hand, Desta (23) recorded no effect on the camel age on the parasitism.

Parasitic helminthiasis is mainly subclinical or inapparent where affected animals appear clinically normal but are performing at below their full potential (20, 27). In this study, camels infested with gastrointestinal nematodes showed observable signs only in young camels while adult animals appeared clinically normal and rarely showed clinical signs. The signs observed in young camels were in the form of emaciation in spite of good appetite, pale mucous membranes and weakness. Similar clinical signs were recorded previously by Solanki et al. (27). Some Nematode species feed on blood and responsible for specific clinical symptoms linked to severe anemia, diarrhea, loss of body weight and death (28).

Hematological examination of examined healthy and diseased camels revealed a decrease in the erythrocyte counts and hemoglobin concentration in infested camels compared with the healthy controls. Similar results were recorded previously by Rabana et al. (15) and Solanki et al. (27) who recorded a significant decrease in hemoglobin, total erythrocytes count, packed cell volume, total leucocytes count and a significant increase in values of MCH as compared with helminths free camels. On contrary, Bamiyi and Kalu (29) recorded a non-significant difference between camels infested with parasitic gastroenteritis compared with those non-infested ones for blood parameters.

Concerning the treatment trials, albendazole alone or in combination with ivermectin twice with 2 weeks interval gave 100% cure rate both clinically and parasitologically. However, treatment using ivermectin alone gave only 93.33% parasitological cure. Similar findings were observed previously by Demelash et al. (21) who documented the efficacy of albendazole and ivermectin in the treatment of nematodiasis in camels and Kagira et al. (30) who found that the combination between ivermectin and albendazole are very effective in the treatment of nematodes in vervet monkeys and baboons. The intensive use of ivermectin in the treatment of mange in camels in Qassim region, KSA without veterinary supervision may lead to the development of drug resistance. Parasites can adapt to the commonly used anthelmintics resulting in the development of resistance (21, 31).

Finally, it can be concluded that the prevalence of gastrointestinal nematodiasis is less prevalent in Qassim region and the age factor has a significant effect on the prevalence but the sex factor has no effect. In addition, albendazole either alone or in combination with ivermectin is the drug of choice in the treatment of gastrointestinal nematodiasis in dromedary camels in this region.

Acknowledgements

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Compliance with ethical standards

This study was approved by the Animal Care and Welfare Committee, Deanship of Scientific Research, Qassim University, Kingdom of Saudi Arabia.

Conflict of interest

The author declares that he has no conflict of interest.
References


