

ORIGINAL ARTICLE

EXPERIMENTAL SUBCUTANEOUS CYSTICERCOSIS BY *Taenia crassiceps* IN
BALB/c AND C57BL/6 MICE

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SUMMARY

Human cysticercosis is one of the most severe parasitic infections affecting tissues. Experimental models are needed to understand the host-parasite dynamics involved throughout the course of the infection. The subcutaneous experimental model is the closest to what is observed in human cysticercosis that does not affect the central nervous system. The aim of this study was to evaluate macroscopically and microscopically the experimental subcutaneous cysticercosis caused by *Taenia crassiceps* cysticerci in BALB/c and C57BL/6 mice. Animals were inoculated in the dorsal subcutaneous region and macroscopic and microscopic aspects of the inflammatory process in the host-parasite interface were evaluated until 90 days after the inoculation (DAI). All the infected animals presented vesicles containing cysticerci in the inoculation site, which was translucent at 7 DAI and then remained opaque throughout the experimental days. The microscopic analysis showed granulation tissue in BALB/c mice since the acute phase of infection evolving to chronicity without cure, presenting 80% of larval stage cysticerci at 90 DAI. While C57BL/6 mice presented 67% of final stage cysticerci at 90 DAI, the parasites were surrounded by neutrophils evolving to the infection control. It is possible to conclude that the genetic features of susceptibility (BALB/c) or resistance (C57BL/6) were confirmed in an experimental subcutaneous model of cysticercosis.

KEYWORDS: Taeniosis-cysticercosis; Subcutaneous cysticercosis; Granuloma; Anatomopathological; *Taenia crassiceps*.

INTRODUCTION

Cysticercosis is a public health problem and is considered one of the tropical neglected diseases by the WHO¹. It is estimated that 50 million people around the world are infected with the taenioses-cysticercosis complex, and 80% of these people dwell in developing countries^{2,3}. In Brazil, neurocysticercosis, the most severe clinic manifestation of cysticercosis presents high frequency in the States of *Goiás*, *Minas Gerais* and *São Paulo*. However, the exact prevalence is not known because there is no compulsory notification of this disease⁴.

Taenia crassiceps is a helminth that belongs to the *Taeniidae* family and the cysticerci are able of budding within the intermediate host⁵. It has been used as an experimental model in studies of both subcutaneous and central nervous system locations of *T. solium* cysticercosis^{6,7}. Also *T. crassiceps* cysticerci present antigenic similarity to *T. solium* ones, therefore enabling the comprehension and to carry out immunopathological studies of this infection, in both forms, systemic and local, in experimental models⁸. In the subcutaneous tissue *T. crassiceps* cysticerci form a granuloma in a pathological process that is similar to the one observed in human cysticercosis⁶.

The most described experimental model of human cysticercosis

that does not affect the central nervous system is obtained by means of intraperitoneal infections of *T. crassiceps* cysticerci in BALB/c mice^{9,10,11}. These mice are susceptible to the infection and allow the parasites growth with a predominance of Th2 immune profile due to the detection of IL-4 as well as IL-5 and IL-13, anti-inflammatory cytokines^{12,13}. Unlikely, C57BL/6 mice are known to be genetically resistance to this infection, being able to contain the parasites growth by means of a mixed Th1/Th2 immune profile and production of IL-12, IL-17, and IFN-gamma which are pro-inflammatory cytokines in cysticercosis^{12,14}.

When the resistant lineage of mice C57BL/6 is infected by the subcutaneous route, they develop a granuloma composed of macrophages and neutrophils surrounding the parasite. It was also possible to observe an increase in serum IFN-gamma concentrations during the initial phase of the infection followed by an increase in IL-4 during the transition between the initial and late phases of infection. The Th1 immune profile with subsequent IFN-gamma production contributed to the destruction of the parasite and also to the infection control⁶.

This study proposes an experimental model of subcutaneous cysticercosis similar to what is observed in animals and humans enabling the follow-up of the infection throughout the evolution from the acute to the chronic stage (90 days after the inoculation). Therefore, the aim

of this study is to compare the general pathological processes in the subcutaneous of two lineages of mice, one susceptible (BALB/c) and one resistant (C57BL/6) to *T. crassiceps* infection.

