

## OOCYSTS OF *ISOSPORA PAPIONIS* IN THE SKELETAL MUSCLES OF CHACMA BABOONS\*

E. E. McCONNELL<sup>1</sup>, P. A. BASSON<sup>2</sup>, SHAN E. THOMAS<sup>3</sup> and V. DE VOS<sup>4</sup>

### ABSTRACT

McCONNELL, E. E., BASSON, P. A., THOMAS, SHAN E. & DE VOS, V., 1972. Oocysts of *Isospora papionis* in the skeletal muscles of chacma baboons. *Onderstepoort J. vet. Res.* 39(2) 113-116 (1972). Numerous partially and fully sporulated oocysts of *Isospora papionis* were found in the skeletal muscles of two free-ranging adult male chacma baboons (*Papio ursinus*). Only one of them had *I. papionis* oocysts in the intestines and then only a few. The oocysts appeared potentially viable and provoked a mild inflammatory response.

The importance of the parasite in this location in regard to its life-cycle is discussed.

### INTRODUCTION

*Isospora papionis* McConnell, A. J. de Vos, Basson & V. de Vos, 1971 is a recently discovered coccidium which inhabits the intestinal tract of a small percentage of chacma baboons (*Papio ursinus*) in the Kruger National Park (McConnell, A. J. de Vos, Basson & V. de Vos, 1971). The purpose of this report is to record its occurrence in various skeletal muscles and to describe the associated lesions in this location.

### MATERIALS AND METHODS

A total of 100 chacma baboons were captured from various localities in the Kruger National Park, Republic of South Africa, during the period of November 1969 to October 1971 to survey the naturally occurring diseases among troops of free-ranging animals. They were either directly immobilized with phencyclidine hydrochloride (Sernylant†) or captured in cages before immobilization. After capture they were transported to the Veterinary Investigation Centre, Skukuza, where they were anaesthetized with the same drug, killed by exsanguination and necropsied.

Portions of various skeletal muscles were collected from each animal and preserved in 10% buffered formalin. Sections of these muscles were prepared at the Veterinary Research Institute, Onderstepoort, from paraffin embedded tissue and stained with haematoxylin and eosin (HE). After initial discovery of the coccidium in sections, small portions of infected unembedded formalin fixed muscle were placed between a slide and cover slip and examined directly to determine the exact nature, size and morphology of the parasite.

### RESULTS

Parasites resembling the coccidium *I. papionis* were found in the skeletal muscles of two adult males (B1 - 19,1 kg and B39 - 24,1 kg) of the 100 baboons surveyed. The affected muscles were the *longissimus dorsi* and *quadriceps* in B1 and the *masseter* in B39. They appeared as various developmental stages of sporulating and fully

sporulated oocysts in the endomesial and perimesial connective tissues of both baboons where they usually elicited a mild inflammatory response (Fig. 1 and 2). Plasma cells predominated and, to a lesser extent, there were macrophages and fibroblasts. Eosinophiles were rare. It could not be determined whether the parasites were intra- or extracellular, although they were intimately surrounded by cells resembling fibroblasts. Small blood vessels occurred in the parasitized areas and although direct involvement was not determined, such a possibility could not be excluded. The sarcolemma appeared intact and not demonstrably affected by the coccidium or the inflammatory process.

A thin delicate oocyst wall surrounded two ellipsoidal sporocysts which were in various stages of development (Fig. 3 and 4). The fully developed ones each contained four banana-shaped sporozoites and a coarse granular residuum. The sporocyst wall was thicker and more pronounced than that of the oocysts and did not rupture as easily as the latter when the parasites were teased from the tissue. Twenty oocysts measured 16,3 to 18,5 by 11,1 to 13,3 $\mu$  with a mean of 17,6 by 12,1 $\mu$ . Their length-width ratios were 1,3 to 1,7 with a mean of 1,45. Fifteen sporocysts measured 10,4 to 12,6 by 8,1 to 9,6 $\mu$  with a mean of 12,1 by 9,0 $\mu$ . Their length-width ratios were 1,2 to 1,5 with a mean of 1,3.

One of the baboons (B1) had a very small number of gamonts and oocysts of *I. papionis* in the small intestine but none could be found in B39, either on histological examination or after scraping several areas of the intact mucosa. Two other baboons, B4 (male - 28,3 kg) and B16 (male - 29,1 kg) had a few coccidia in the intestinal mucosa but none were found in specimens of the skeletal muscle. None of the other tissues examined, including the myocardium, were parasitized by oocysts.

Faeces were obtained from all 100 baboons but oocysts were found only in B4 and then only after an exhaustive search.

### DISCUSSION

According to McConnell *et al.* (1971), the oocysts of *I. papionis* in the small intestine measured 17 by 11 $\mu$

†Parke-Davis & Co.

