Available online at www.sciencedirect.com
ScienceDirect
Experimental Parasitology 119 (2008) 197–201
Experimental Parasitology
www.elsevier.com/locate/yexpr

Trypanosoma cruzi: Effects of social stress in *Calomys callosus* a natural reservoir of infection

Carla Domingues Santos [a], Míriam Paula Alonso Toldo [a], Antônio Marcos Aparecida Levy [b], José Clóvis Prado Júnior [a,*]

[a] *Departamento de Análises Clínicas, Toxicológicas e Bromatológicas, Faculdade de Ciências Farmacêuticas de Ribeirão Preto, FCFRP-USP, Universidade de São Paulo, Avenida do Café s/no., 14040-903 Ribeirão Preto, SP, Brazil*
[b] *Instituto Dante Pazzanese de Cardiologia Avenida Dr. Dante Pazzanese 500, CEP 04012-180 São Paulo, Brazil*

Received 8 November 2007; accepted 18 January 2008
Available online 2 February 2008

Abstract

Social environment can represent a major source of stress affecting cortisol and/or corticosterone levels, thereby altering the immune response. We have investigated the effects of social isolation on the development of *Trypanosoma cruzi* infection in female *Calomys callosus*, a natural reservoir of this protozoan parasite. Animals were divided in groups of five animals each. The animals of one group were kept together in a single cage. In a second group, four females were kept together in a cage with one male. In the final group, five individuals were kept isolated in private cages. The isolated animals showed body weight reduction, decreased numbers of peritoneal macrophages, lower global leucocytes counts, smaller lytic antibody percentage and a significantly higher level of blood parasites compared to the other animals. Their behavior was also altered. They were more aggressive than grouped females, or females exposed to the presence of a male. These results suggest that isolation creates a distinct social behavior in which immunity is impaired and pathogenesis is enhanced.
© 2008 Elsevier Inc. All rights reserved.

Index Descriptors and Abbreviations: *Trypanosoma cruzi*; *Calomys callosus*; Social stress; Parasitemia

1. Introduction

Chagas' disease is among the most important parasitic infections in terms of public health and economic impact. From a global perspective it represents the third largest tropical disease burden after malaria and schistosomiasis, affecting 20 million people in Central and South Americas (WHO, 2002). The acute phase is normally characterized by patent parasitemia and intense proliferation of amastigotes in several tissues including heart. The cardiac pathogenesis of Chagas' disease is characterized by myocarditis and inflammatory processes. The host immune response to *Trypanosoma cruzi* has been studied in different experimental models, including sylvatic rodents (Dost et al., 2006), mice (Santos et al., 2007a) and rats (Santos et al., 2005b, 2007b) due to their ability to mimic the human disease.

The immune response can be suppressed in humans and in animals by both acute and chronic stress (Bohus et al., 1991; Chrousos and Gold, 1992). Such immune system imbalances can create conditions favorable to the parasite's establishment. Many stressors have been shown to affect both cellular and humoral immune function (Khansari et al., 1990). Although the hormones of the HPA axis also play a role in regulating the establishment and maturation in models of parasite disease (Morales-Montor et al., 2001), there is as yet no strong evidence relating the activity of the HPA axis to experimental Chagas' disease. The importance of immune suppression in *T. cruzi* pathogenesis is unclear, although this area has received considerable attention (Rassi, 1979). Since stress is known to significantly influence the activity of the immune system, it is important to understand its effects on the course of infection by *T. cruzi* (Santos et al., 2005a, 2007c).

* Corresponding author. Fax: +55 16 602 4163.
E-mail address: jcprado@fcfrp.usp.br (J.C. Prado Júnior).