MATERIAL AND METHODS

Ethical aspects

This study was approved by the Ethics Committee in animal use of the Federal University of Goiás (CEUA/UFG), protocol number 076/12.

Male mice from both lineages, BALB/c and C57BL/6, were used. They had between eight to 12 weeks of age, weighing between 20 and 30 grams, maintained in 20 x 30 cm cages in the animal facility of the Tropical Pathology and Public Health Institute of the Federal University of Goiás (IPTSP/UFG). These animals were fed with standard sterilized mouse food and acidified water *ad libitum*. Luminosity was controlled so as to provide a period of light of 12 hours.

Maintenance of *T. crassiceps*

T. crassiceps ORF strain is maintained in the animal facility of the IPTSP/UFG by means of peritoneal passages that are performed every 90 days using female BALB/c mice with 8-12 weeks of age. This maintenance is performed since 2002 according to a previously described protocol⁸.

Experimental subcutaneous cysticercosis

Four groups of mice were randomly distributed and contained five animals which were divided into four groups: Group 1 - BALB/c mice infected subcutaneously with 10 *T. crassiceps* cysticerci; Group 2 - BALB/c mice inoculated with sterile saline solution; Group 3 - C57BL/6 mice infected subcutaneously with 10 *T. crassiceps* cysticerci; and Group 4 - C57BL/6 mice inoculated with sterile saline solution.

The mice from the experimental infection groups (Groups 1 and 3) were inoculated in the subcutaneous dorsal region with 10 initial phase cysticerci of approximately 1.5 mm of size (each), in sterile saline solution and a total volume of 0.2 mL. Mice from the control groups (Groups 2 and 4) were inoculated with 0.2 mL of sterile saline solution⁶.

Seven, 30, 60 and 90 days after the inoculation the animals were euthanized and the subcutaneous infected region was collected for the anatomopathological analysis. Macroscopically, the size of the injury (vesicle) and the evolutionary stages of the cysticerci (initial - no buds, translucent membrane; larval - with buds, translucent membrane; final - no buds, opaque membrane) were evaluated¹⁵.

Anatomopathological analysis

The macroscopic and microscopic study of the pathological processes present in the subcutaneous tissues of BALB/c and in C57BL/6 mice infected with *T. crassiceps* cysticerci at seven, 30, 60 and 90 days after the inoculation (DAI) was performed. Tissues were fixed in 10% buffered formalin and embedded in paraffin. The slides were stained with hematoxylin and eosin (HE).

The following parameters were observed: presence/absence of the parasite, evolutionary stages of the parasite, presence/absence and preservation of the parasite membrane, inflammatory infiltration. In the host-parasite interface the analyzed pathological processes were changes of the cells, the interstitium, local alterations of the circulation, abnormal calcifications, edema, lymphocytes, plasmocytes, macrophages, neutrophils, eosinophils, necrosis, hyperemia, granulation tissue, fibrosis and abnormal pigmentation.

To characterize the granulomas, the presence/absence of macrophages and cellular aggregates surrounding the parasite were considered. The granulomas were considered primary when they contained agglomerates of macrophages surrounding the parasite. The granulomas were considered secondary when there was a variable extension of necrosis, cellular exudate and presence of epithelioid cells. The tertiary granuloma showed a smaller area of necrosis and diminished cellular exudate with predominance of conjunctive proliferation.

A semi-quantitative classification was used as follows: absent (score 0); discrete with up to 25% of compromised area (score 1); moderate with 26 to 50% of compromised area (score 2); and accentuated with more than 50% of compromised area (score 3).

Statistical analysis

All variables were tested as to the normal distribution and homogenous variation. When the distribution was considered normal, with a homogenous variation, the Student t-test was used. In the cases in which there was not a normal distribution, the Mann-Whitney test was used. The differences were considered significant when $p < 0.05$. The statistical analysis was performed using the Sigma Stat software version 3.5.

