

## THE PREVALENCE OF GASTROINTESTINAL PARASITES IN WILD AND DOMESTIC ANIMALS IN RADOM NATIONAL PARK; SOUTH DARFUR STATE, SUDAN

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### ABSTRACT

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This paper describes the results of a survey of the gastro-intestinal helminth parasites in the faecal matters of fourteen wildlife species and four domestic animal species collected from five sites in Radom National Park (R.N.P), South Darfur State, Sudan, namely: *Radom* area, *Alhufra*, *Titirbi*, *Kafindibei* and *Kafiakingi*. Out of the 1179 faecal matters examined, 115 (9.8%) were found harboring eggs of helminth parasites. The leopard (*Panthera pardus*) had the highest overall infection rate of helminth eggs (50%) (6/12), while *Patas* monkeys (*Erythrocebus patas*) showed the lowest prevalence (2.7%) (1/37). The prevalence recorded in the two types revealed that domestic animals had a prevalence of 9.8% (59/600) while wild animals had 9.7% prevalence rate (56/579). *Radom* area showed the highest prevalence (13.9%) (49/352), followed by *Kafiakingi* (9.3%) (27/289), whereas *Alhufra* area showed the lowest prevalence (5.4%) (7/129). The results of this survey were compared and discussed with previous findings of similar studies in Sudan and elsewhere.

**Key words:** Helminth parasites, Radom National Park, South Darfur State, Sudan.

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### INTRODUCTION

The available information on parasitic infection among wildlife species, particularly in the Sudan, is scanty. There are few scattered published papers in scientific journals. Eisa *et al.* (1979) published a check-list of helminth parasites of domestic and wild animals in Sudan during the period 1902 – 1975. According to these authors, *Cysticercus tenuicollis* was reported in the reedbeak, monkey and kob; *Cysticercus pisiformis* in the rabbit; *Trichuris spp.* was reported in the monkey and gazelle; *Toxocara canis* was reported in cheetah and wild cat; *Setaria labiatopapillosus* in the reedbeak; *Trichostrongylus spp.* in the giraffe; *Ascaris lumbricoides* in the wild pig; *Strongyloid spp.* in the gazelle; *Ascaris pythonis* in the python and *Toxascaris leonina* in the lion. All the investigated faecal matters for the above mentioned findings were collected from wildlife species kept in captivity at Khartoum Zoo. Saad and Eisa (1980) surveyed the parasites of seven hussar monkeys in which they reported the presence of three helminthes, namely; *Streptophagus pigmentatus*, *Oesophagostomum biforcum* and *Trichuris trichura*. They noticed that, although some wild mammals are infected by endoparasites, however, they did not show any clinical evidence of disease or health deviation despite the presence of these parasites. Laboratory examination of 184 faecal samples collected from 44

species of wild animals kept at Khartoum Zoo (Sudan) revealed the presence of *Trichostrongylus* eggs in faeces of dorcas gazelles, cheetah, roan antelope, giraffe, red-fronted gazelles, *Nubis* baboons, vervet monkeys and cape buffaloes (Saad *et al.*, 1983). Free ranging wild animals in Sudan seemed not had been investigated for the prevalence of helminth parasites before. The present study is intended to investigate the prevalence of helminth parasite in free-ranging domestic and wildlife in *Radom* National Park, South Darfur State, Sudan.

### MATERIALS and METHODS

**Study Areas:** *Radom* National Park is located to the south-west of Lake *Kundi* on the border with the Central Africa Republic, in the south-western corner of Southern Darfur State. The park consists of an area of broken hilly country lying between two main rivers, the *Adda* and the *Umbelasha*. *Radom* was declared a Biosphere Reserve in 1979 by the International Union for Conservation of Nature (IUCN) (1987). The vegetation is principally heavy savannah woodland dominated by some bush trees such as *Terminalia brownii*, *Combretum spp.*, *Anogeissus leiocarpus* and *Isobertinia doka*.

**Collection and examination of faecal samples:** The study was done during the period from December, 2010 to December, 2011. A total of 1179 faecal

samples were collected from the five sites namely: *Radom* area, *Alhufra*, *Titrbi*, *Kafindibei* and *Kafiakingi*. 10% formaldehyde solution was added to the collected faecal samples, then the samples were put in nylon bags, labeled then transported to the Veterinary Laboratory in *Nyala* for examination. In the laboratory, two qualitative techniques, namely floatation and sedimentation techniques were used for separation, concentration and demonstration of parasite eggs and oocysts in the collected faecal samples. Both techniques were done following the method described by FAO (2006). Results of faecal examination were analyzed using Chi – square analysis methods.

