The effect of recreational physical exercise on inflammatory markers in a rat model of colitis

Zita Szalai

Dept. of Physiology, Anatomy and Neuroscience, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary

Supervisor: Csaba Varga PhD
e-mail: sz.zita84@freemail.hu

The sedentary lifestyle can lead to health problems such as metabolic syndrome including obesity with hypertension, insulin resistance and high blood lipid levels. Metabolic syndrome is associated with a chronic low-grade inflammatory state and oxidative stress. Many studies reported that physical activity is an effective way of controlling body weight, but the influence of long term low intensity exercise on inflammation and activity of anti- and proinflammatoric enzymes is not well known. Heme oxygenase-1 (HO-1), which is the inducible isoform of heme oxygenase enzyme (HO), is thought to play an important role in the protection of tissues from oxidative injuries. Another enzyme involved in oxidative stress and inflammation is nitric monoxide synthase enzyme (NOS) with 3 isoforms: the inducible (iNOS) and the two constitutively expressed (cNOS) isoforms namely neuronal NOS (nNOS) and endothelial NOS (eNOS). Nitric monoxide (NO) produced in different amount by the three NOS isoforms can be both harmful and beneficial. We used a rat model, trinitrobenzene-sulphonic acid (TNBS) induced colitis, to investigate the changes of inflammation and activity of HO and NOS enzymes in the colon after running.

We investigated the effects of long-term leisure-type physical exercise on the activity of HO, NOS and myeloperoxidase (MPO, an inflammatory marker) enzymes in the trinitrobenzene-sulphonic acid (TNBS) induced colitis in rats in dependence on time.

After 3, and 6 weeks self-administered physical activity (running wheel) male Wistar rats were treated with TNBS (10 mg). After 72 h TNBS challenge we measured colonic inflammatory parameters and HO, iNOS, cNOS, MPO activity.

While after 3-week running we found no difference in the severity and extent of colonic inflammation in the sedentary and running TNBS treated group, the 6-week freewheel running significantly increased the activity of HO (from 1,3±0,2 to 2,8±0,3 nmol bilirubin/h/mg protein), constitutive NOS isoforms (from 321,1±35,2 to 438,0±30,1 pmol/min/mg protein). The TNBS challenge after 6 weeks running significantly decreased the level of inflammatory markers including extent of lesions (from 54,6±2,6% to 42,9±3,2%), severity of mucosal damage (from 7,6±0,3 to 6,6±0,3) and the level of MPO activity (from 880,6±79,3 to 568,4±59,9 mU/mg protein), increased the activity of cNOS (from 108,9±25,6 to 333,9±32,3 pmol/min/mg protein) decreased the iNOS activity (from 217,6±26,4 to 128,9±15,8 pmol/min/mg protein), but did not changed the activity of HO compared to the sedentary TNBS-treated group.

Long lasting recreational physical activity, at least 6 weeks by rats, improves body's defence mechanisms. Physical activity-induced increasing activation of HO and cNOS systems, decreased activation of iNOS system may play role of these mechanisms including colonic inflammation.

This work is supported by the TÁMOP 4.2.1./B-09-1/KNOV-210-0005 and TÁMOP 4.2.2.-08/1-2008-0006 research grants.
The presentation is supported by the European Union and co-funded by the European Social Fund.
Project title: "Broadening the knowledge base and supporting the long term professional sustainability of the Research University Centre of Excellence at the University of Szeged by ensuring the rising generation of excellent scientists."
Project number: TÁMOP-4.2.2/B-10/1-2010-0012