RESULTS

Macroscopic analysis

In BALB/c mice it was possible to observe the formation of a vesicle containing cysticerci with a size corresponding to the development and multiplication of the parasite in its interior. In these animals the presence of cysticerci induced an inflammatory process initially marked by signs of hyperemia and plasmatic exudation which evolved to chronicity without cure throughout the experimental days, with persistence of the infection and the presence of repair-related phenomena such as fibrosis detected by the vesicles membrane opacity (Fig. 1).

In C57BL/6 mice, the formation of vesicles surrounding the parasite and presenting increased sizes in comparison with the ones of BALB/c mice was observed during the acute phase of infection. However, in C57BL/6 animals, as the infection evolved to chronicity the vesicle diminished in size due to the death of parasites in its interior. In these animals the presence of the parasites induced the installation of an inflammatory process with plasmatic exudation. It is important to highlight that the cure of the infection was observed in C57BL/6 animals and they present fibrosis at the final stage (Fig. 1).

At 7 DAI, in BALB/c animals, it was possible to observe a small vesicle containing few parasites. The vesicle membrane was translucent

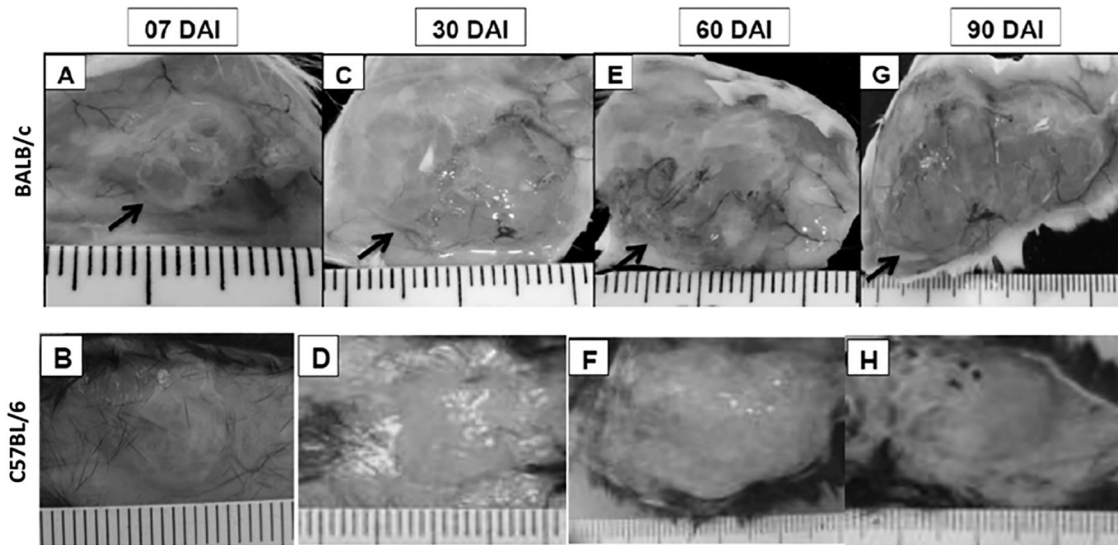


Fig. 1 - Macroscopic evolution of experimental subcutaneous cysticercosis by *Taenia crassiceps* in BALB/c (A, C, E, G) and C57BL/6 (B, D, F, H) mice throughout the experiment (90 days after the inoculation - DAI). Arrows indicate the vesicle containing the parasite.

in 80% of the animals filled with initial stage cysticerci (60%) and larval stage cysticerci (40%). The C57BL/6 animals presented cysticerci in different evolutionary stages (67% initial stage; 33% larval stage) within a translucent vesicle. In these animals, the vesicle was small and contained cysticerci adhered to the subcutaneous. The cysticerci membranes were preserved in the initial stages, but in the larval stage and in the final stages it was possible to observe the destruction of their membranes (Table 1).

At 30 DAI, BALB/c animals presented a larger vesicle when compared to the anterior experimental day, and the vesicle contained a greater amount of cysticerci (20% initial stage; 80% larval stage). The vesicle membrane was opaque in most animals. While in C57BL/6 mice there was a predominance of initial-stage cysticerci (100%), they were inside an opaque vesicle which was a little bigger than the one found at 7 DAI due to a greater amount of cysticerci in it.