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<sup>1</sup>Major, USAF, VC, Geographic Pathology Division, Armed Forces Institute of Pathology, Washington, D.C., Temporary assignment - Section of Pathology, Veterinary Research Institute Onderstepoort

<sup>2</sup>Section of Pathology, Veterinary Research Institute, Onderstepoort

<sup>3</sup>Section of Protozoology, Veterinary Research Institute, Onderstepoort

<sup>4</sup>Veterinary Investigation Centre, Skukuza, Kruger National Park

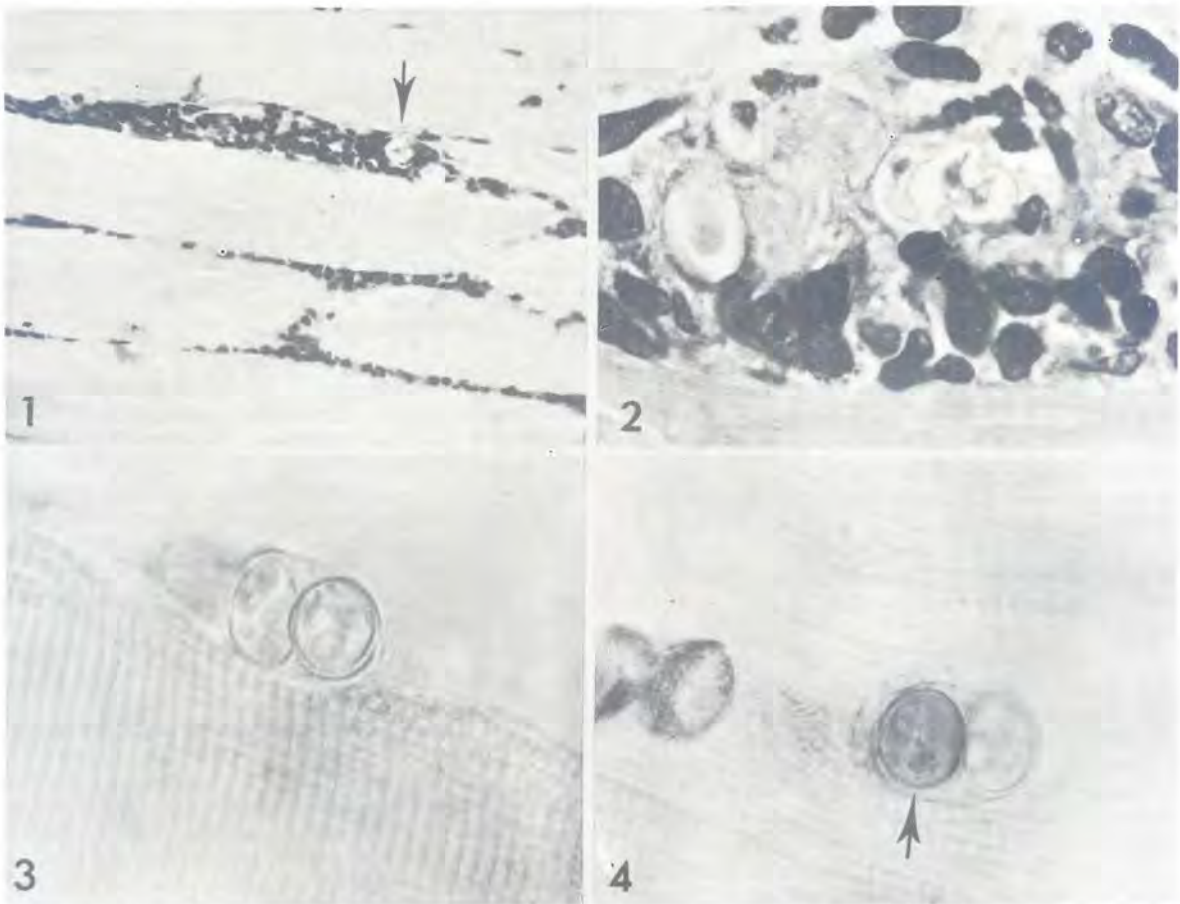


FIG. 1 Section of skeletal muscle showing oocysts of *I. papionis* (arrow) between muscle fibres within a mild inflammatory reaction. HE  $\times 200$   
 FIG. 2 Higher magnification of a similar area showing an oocyst containing two collapsed sporocysts (with parts of sporozoites within) in the centre and portions of two other ones at the left. HE  $\times 1200$   
 FIG. 3 Thin portion of unstained muscle showing sporulated oocyst at the edge of a fibre. Note that the sarcolemma appears intact. Wet preparation  $\times 1200$   
 FIG. 4 Similar to Figure 3. Note the granular residuum (arrow). Wet preparation  $\times 1200$

(muscle oocysts  $17,6 \times 12,1\mu$ ) with a length-width ratio of 1,45 (muscle oocysts 1,45). The sporocysts measured 11 by  $8,5\mu$  (muscle sporocysts  $12,1 \times 9,0\mu$ ) with a length-width ratio of 1,38 (muscle sporocysts 1,3). Thus the measurements of the parasites from both sites are virtually identical. They are also indistinguishable in shape and internal structure. Hence, it seems perfectly reasonable to assume that one is dealing with the same parasite.