**RESULTS**

Frequencies and distributions of the test samples by type, species, and area are presented in Table 1. Almost equal numbers of samples were collected from both domestic animals (600 samples) and wildlife (579 samples) (Table 1). Domestic animals were available within the study areas and were easy to catch and sample. Within the wildlife groups, the *Dikdik* represented the highest sampled animal.

Conversely, the bushbuck and the leopard represented the lowest species sampled (Table1).

Generally, eggs of internal parasites were detected in the study area with variations observed in the prevalence between different types, species, and areas as presented in Table 2. The overall prevalence was 9.8% (115/1179) with 95% CI between 8.1 and 11.5.

The prevalence estimated in the two types with domestic animals had the high prevalence of 9.8% (59/600), with 95% CI between 7.42 and 12.18, and wild animals showed the low prevalence of 9.7% (56/579), with 95% CI between 7.29 and 12.11, as presented in Table 2.

Among the infected animals, the leopard (*Panthera pardus*) had the highest prevalence (50%) (6/12), with 95% CI between 21.71 and 78.29, and *Patas* monkey (*Erythrocebus patas*) showed the lowest prevalence (2.7%) (1/37), with 95% CI between -2.52 and 7.92, as presented in Table 2. *Radom* area showed the highest prevalence of internal parasites (13.9%) (49/352), with 95% CI between 10.29 and 17.51, followed by *Kafiakingi* with a prevalence of 9.3% (27/289), with 95% CI between 5.95 and 12.65, whereas *Alhufra* showed the lowest prevalence (5.4%) (7/129), with 95% CI between 1.5 and 9.3 (Table 2).

**Table 1:** Frequencies and distributions of examined faecal samples by type, species and area for internal parasites in *Radom* National Park, South Darfur State.

| <b>Factor and its level</b> | <b>Number of tested samples</b> | <b>% of tested samples</b> |
|-----------------------------|---------------------------------|----------------------------|
| <b>Types:</b>               |                                 |                            |
| Domestic                    | 600                             | 50.9                       |
| Wild                        | 579                             | 49.1                       |
| <b>Species:</b>             |                                 |                            |
| Warthog                     | 75                              | 6.4                        |
| Baboons                     | 83                              | 7.0                        |
| Patas monkey                | 37                              | 3.0                        |
| Velvet monkey               | 35                              | 3.0                        |
| Leopard                     | 12                              | 1.0                        |
| Reedbuck                    | 17                              | 1.4                        |
| Cheetah                     | 27                              | 2.3                        |
| Aardvak                     | 15                              | 1.3                        |
| Dikdik                      | 101                             | 8.6                        |
| Rabbit                      | 69                              | 5.9                        |
| Fox                         | 41                              | 3.5                        |
| Spotted hyaena              | 34                              | 2.9                        |
| Bushbuck                    | 11                              | 0.9                        |
| Waterbuck                   | 22                              | 1.9                        |
| <b>Domestic:</b>            |                                 |                            |
| Cattle                      | 132                             | 11.2                       |
| Sheep                       | 138                             | 11.7                       |
| Goats                       | 161                             | 13.7                       |
| Donkeys                     | 169                             | 14.3                       |
| <b>Area:</b>                |                                 |                            |
| <i>Radom</i> area           | 352                             | 29.9                       |
| <i>Alhufra</i>              | 129                             | 10.9                       |
| <i>Titrbi</i>               | 184                             | 15.6                       |
| <i>Kafindibei</i>           | 225                             | 19.1                       |
| <i>Kafiakingi</i>           | 289                             | 24.5                       |
| <b>Total</b>                | <b>1179</b>                     | <b>100</b>                 |

Out of all internal parasites identified in the present study, *Toxocara* spp. Recorded the highest prevalence rate (7.4%), followed by *Oesophagostomum* spp. (3.6%), then *Haemonchus* spp. (1.4%) and finally *Ascaris* spp. (1.2%).

**The univariate associations with positive status against *Ascaris*:**

The proportions of positive results differed between type, species, and area. In the univariate analysis using chi square, type (p-value = 0.037) and species (p-value = 0.000) were significantly associated with floatation and sedimentation methods of identification for *Ascaris* infection. However, area (p-value=0.577) was not significantly associated with floatation and sedimentation methods of identification for *Ascaris* infection.