At 60 DAI, in BALB/c mice, was possible to observe an opaque vesicle membrane with predominance of larval stage cysticerci (60%) within it. In C57BL/6 mice the vesicle was extended to almost the entire

dorsum of the animal containing all larval (67%) and final (33%) stage cysticerci in its interior.

At 90 DAI, in BALB/c mice the vesicle membrane was opaque in 60% of the animals, presenting larval (80%) and final (20%) stage cysticerci. While in the C57BL/6 mice there was a predominance of initial (33%) and final (67%) stage cysticerci in a vesicle that diminished in size comparing to the previous experimental day (Table 1). Also in these animals the vesicle was opaque and fibrotic.

Microscopic analysis

In BALB/c mice, at 7 DAI, the general pathologic process observed in the host-parasite interface was an inflammatory infiltration mainly constituted by neutrophils (Table 2). Lymphocytes and plasmocytes were absent. Macrophages, neutrophils and eosinophils were found in moderate intensity. Calcification and pigmentation were absent. Caseous necrosis was of discrete intensity while edema, hyperemia and fibrosis were of moderate intensity. Granulation tissue was observed in

Table 1

Granuloma and cysticerci classification from experimental subcutaneous cysticercosis by *Taenia crassiceps* in BALB/c and C57BL/6 mice throughout 90 days of infection

DAI	BALB/c						C57BL/6					
	Granuloma (%)			Cysticerci (%)			Granuloma (%)			Cysticerci (%)		
	Primary	Secondary	Tertiary	Initial	Larval	Final	Primary	Secondary	Tertiary	Initial	Larval	Final
7	100	-	-	60	40	-	20	80	-	67	33	-
30	-	40	60	20*	80*	-	-	80	20	100*	-	-
60	-	-	100	20	60	20	-	-	100	67	33	-
90	-	-	100	-	80	20	-	20	80	33	-	67

* statistical difference ($p < 0.05$) when compared to the other lineage.

a discrete intensity (Table 2) (Fig. 2). In these animals the granulomas observed were 100% classified as primary (Table 1). On the other hand, at this same experimental day, C57BL/6 mice presented absence of lymphocytes; while plasmocytes, macrophages and eosinophils were of discrete intensity and neutrophils of moderate one (Table 2) (Fig. 2). Calcification was absent and pigmentation, caseous necrosis, edema and hyperemia were of discrete intensity. Fibrosis intensity (absent) and granulation tissue (absent) were significantly lower than the one observed in BALB/c mice (Table 2). In C57BL/6 mice, primary granulomas were observed in 20% of the animals and 80% of them presented secondary granulomas (Table 1).

At 30 DAI, in BALB/c mice, plasmocytes were absent; while lymphocytes, neutrophils and eosinophils were of discrete intensity and macrophages were found in moderate numbers. Pigmentation was absent, while calcification and edema were of discrete intensity and caseous necrosis, hyperemia, fibrosis and granulation tissue were present in moderate quantity (Table 2) (Fig. 2). In these animals the 60% of the granulomas were classified as tertiary, and the remaining 40% were classified as secondary (Table 1). In C57BL/6 mice, lymphocytes were absent; while plasmocytes, macrophages, neutrophils and eosinophils were present in low numbers. Pigmentation was absent. The granulation tissue was absent and presented a statistical difference ($p < 0.05$) when

compared to the amount of granulation tissue detected in the other mice lineage. Caseous necrosis, edema, hyperemia and fibrosis were present in low amounts (Table 2) (Fig. 2). In C57BL/6 mice, the granulomas found were classified as secondary (80%) and tertiary (20%).

At 60 DAI, in BALB/c mice, lymphocytes, plasmocytes and eosinophils were of present in low amounts, neutrophils were moderately observed and macrophages were highly represented. Pigmentation and fibrosis were absent. The presence of edema and calcification was discrete. Caseous necrosis, hyperemia and granulation tissue were of moderate intensity (Table 2) (Fig. 2). In these animals, the granulomas were classified as tertiary (100%) (Table 1). In C57BL/6 mice, neutrophils were present in low amounts, and these numbers were significantly lower ($p < 0.05$) than the ones detected in the other mice lineage. Also, in these animals lymphocytes, plasmocytes and eosinophils were only discretely represented and macrophages were moderately observed. Calcification and pigmentation were absent. Caseous necrosis, edema, hyperemia, fibrosis and granulation tissue presented significantly different intensities ($p < 0.05$) when compared to the ones detected in BALB/c mice (Table 2) (Fig. 2). In C57BL/6 mice, the granulomas found were classified as tertiary (100%) (Table 1).