Coccidiosis is usually considered to be a disease of the intestinal tract. However, there are exceptions such as hepatic coccidiosis (*Eimeria stiedae*) of rabbits, renal coccidiosis (*E. truncata*) in geese and *Eimeria* spp. of certain fish which attack the liver, gall bladder, peritoneum and air bladder (Pellérdy, 1965). Recently coccidia (*E. neitzi*) have been found in the uterus of impalas (*Aepyceros melampus*) (McCully, Basson, V. de Vos & A. J. de Vos, 1970) and what was believed to be coccidia were encountered in the uterus and liver of the hippopotamus (*Hippopotamus amphibius*) by McCully, Van Niekerk & Kruger (1967). The schizonts of certain intestinal coccidia (*Eimeria* spp.) have been found in the mesenteric lymph nodes of naturally infected sheep (Lotze, Shalkop, Leek & Behin, 1964) and in the livers of experimentally infected chicken embryos (Long, 1970).

The historic discovery by Hutchison, Dunachie, Siim & Work (1970) and Frenkel, Dubey & Miller

(1970) of the coccidian (*Isospora* sp.) developmental cycle of *Toxoplasma gondii* in cats has introduced new concepts in the life cycle of these protozoan parasites. Frenkel & Dubey (1972) subsequently showed that rodents may act as intermediate hosts of the feline coccidia, *Isospora felis* and *I. rivolta*, and Dubey & Frenkel (1972) found asexual stages of these parasites in the liver, spleen, mesenteric lymph nodes, brain, lung and muscle of experimentally infected kittens. The present study extends the above new information by demonstrating that **sexual** stages (*oocysts*) of an intestinal *Isospora* sp. can occur **spontaneously** in an extra-intestinal location.

The above-mentioned studies (Hutchison *et al.*, 1970; Frenkel *et al.*, 1970; Dubey & Frenkel, 1972 and Frenkel & Dubey, 1972) have confirmed that some *Isospora* spp. may develop in more than one host and in various tissues. The interesting question now arises whether carnivores play a role in the life-cycle of *I. papionis*. It is well known that leopards and lions are the primary predators of feral baboons. If *I. papionis* could infect these carnivores, then sporulated oocysts in the muscle would not be a "dead-end" for the parasite but rather an advantageous locality.

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## REFERENCES

- DUBÉY, J. P. & FRENKEL, J. K., 1972. Extra-intestinal stages of *Isospora felis* and *I. rivolta* (Protozoa: Eimeriidae) in cats. *J. Protozool.*, 19, 89-92.
- FRENKEL, J. K. & DUBÉY, J. P., 1972. Rodents as vectors for feline coccidia, *Isospora felis* and *Isospora rivolta*. *J. inf. Dis.*, 125, 69-72.
- FRENKEL, J. K., DUBÉY, J. P. & MILLER, N. L., 1970. *Toxoplasma gondii* in cats: Fecal stages identified as coccidian oocysts. *Science, N.Y.*, 167, 893-896.
- HUTCHISON, W. M., DUNACHIE, J. F., SIM, J. CHR. & WORK, K., 1970. Coccidian-like nature of *Toxoplasma gondii*. *Brit. med. J.*, 1, 142-144.
- LONG, P. L., 1970. Development (schizogony) of *Eimeria tenella* in the liver of chickens treated with corticosteroids. *Nature, Lond.*, 225, 290-291.
- LOTZE, J. C., SHALKOP, W. T., LEEK, R. G. & BEHIN, R., 1964. Coccidian schizonts in mesenteric lymph nodes of sheep and goats. *J. Parasitol.*, 50, 205-208.
- McCONNELL, E. E., DE VOS, A. J., BASSON, P. A. & DE VOS, V., 1971. *Isospora papionis* n.sp. (Eimeriidae) of the chacma baboon *Papio ursinus* (Kerr, 1792). *J. Protozool.*, 18, 28-32.
- McCULLY, R. M., VAN NIEKERK, J. W. & KRUGER, S. P., 1967. Observations on the pathology of bilharziasis and other parasitic infections of *Hippopotamus amphibius* Linnaeus, 1758, from the Kruger National Park. *Onderstepoort J. vet. Res.*, 34, 563-618.
- McCULLY, R. M., BASSON, P. A., DE VOS, V. & DE VOS, A. J., 1970. Uterine coccidiosis of the impala caused by *Eimeria neitzi* spec. nov. *Onderstepoort J. vet. Res.*, 37, 45-58.
- PELLÉRDY, L. P., 1965. Coccidia and coccidiosis. Budapest: Akadémiai Kiadó.