**Table 2:** Prevalence of internal parasites by type, species, and area in *Radom* National Park South Darfur State (December 2010 - December 2011).

| Factor and its levels   | Number of tested sample | Number of positive samples | Prevalence (%) | 95% CI Lower - Upper |
|-------------------------|-------------------------|----------------------------|----------------|----------------------|
| <b><u>Type:</u></b>     |                         |                            |                |                      |
| Domestic                | 600                     | 59                         | 9.8            | 7.42 - 12.18         |
| Wild                    | 579                     | 56                         | 9.7            | 7.29 - 12.11         |
| <b><u>Species:</u></b>  |                         |                            |                |                      |
| Warthog                 | 75                      | 6                          | 8              | 1.86 - 14.14         |
| Baboons                 | 83                      | 0                          | 0              | 0.00 - 0.00          |
| Patas monkey            | 37                      | 1                          | 2.7            | -2.52 - 7.92         |
| Vervet monkey           | 35                      | 0                          | 0              | 0.00 - 0.00          |
| Leopard                 | 12                      | 6                          | 50             | 21.71 - 78.29        |
| Reedbuck                | 17                      | 3                          | 17.6           | -0.5 - 35.7          |
| Cheetah                 | 27                      | 8                          | 29.6           | 12.38 - 46.82        |
| Aardvak                 | 15                      | 0                          | 0              | 0.00 - 0.00          |
| Dikdik                  | 101                     | 4                          | 4              | 0.18 - 7.82          |
| Rabbit                  | 69                      | 0                          | 0              | 0.00 - 0.00          |
| Fox                     | 41                      | 18                         | 43.9           | 28.71 - 59.09        |
| Spotted hyaena          | 34                      | 8                          | 23.5           | 9.25 - 37.75         |
| Bushbuck                | 11                      | 2                          | 18.2           | -4.6 - 41            |
| Waterbuck               | 22                      | 0                          | 0              | 0.00 - 0.00          |
| <b><u>Domestic:</u></b> |                         |                            |                |                      |
| Cattle                  | 132                     | 22                         | 16.7           | 10.34 - 23.06        |
| Sheep                   | 138                     | 28                         | 20.3           | 13.59 - 27.01        |
| Goats                   | 161                     | 9                          | 5.6            | 2.05 - 9.15          |
| Donkey                  | 169                     | 0                          | 0              | 0.00 - 0.00          |
| <b><u>Area:</u></b>     |                         |                            |                |                      |
| <i>Radom</i> area       | 352                     | 49                         | 13.9           | 10.29 - 17.51        |
| <i>Alhufra</i>          | 129                     | 7                          | 5.4            | 1.5 - 9.3            |
| <i>Titrbi</i>           | 184                     | 14                         | 7.6            | 3.77 - 11.43         |
| <i>Kafindibei</i>       | 225                     | 18                         | 8              | 4.46 - 11.54         |
| <i>Kafiakingi</i>       | 289                     | 27                         | 9.3            | 5.95 - 12.65         |
| <b>Total/Overall</b>    | <b>1179</b>             | <b>115</b>                 | <b>9.8</b>     | <b>8.1 - 11.5</b>    |

The prevalence of *Ascaris* infection in the wildlife was low (0.5%) (3/579), with 95% CI ± 0.57, while in the domestic animals was higher (1.8%) (11/600), with 95% CI ± 1.06.

Regarding prevalence of *Ascaris* per animal species, Bushbuck (*Tragelaphus scriptus*) had the highest prevalence (18.2%) (2/11), with 95% CI ± 22.8, and *Dikdik* (*Madaqua guentheri*) showed the lowest prevalence (1%) (1/101), with 95% CI ±1.94. All domestic animals were free of parasitic infection

except sheep which has only eleven positive samples out of 138 samples examined. All wildlife infected by *Ascaris* eggs were ruminant animals.

As for the prevalence of *Ascaris* per area or site of sample collection, *Radom* area showed the highest prevalence (1.7%) (6/352), with 95% CI ± 1.35, whereas *Kafiakingi* showed the lowest prevalence (1%) (3/289), with 95% CI ± 1.15.

For *Toxocara* infection, the proportions of positive results differed between type, species and area. In the

univariate analysis using chi square, type (p-value = 0.000) and species (p-value = 0.000) were significantly associated with floatation and sedimentation methods of identification. However, area (p-value=0.778) was not significantly associated with floatation and sedimentation methods of identification for *Toxocara* infection.

For the prevalence of *Toxocara* by animal type, the wildlife had a prevalence of 7.4% (43/579), with 95% CI  $\pm$  2.13, whereas the domestic animals were not infected at all with *Toxocara* (0%) (0/600), with 95% CI  $\pm$  0.

Regarding the prevalence of *Toxocara* by animal species, the leopards (*Panthera pardus*) had a prevalence of 50% (6/12), with 95% CI  $\pm$  28.29, and the warthog (*Phacochoerus aethiopicus*) showed a lower prevalence (4%) (3/75), with 95% CI  $\pm$  4.43.