At 90 DAI, BALB/c mice presented lymphocytes, plasmocytes

Table 2

Microscopic aspects of general pathologic processes found in experimental subcutaneous cysticercosis caused by *Taenia crassiceps* in different mice lineages, BALB/c and C57BL/6, throughout 90 days of infection (DAI). Results in medium \pm standard deviation

Pathologic processes	DAI	BALB/c	C57BL/6	p
Lymphocytes	7	0.0 \pm 0.0	0.0 \pm 0.0	>0.05
	30	1.0 \pm 0.0	0.0 \pm 0.0	>0.05
	60	1.0 \pm 0.5	0.6 \pm 0.0	>0.05
	90	1.0 \pm 0.0	0.4 \pm 0.6	>0.05
Plasmocytes	7	0.0 \pm 0.0	0.4 \pm 1.2	>0.05
	30	0.0 \pm 0.0	0.2 \pm 0.6	>0.05
	60	1.0 \pm 0.0	1.0 \pm 0.6	>0.05
	90	0.8 \pm 0.4	0.4 \pm 0.6	>0.05
Macrophages	7	1.2 \pm 0.4	0.8 \pm 0.6	>0.05
	30	2.4 \pm 0.9	1.4 \pm 0.6	>0.05
	60	3.0 \pm 0.0	1.8 \pm 0.0	>0.05
	90	2.6 \pm 0.5	0.8 \pm 1.2	>0.05
Neutrophils	7	2.0 \pm 0.0	1.6 \pm 0.6	>0.05
	30	1.6 \pm 0.9	1.4 \pm 0.6	>0.05
	60	2.0 \pm 0.0	0.6 \pm 0.0	<0.05
	90	1.8 \pm 0.8	0.8 \pm 1.2	>0.05
Eosinophils	7	1.0 \pm 0.0	0.2 \pm 0.6	>0.05
	30	1.2 \pm 0.4	0.6 \pm 0.0	>0.05
	60	1.0 \pm 0.0	0.6 \pm 1.0	>0.05
	90	1.2 \pm 0.4	0.2 \pm 0.6	>0.05
Calcification	7	0.0 \pm 0.0	0.0 \pm 0.0	>0.05
	30	0.2 \pm 0.4	0.2 \pm 0.6	>0.05
	60	0.2 \pm 0.4	0.0 \pm 0.0	>0.05
	90	0.8 \pm 1.3	0.0 \pm 0.0	>0.05

Pathologic processes	DAI	BALB/c	C57BL/6	p
Pigmentation	7	0.0 \pm 0.0	0.4 \pm 1.2	>0.05
	30	0.0 \pm 0.0	0.0 \pm 0.0	>0.05
	60	0.0 \pm 0.0	0.0 \pm 0.0	>0.05
	90	0.4 \pm 0.5	0.2 \pm 0.6	>0.05
Caseous Necrosis	7	0.2 \pm 0.4	0.6 \pm 1.7	>0.05
	30	2.0 \pm 0.7	0.4 \pm 1.2	>0.05
	60	2.0 \pm 0.7	0.0 \pm 0.0	<0.05
	90	1.8 \pm 1.1	0.0 \pm 0.0	>0.05
Edema	7	1.8 \pm 0.4	1.0 \pm 1.5	>0.05
	30	1.0 \pm 0.0	0.2 \pm 0.6	>0.05
	60	1.2 \pm 0.4	0.0 \pm 0.0	<0.05
	90	0.0 \pm 0.0	0.0 \pm 0.0	>0.05
Hyperemia	7	1.6 \pm 0.5	1.0 \pm 1.2	>0.05
	30	1.8 \pm 0.8	0.2 \pm 0.6	>0.05
	60	2.2 \pm 0.8	0.2 \pm 0.6	<0.05
	90	2.4 \pm 0.5	0.0 \pm 0.0	<0.05
Fibrosis	7	1.6 \pm 0.4	0.0 \pm 0.0	<0.05
	30	2.0 \pm 0.0	0.6 \pm 1.0	>0.05
	60	0.0 \pm 0.0	0.8 \pm 0.6	<0.05
	90	0.0 \pm 0.0	1.0 \pm 0.6	<0.05
Granulation tissue	7	1.0 \pm 0.0	0.0 \pm 0.0	<0.05
	30	2.0 \pm 0.7	0.0 \pm 0.0	<0.05
	60	2.4 \pm 0.9	0.0 \pm 0.0	<0.05
	90	2.2 \pm 0.4	0.0 \pm 0.0	<0.05

