Saudi Journal of Biological Sciences (2012) **19**, 495–501

King Saud University

Saudi Journal of Biological Sciences

www.ksu.edu.sa
www.sciencedirect.com

ORIGINAL ARTICLE

Neuronal activation and plasticity in *Schistosoma mansoni* infected mice

Faiza B. Abdu *

Department of Biological Sciences, Faculty of Science, King Abdulaziz University, P.O. Box 42699, Jeddah 21551, Saudi Arabia

Received 28 May 2012; revised 9 July 2012; accepted 14 July 2012
Available online 22 July 2012

KEYWORDS

Schistosoma mansoni;
Inflammatory mediators;
Intestinal motility;
Mice;
Nitric oxide

Abstract Schistosomiasis leads to structural and functional changes which may result from unbalanced release of some inflammatory mediators. The aim of the study was to investigate the effect of intestinal parasitic infection on nitric oxide release and to evaluate the neural plasticity that leads to motility disturbance. Experiments were performed in Swiss mice 8- and 12-weeks following infection with *Schistosoma mansoni* compared to untreated controls. Jejunal motility was assessed using a Trendelenburg preparation to study aboral directed peristaltic pressure waves. Histological examination was used to determine the pathological characteristics of inflammation.

Parasitic infection produces diffuse inflammatory infiltrate in both 8- and 12-weeks infected animals. Inflammation had significant effect on peristaltic pressure waves amplitude and intervals at 8-weeks compared to control; whereas, in 12-weeks post infection there was a significant decrease in peristaltic pressure waves amplitude and interval compared to 8- weeks and control.

Nitric oxide synthase inhibitor (L-NAME 100 μM) induced a significant increase in amplitude and decrease in intervals in control, 8- and 12- weeks infected animals. In conclusion, parasitic infection leads to disturbance in the release of the inflammatory mediators. This study indicated the role of nitric oxide in developing granulomatous inflammation and participating in motility disturbance.

1. Introduction

Schistosomiasis is a chronic, debilitating, parasitic disease affecting over 200 million people (King and Dangerfield-Cha, 2008). It leads to motility-related disturbances that play a key role in most of the gastrointestinal symptoms. Seven weeks after the initial transcutaneous infection, egg production starts. These eggs penetrate the vessel wall to reach the small intestine, leading to inflammation (Herbert et al., 2010). After penetrating the mucosa, the eggs are excreted along with the feces. However, 50% of the eggs remain entrapped within the gut wall leading to chronic granulomatous inflammation and resulting in intestinal dysfunction (Abdu, 2009).

Enteric nerves play an important role in the regulation of gut function indirectly through changes of the myenteric plexus and the neurochemical mediators which alter the neural circuit controlling the structural and functional mechanisms in the small intestine (Ren and Bertrand, 2008). The effect of

* Fax: +966 2 695 3199.
E-mail address: fabdu@kau.edu.sa.

Peer review under responsibility of King Saud University.

ELSEVIER Production and hosting by Elsevier

1319-562X © 2012 King Saud University. Production and hosting by Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.sjbs.2012.07.002

Schistosoma mansoni (*S. mansoni*) infection on the smooth muscle leads to a dysfunction of specific neuronal regulatory mechanisms in the enteric nervous system (Balemba et al., 2002; De Man et al., 2003). However the structure and function of neurons and the release of neurotransmitters in the enteric nervous system during schistosomiasis are still unclear.

In intestinal inflammation, neuronal activation and plasticity (structural and neurochemical changes) cause dysfunction of peptidergic neurons, and may contribute to motor, secretory, and vascular disturbances (Sharkey and Kroese, 2001; Krauter et al., 2007; Mawe et al., 2009). The synaptic plasticity leads to facilitation of fast excitatory postsynaptic potentials (fEPSPs) in the colonic myenteric plexus in response to inflammation (Linden et al., 2003, 2004).

Neuronal dysfunction affects the enzymes that synthesize the inflammatory mediators and accounts for the irregulation of several physiological events. These enzymes are induced in a variety of cells, and produced large amounts of proinflammatory including cytotoxic nitric oxide (NO) which in turn activates cyclooxygenase (COX) enzymes to release prostagla ndins (PG) (Gookin et al., 2004; Mohn et al., 2005).