0014-4894/$ - see front matter © 2008 Elsevier Inc. All rights reserved.
doi:10.1016/j.exppara.2008.01.011

Profound societal changes have caused humans to be subjected to new kinds of stress. Modern life exposes people to conflict, anxiety, and emotionally trying situations unknown to our ancestors (Khansari et al., 1990). Moreover, social behaviors are known to play an important role in susceptibility to infection. For example, male house mice (*Babesia microti*) subjected to the stress of aggressively maintaining high social status is more susceptible to infection (Barnard et al., 1993, 1994). The pairing of male Syrian hamsters renders them more susceptible to the effects of *Schistosoma mansoni* infection; paired hamsters seemed to be immunological suppressed and showed increases in the fertility and number of worms recovered (Rashed et al., 1996).

Recent studies in animals suggest that stress can also exert an important effect on the course of Chagas' disease. Repetitive stress is known to increase the number of blood parasites (Santos et al., 2005a), and comparing the parasitemias of males and females kept singly or in groups, suggests that the social stress of isolation can elevate parasitemia (Schuster and Schaub, 2001). We have now extended these studies by examining the effects of social stress during the development of Chagas' disease in the naturally tolerant model of female *Calomys callosus* in order to better understand whether animals' behavior can alter some parameters like blood parasite levels, leukocyte and macrophage counts, and lytic antibody percentage.

2. Material and methods

2.1. Experimental animals and infection

Female *C. callosus* ($n = 60$) weighing 25–30 g were used. Animals were intraperitoneally (i.p.) inoculated with 10,000 blood tripomastigotes of the Y strain of *T. cruzi* (Silva and Nussenszweig, 1953).

2.2. Parasites

Analyses were performed on 5, 8, and 14 days post-inoculation using Brener's method (Brener, 1962).

2.3. Social condition

The animals were divided in three groups: females *C. callosus* were kept five to a cage they are nominated as grouped female, the other group were kept alone in a cage and the other group were kept in the presence of male. Commercial rodent chow and water are available *ad libitum*.

2.4. Euthanasia

The animals were killed by decapitation to prevent additional stress and enhanced corticosterone plasma levels.

2.5. Counting peritoneal macrophages

Macrophages were assessed by the injection of 3 mL of cold RPMI-1640 medium (Cultlab-Campinas, Brazil) into the peritoneal cavity. Forty microliters of each harvested peritoneal exudate cell suspension were added to 360 μL of Turkey solution, and the macrophages cell counting was proceeded in a Neubauer chamber.

2.6. Leucocytes

Leucocytes were evaluated using total blood with anticoagulant (EDTA 10%). Blood was diluted in Turkey's solution and counted in Neubauer's chamber.

2.7. Lytic antibody analysis

Lytic antibody percentage was determined according to (Levy et al., 1996).

2.8. Statistical analysis

The results were expressed as the mean ± standard deviation of means. Statistical significance between the groups was determined by analysis of variance ANOVA ($P < 0.05$). All statistical analysis were made using Graph Pad Prism version 3.0.

3. Results and discussion

3.1. Social stress and behavior

We used isolation as a standardized psychological stressor to determine whether the severity of depression-like behavior correlates with a higher risk of *T. cruzi* infection. To avoid adaptation of the animals to stress, we utilized a randomized schedule of blood collection. If adaptation is impeded, circulating corticosterone levels remain elevated for a long period of time. This excess of corticosteroids has catabolic consequences and leads to the break down of vital functions (Selye, 1952). Using a system of observational scoring to measure stress-induced behavioral changes, we found higher levels of irritability for *C. callosus* kept alone compared to those kept with other animals in the same cage.

3.2. Social stress and parasitemia

Over the last two decades, a number of reports have indicated that stress and illness can compromise immunological function. For this reason there has been an increased interest in the study of the influences of stress on susceptibility to disease (Khansari et al., 1990). Recent works has demonstrated that repetitive stress can increase the number of blood and tissue parasites and enhance the pathological effects of *T. cruzi* infection (Santos et al., 2005a, 2007c). Another study, demonstrated the effect of

Download English Version:

https://daneshyari.com/en/article/4372129

Download Persian Version:

https://daneshyari.com/article/4372129

Daneshyari.com