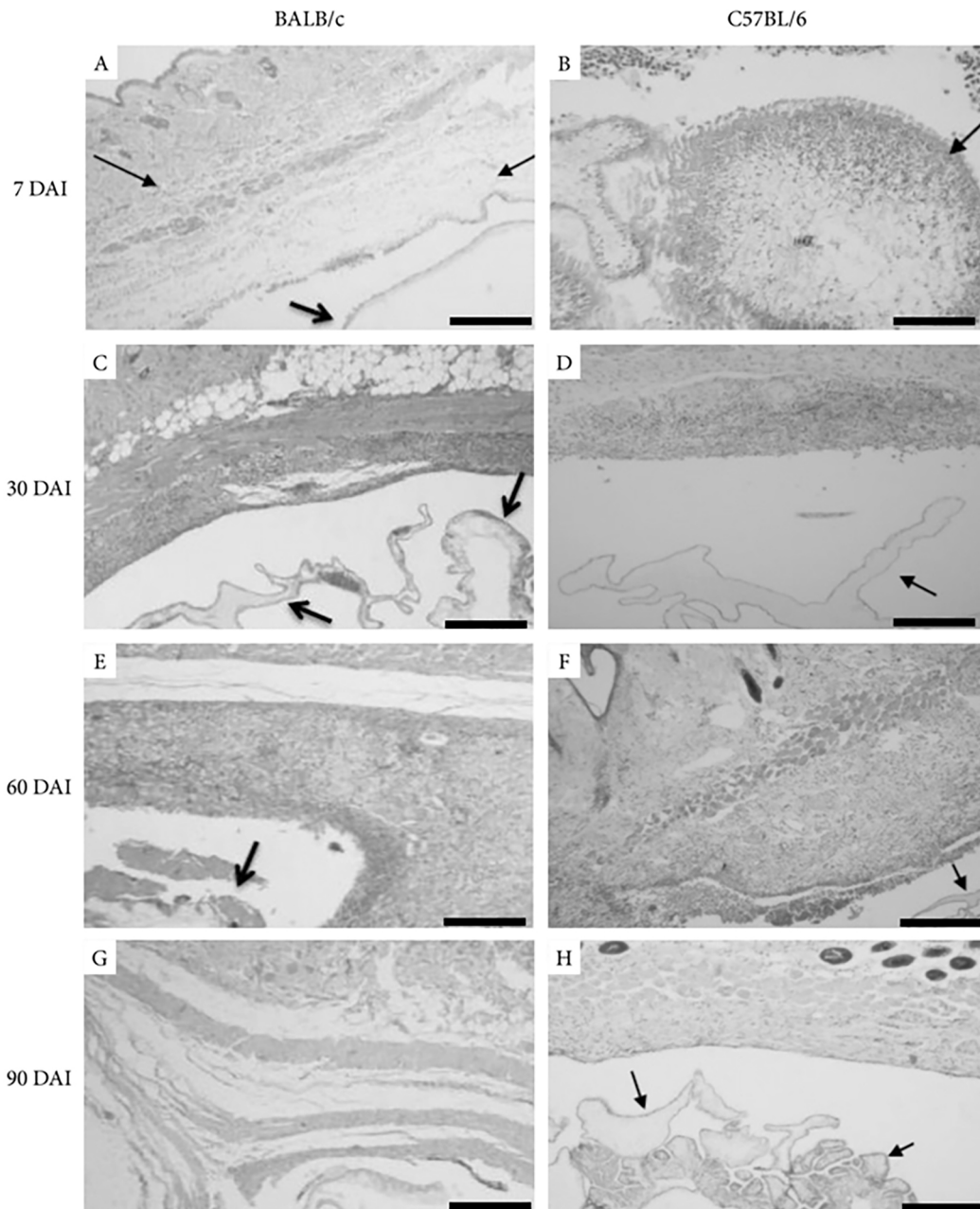


Fig. 2 - Photomicrography of the subcutaneous tissue of BALB/c and C57BL/6 mice experimentally infected with *Taenia crassiceps* cysticerci at 7, 30, 60 and 90 days after the inoculation (DAI). **A.** BALB/c mouse at 7 DAI with moderate and diffuse inflammatory infiltration in all skin layers (thin arrow) and next to an initial stage cysticercus (thick arrow), (HE, scale = 200 μ m). **B.** C57BL/6 mouse at 7 DAI with an inflammatory infiltrate surrounding the parasite (arrow), (HE, scale = 200 μ m). **C.** BALB/c mouse at 30 DAI with an accentuated inflammatory infiltrate next to a larval stage cysticercus (arrows). (HE, scale = 200 μ m). **D.** C57BL/6 mouse at 30 DAI with presence of an accentuated inflammatory infiltrate in the host-parasite interface and initial stage cysticercus (arrow), (HE, scale = 200 μ m). **E.** BALB/c mouse at 60 DAI with a final stage cysticercus and necrosis (arrow), (HE, scale = 200 μ m). **F.** C57BL/6 mouse at 60 DAI with initial stage cysticercus (arrow) and an accentuated inflammatory infiltrate surrounding the parasite. (HE, scale = 200 μ m). **G.** BALB/c mouse at 90 DAI with inflammatory infiltrate in all skin layers, (HE, scale = 200 μ m). **H.** C57BL/6 mouse at 90 DAI with cysticerci in all development stages (arrows) and moderate inflammatory infiltrate surrounding the parasites (HE, scale = 200 μ m).

and eosinophils in low amounts. Macrophages and neutrophils were moderately represented. Edema and fibrosis were absent. Calcification and pigmentation were discrete. Caseous necrosis, hyperemia and granulation tissue were moderately observed (Table 2) (Fig. 2). In these animals, the granulomas were classified as tertiary (100%) (Table 1). In