For the prevalence of *Toxocara* infection by area (site of sample collection), *Kafiakingi* showed a prevalence of 4.5% (13/289), with 95% CI  $\pm$  2.39, and *Alhufra* showed a lower prevalence (2.3%) (3/129), with 95% CI  $\pm$  2.59.

The proportions of positive results for *Haemonchus* infection differed between type, species, and area. In the univariate analysis using chi square, species (p-value = 0.000) were significantly associated with floatation and sedimentation methods of identification for *Haemonchus* infection. However, type (p-value = 0.150) and area (p-value=0.135) were not significantly associated with floatation and sedimentation methods of identification for this parasite.

For the prevalence of *Haemonchus* infection by animal type, the wild animals had lower prevalence (0.9%) (5/579), with 95% CI  $\pm$  0.77 compared to the domestic animals which had a prevalence of 1.8% (11/600), with 95% CI  $\pm$  1.06. Concerning the prevalence of *Haemonchus* by animal species, the reedbuck (*Redunca redunca*) had a prevalence of 17.6% (3/17), with 95% CI  $\pm$  18.1, while goats showed a lower prevalence (1.2 %) (2/161), with 95% CI  $\pm$  1.68.

As far as the area of sampling is concerned, *Radom* area showed the highest prevalence of *Haemonchus* (2.6%) (9/352), with 95% CI  $\pm$  1.66, and *Alhufra* showed the lowest prevalence (0.8%) (1/129), with 95% CI  $\pm$  1.54.

The proportions of positive results for *Oesophagostomum* infection differed between type, species and area. In the univariate analysis using chi square, type (p-value = 0.000) and species (p-value = 0.000) were significantly associated with floatation and sedimentation methods of identification for *Oesophagostomum* infection. However, area (p-

value=0.010) was not significantly associated with floatation and sedimentation methods of identification for this parasite.

The prevalence of *Oesophagostomum* by animal type showed that the wild animals had lower prevalence (0.9%) (5/579), with 95% CI  $\pm$  0.77, compared to the domestic animals which showed higher prevalence (6.2%) (37/600), with 95% CI  $\pm$  1.93. Cattle had the highest prevalence (16.7%) (22/132), with 95% CI  $\pm$  6.36, while *Patas* monkeys (*Erythrocebus patas*) showed the lowest prevalence (2.7%) (1/37), with 95% CI  $\pm$  5.22.

Considering the prevalence of *Oesophagostomum* by area of faecal sample collection, *Radom* area showed the highest prevalence (6.5%) (23/352), with 95% CI  $\pm$  2.58, in contrast to *Titrb* which showed the lowest prevalence (1.6%) (3/184), with 95% CI  $\pm$  1.81.

## DISCUSSION

In the present study, wild and domestic animal species in *Radom* National Park, South Darfur State (Sudan), were investigated for gastrointestinal helminths by examination of faecal samples, gastrointestinal tracts and detection of pasture contamination in the study area. The present study confirmed the presence of *Ascaris spp.* as the most predominant parasite of Bushbuck (*Tragelaphus scriptus*) in *Radom* area. *Ascaris* worms are known to have a wide range of hosts and were formerly reported in waterbuck in Lake Mburo National Park in Uganda (Ocaido *et al.*, 2004).

The prevalence of *Toxocara spp.* parasites in the study area was higher (63.51%) in the rainy season as compared to the winter season (50%). The first report of *Toxocara cati* in wildlife was in the leopard (*Panthera pardus saxicolor*) in Iran and was documented by Esfandiari *et al.* (2010). It was also reported in tiger, lion, leopard and jungle cat in India (Mahali *et al.*, 2010). *Toxocara* worms were recovered in the faeces of *Nubis* baboons, Hussar monkeys, *Asmara* gazelle and lion by Saad *et al.* (1983). It was also reported in a tiger and a lion in Khartoum Zoo, Sudan (Saad *et al.*, 1983). Similar results were also recorded in the present study where *Toxocara spp.* eggs were reported in leopards (*Panthera pardus*) in *Kafiakingi* where these worms had the highest prevalence in leopards (50%) than in other animals in the study area. It worths mentioning that *Kafiakingi* was more populated with feline and canine animals compared to the other remaining four study sites. These results indicated that all domestic animals were free of infection since they are not the right hosts for this parasite.