Nitric oxide is implicated in multiple physiological functions, including neuronal communication (Ding and Weinberg, 2006; Benarroh, 2011). On the other hand, NO and related radicals are very toxic group which physiologically contribute to immune regulation and defense against *S. mansoni*. It is produced by cytokine-activated macrophages within the muscle layers and impairs smooth muscle responsiveness (Akaike et al., 2009; Zahoor et al., 2009).

The effect of nitric oxide as intercellular messenger during inflammation has been studied (Balemba et al., 2001; Chen et al., 2010). However, the morphological basis for the disturbances is not well known. The present study was performed to investigate the possible neuronal damage induced by *S.*

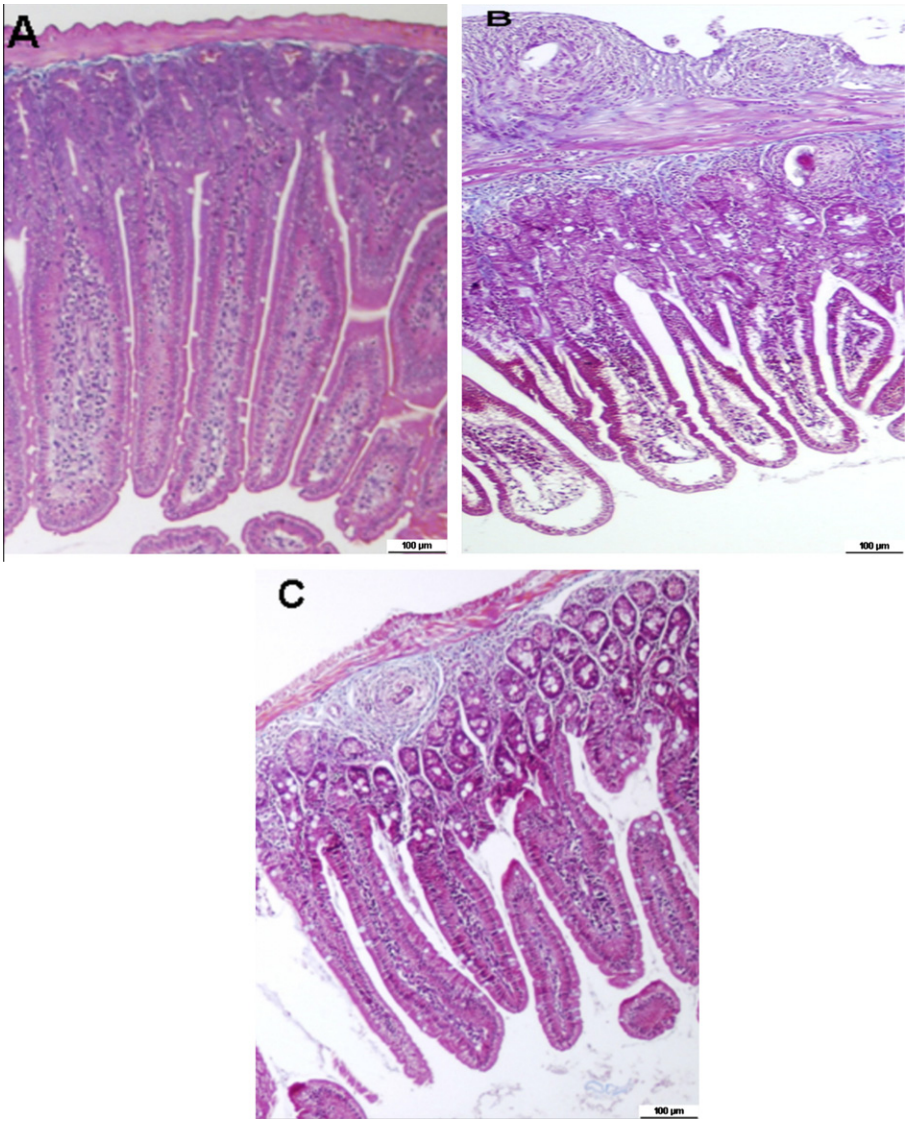

Figure 1 Cross sections of the jejunum from (A) control mice and from mice that were infected with *S. mansoni* for (B) 8- and (C) 12-weeks. The jejunum of 8-weeks infected mice showed a thickened smooth muscle layer compared to control and 12-weeks. Images are printed in the same final magnification (Trichrome stain, ×10). Scale bar, 100 µm.