C57BL/6 mice, lymphocytes, plasmocytes, macrophages, neutrophils and eosinophils were discretely represented. Calcification, caseous necrosis and edema were absent. Pigmentation was discrete. Hyperemia, fibrosis and granulation tissue presented significantly different intensities ($p < 0.05$) when compared to the ones observed in the other mice lineage

(Table 2) (Fig. 2). In C57BL/6 mice the granulomas were classified as tertiary (80%) and secondary (20%) (Table 1).

Control animals from both lineages did not present any pathological process.

DISCUSSION

This study compared the local pathological processes involved in the inflammatory response of two mice lineages, BALB/c and C57BL/6, experimentally infected in the subcutaneous layer of the dorsal region, with *T. crassiceps* cysticerci.

T. crassiceps Most experimental models use *T. crassiceps* administered by intraperitoneal route to cause infection. The initial stage cysticerci are inoculated and normally develop in size, numbers, allowing the development of evolutionary stages in BALB/c mice, while in C57BL/6 the infection is controlled in approximately 30 days¹⁶. In the experimental model used in this study, subcutaneous infection in two mice lineages, BALB/c mice are genetically susceptible to the infection, while C57BL/6 mice are genetically resistant^{16,17}. This model is considered the most similar to human cysticercosis. In addition, human intraperitoneal cysticercosis caused by *T. solium* has not yet been described in the literature.