The results of this study confirmed that *Haemonchus spp.* was the most predominant parasite of Reedbuck

(*Redunca redunca*) in *Radom* area. Furthermore, *Haemonchus spp.* was found to be more prevalent in small ruminants (sheep and goats). The samples collected from reedbuck were few (only 17) compared to those collected from sheep (138) or goats (161). This could be the reason that the reedbuck represented the highest percentage of infection. *Haemonchus spp.* was reported as the most predominant parasite in South Africa in mountain Reedbuck (*Redunca fulvorufula*) (Boomker *et al.*, 1989). It was also reported in the *Loskop* Dam Nature Reserve and the Mountain Zebra National Park (Boomker *et al.*, 1983). *Haemonchus contortus* is a cosmopolitan helminth parasite of sheep and goats (Chaudary *et al.*, 2007). It was also reported in blue wildebeest and *Kudu* in South Africa (Ilana *et al.*, 2011). *Haemonchus* species diagnosed in sheep and goats were not identified to species level, however, most probably they were *Haemonchus contortus*. The different species of genus *Haemonchus* had a wide range of domestic animal hosts as it is a known and widely spread ruminant parasite (Soulsby, 1982).

*Oesophagostomum spp.* was reported as the most predominant parasite in cattle in the neighboring Abyei area (Idriss *et al.*, 2012). *Oesophagostomum* eggs were found in the faeces of Warthog (*Phacochoerus aethiopicus*) in *Dinder* National Park (Sudan) by Dunn (1978). Also *Oesophagostomum dentatum* was reported as a helminth of swine. *Oesophagostomum macombiquei* was described from 9 females of Warthog (*Phacochoerus aethiopicus*) by Boomker (1990) in northern Mozambique. Also *Oesophagostomum spp.* was reported in water buffaloes in Bangladesh (Islam *et al.*, 1992). A high prevalence of *Oesophagostomum* infection in cattle (44.7%) was reported in Pakistan by Farooq *et al.* (2012). The present study confirmed that *Oesophagostomum spp.* was the most predominant parasite of cattle in *Radom* area. However, *Oesophagostomum spp.* had the highest prevalence in cattle (16.7%) than in other animals in the study area which might be due to differences in feeding behaviour as domestic animals are found grazing as a herd and often mixed up with other herds on communal type of pastures. *Oesophagostomum* is a mainly ruminant parasite.

Therefore, depending on the results of this study, it is recommended to conduct more research and surveys for internal parasites in the *Radom* National Park to confirm the findings of this study. It is also recommended that the government should provide adequate veterinary and animal health extension services in *Radom* National Park in order to improve the health condition of both domestic and wildlife and to create the necessary awareness among animal owners in the study area.

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### انتشار ديدان المعدة والإمعاء في الحيوانات الوحشية والأليفة في حظيرة الردوم ولاية جنوب دارفور، السودان.

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تقدم هذه الورقة نتائج بحث ميداني عن الإحتشار الطفيلي الداخلي في عينات روث لأربعة عشر نوعاً من الحيوانات البرية وأربعة أنواع من الحيوانات الأليفة. تم جمع العينات من خمسة مناطق بحظيرة الردوم المحمية القومية بولاية جنوب دارفور بغرب السودان (منطقة الردوم، الحفرة، تيتربي، كفن دبي وكفية كنجي). تم رصد وجود علامات ودلائل الإحتشار الطفيلي في عينات الروث التي تم جمعها وفحصها أثناء المسح الميداني من جميع أنواع الحيوانات البرية والأليفة. وجد من بين 1179 عينة روث شملت الدراسة أن 115 عينة بها إحتشار طفيلي داخلي وبنسبة إصابة مئوية بلغت 9,8%. وجد أن النمر يمتلك أعلى نسبة إصابة بين الحيوانات التي شملها البحث الميداني (50%) وأن قرد الطلح يملك أقل نسبة إصابة بين الحيوانات التي شملها البحث الميداني (2,7%) بينما الحيوانات الأليفة أعطت نسبة إصابة بلغت (9,8%). كانت نسبة إصابة الحيوانات البرية 9,7% ونسبة الإصابة في منطقة الردوم وهي أعلى إصابة حيث بلغت 13,9% ثم تليها منطقة كفن دبي بنسبة إصابة بلغت 9,3% ونسبة الإصابة في منطقة الحفرة وهي أقل نسبة إصابة بلغت 5,4%. تم رصد عدد من أنواع الطفيليات الداخلية والتعرف عليها أثناء الدراسة الميدانية شملت الديدان الأسطوانية (النيماتودا) (الاسكارس، التوكسوكارا، الهيمونكس والاسوفوقوستم). تمت مقارنة ومناقشة نتائج هذا البحث مع نتائج بحوث سابقة ومماثلة أجريت في السودان وفي مناطق أخرى من العالم.