

BRIEF COMMUNICATION

SUSCEPTIBILITY AND MORBIDITY BETWEEN MALE AND FEMALE SWISS MICE INFECTED WITH *Angiostrongylus costaricensis*

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SUMMARY

The gender of vertebrate hosts may affect the outcome of parasitic infections. An experimental murine infection with *Angiostrongylus costaricensis* was followed with determinations of body weight, fecal larval elimination, number and length of adult worms, number of macroscopic intestinal lesions, and mortality. Groups of male and female Swiss mice were infected with 10 3rd-stage *A. costaricensis* larvae per animal. The results indicate there are no significant differences related to gender of the host, except for higher length of worms developed in male mice.

KEYWORDS: Metastrongyloidea; *Angiostrongylus costaricensis*; Gender; Sex; Murine.

INTRODUCTION

Angiostrongylus costaricensis Morera and Céspedes, 1971 is the etiologic agent of human abdominal angiostrongyliasis. This nematode lives inside the ileo-colic branches of the mesenteric artery of wild rodents, and its larvae develop in terrestrial mollusks⁹. The naturally infected rodent hosts are primarily wild species found in Central America and southern Brazil: *Tylomys watsoni*, *Lyomis salvini*, *L. adspersus*, *Proechimys semispinosus*, *Peromyscus nudipes*, *Zygodontomys microtinus*, *Oryzomys albigularis*, *O. caliginosus*, *O. fulvescens*, *O. nigripes*, and *O. ratticeps*^{3,10,14}. The cotton rat, *Sigmodon hispidus*, is the most important definitive host and occurs both in the wild and in peridomestic areas¹⁰. All experimental *A. costaricensis* studies reported thus far have used male mice, *Mus musculus*, and none have assessed whether gender is a determining factor for susceptibility or morbidity. The aim of the present study was to compare the course of *A. costaricensis* infection in male and female Swiss mice.

MATERIAL AND METHODS

Infective third-stage *A. costaricensis* larvae (L3), Santa Rosa strain, were inoculated orally through a metal cannula into six week-old mice. The larvae were obtained from experimentally infected *Phyllocaulis soleiformis* slugs. The mollusks were digested in a 0.03% pepsin (Sigma P-7125) solution in 0.7% HCl for two hours at 37 °C. Two groups of seven male (M) and female (F) mice were inoculated with 10 L3 per animal. Infection was confirmed at 21 days post infection (dpi) by

isolation of first stage larvae (L1) from feces, using the Baermann-Moraes method, followed by daily L1 quantification until 35 dpi. Body weight was registered at the beginning and end of the experiment, and was expressed as relative body weight (variation of the final weight, taking the initial weight as 100%). All surviving mice were sacrificed by CO₂ inhalation at 35 dpi and examined for the presence, number, location, and size of adult worms and macroscopic intestinal lesions. During the experiment, animals were housed in polystyrene boxes and maintained under laboratory conditions with food and tap water *ad libitum*. Animal handling was performed in accordance with the recommendations from the "Colégio Brasileiro de Experimentação Animal" (COBEA) and approved by the local Ethics Committee.

RESULTS AND DISCUSSION

There was a significant difference ($p < 0.05$; ANOVA of Repeated Measure, Bonferroni) in body mass gain, with groups M and F having losses of 6.0% and 14.5%. Variance analysis revealed that relative body weight was equally affected in both sexes ($p = 0.0050$). Gender did not influence the number of larvae released, since average daily larvae outputs were 5.0 and 5.3. Male mice survival was 43% (3/7) while 57% (4/7) of the female animals were alive at the end of the observations ($p > 0.05$). Variance analysis did not show differences in the proportion of macroscopic intestinal lesions ($p = 0.567$). There was also no significant difference ($p > 0.05$, chi-square) in the proportion of male/female worms recovered from their intra-arterial location, 9:9 and 7:6 for M and F groups. Worms recovered from M group ($n = 18$) were larger than those

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from F group (n = 13), 2.3 cm \pm 0.21 (mean \pm standard deviation) as compared to 2.1 cm \pm 0.22 ($p < 0.05$, variance analysis).

Although natural infection of *M. musculus* with *A. costaricensis* has never been documented^{8,13,14}, experimental investigation of the immunology and biology of parasitism in abdominal angiostrongyliasis have been carried out in several strains of mice: C57BL6, BALB/c, DBA/2, and C3H/He⁴. ISHII *et al.*⁵ infected inbred strains of rats (DA, JAR-2, LOU/M, NIG-III, WBN/Kob, and Wm) and two species of wild rodents, *Rattus norvegicus* and *R. rattus*, in order to study infection susceptibility and resistance. Later, ISHII & NISHIMURA⁶ described mortality, worm burden, hematocrit, and the magnitude of splenomegaly in the experimental infection of SM/J and A/J mice. However, there are scarce reports addressing gender differences in murine models of angiostrongyliasis, as has been done with other infectious agents, like *Paracoccidoides brasiliensis*⁷. It is well recognized that inbred strains of mice may differ in their susceptibility to infection by certain parasitic helminths^{1,2,15}. Variability in recovery of parasites from different individuals of the same host strain, or from animals of different strains, has led to the suggestion that genetic background may affect susceptibility or resistance to infection^{4,11}. Helminth infections are usually more severe in male than in female vertebrate hosts¹². The hypothesis of a facilitating effect of host gender on worm development was supported by the results of a meta-analysis showing higher worm growth rates in male hosts¹², which is also supported by the present data.

Overall, the results now reported do not indicate that gender significantly influences the susceptibility and morbidity in the murine experimental model for studies on abdominal angiostrongyliasis.

RESUMO

Susceptibilidade e morbidade entre camundongos Swiss machos e fêmeas infectados com *Angiostrongylus costaricensis*

O sexo dos hospedeiros vertebrados pode influenciar no resultado de infecções parasitárias. A infecção experimental de camundongos com *Angiostrongylus costaricensis* foi acompanhada com observação do peso corporal, eliminação de larvas nas fezes, número e comprimento dos vermes adultos, número de lesões macroscópicas nos intestinos e mortalidade. Grupos de camundongos Swiss machos e fêmeas foram infectados cada um com 10 larvas de terceiro estágio de *A. costaricensis*. Os resultados indicam que não há diferenças significativas relacionados ao sexo dos hospedeiros, exceto pelo maior comprimento dos vermes nos hospedeiros machos.

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