Gaspar *et al.*¹⁸ reported that resistance and susceptibility to parasitic infections are associated to the predominance of one of the two immune response types, Th1 or Th2 profiles. The Th1 immune profile is characterized by the presence of cytokines such as IL-2, IFN-gamma and TNF-beta, as well as immunological mediators producing cells. On the other hand, the Th2 immune profile is characterized by cytokines such as IL-4, IL-5, IL-6 and IL-13, B lymphocytes, antibodies production and Th1 immune regulation. In this study, at 7 DAI, BALB/c mice presented a significant increase in the granulation tissue and fibrosis when compared to C57BL/6 mice. These data show that already at the acute phase of the infection, i.e., at the beginning of the immune response, BALB/c mice present an inflammatory response which is responsible for the infection process chronicity and not for the parasite clearance. In BALB/c mice intraperitoneally infected by *T. crassiceps* the levels of IFN-gamma are decreased due to the production of Th2 cytokines¹⁹.

At 30 DAI, it was possible to observe a significant increase of lymphocytes and the granulation tissue in BALB/c mice when compared to C57BL/6 at the same experimental day. Moreover, the size of the vesicle in BALB/c mice was significantly larger than the ones found in C57BL/6 mice (data not shown). These data corroborate the ones from Péon *et al.*²⁰ who reported that in the acute phase of the *T. crassiceps* intraperitoneal murine infection, there may be an induction of a Th1 immune profile response during the first weeks, and this initial process is replaced by a Th2 immune profile response that is characterized by an increment in fibrosis.

At 60 DAI, there was an increase of neutrophils and fibrosis in C57BL/6 mice that was the opposite of the effects observed in previous experimental days in which the local inflammatory response in BALB/c mice was more intense than the one observed in C57BL/6 mice. On the other hand, caseous necrosis, edema, hyperemia and granuloma tissue were significantly increased in BALB/c mice. It has been reported that

the presence of *T. crassiceps* in C57BL/6 mice induces a mixed Th1/Th2 immune response leading to the production of IL-12, IL-17 and IFN-gamma¹⁷. The death of the parasites may occur due to an increase in the microbicidal activity of macrophages via the Th1 axis or by classical Th2 mechanisms¹⁴.

At 90 DAI, there was a significant increase in fibrosis in C57BL/6 mice when compared to BALB/c ones. This indicates that the infection in C57BL/6 mice has progressed to a terminating stage. Another fact that is indicative of the infection clearance is that all cysticerci found were in the final stage suggesting that this lineage has a greater capacity to promote the parasite clearance. On the other hand, there was a significant increase in hyperemia and in the granulation tissue in BALB/c mice when compared to C57BL/6 ones corroborating the genetic susceptibility of the BALB/c lineage to *T. crassiceps* infection. The predominant immune profile in BALB/c mice is Th2 (anti-inflammatory profile) and is more permissive in extra-intestinal sites^{14,21}.

The cysticerci presence in the subcutaneous region of BALB/c and C57BL/6 mice induced the *in situ* installation of a granulomatous inflammatory process throughout the experimental days, confirming the previous description by Freitas *et al.*⁶. BALB/c mice are considered genetically susceptible to this infection and that is why this lineage is used to maintain the parasite in research laboratories. This genetic susceptibility is the reason for the absence of cure in infected BALB/c animals in this study^{6,11,16,17,20,22}.

According to Nigam & Sharma²³ the experimental granuloma found in this study is similar to the ones found in human cysticercosis by *T. solium* due to the description of a nodule in subcutaneous cysticercosis. The nodules are composed of an inflammatory infiltrate including neutrophils, eosinophils, lymphocytes and histiocytes surrounded by fibrillar material. Similarly, other authors reported cystic breast lesions caused by *T. solium* cysticerci diagnosed by biopsy showing a typical granuloma surrounding the parasite^{24,26}. These data reinforce the applicability of this experimental model of subcutaneous cysticercosis.

We conclude that BALB/c mice in spite of presenting granulation tissue beginning on the acute phase of infection, they allow the proliferation of *T. crassiceps* cysticerci. On the other hand, in C57BL/6 mice, *T. crassiceps* cysticerci are surrounded by neutrophils mostly during the late phase of infection, leading to the parasite clearance. Therefore, it is also possible to conclude that the genetic features of susceptibility (BALB/c) or resistance (C57BL/6) were confirmed in an experimental model of subcutaneous cysticercosis which is the closest to what is observed in human cysticercosis that does not affect the central nervous system.

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