P. Merkely[1], G.Y. Nadasy[2], M. Bakos[1], M. Torok[1], N. Sydo[3], T. Radovits[3], B. Merkely[3], N. Acs[1], S.Z. Varbiro[1], **[1]Semmelweis University, II. Department of Obstetrics and Gynecology - Budapest - Hungary**, [2]Semmelweis University, Semmelweis University, Institute of Clinical Experimental Research - Budapest - Hungary, [3]Semmelweis University, Semmelweis University, Heart and Vascular Center - Budapest – Hungary:

Gender differences in cardiovascular exercise adaptation in a rat model

Abstract: P1537

Gender differences in cardiovascular exercise adaptation in a rat model

Authors:
P. Merkely[1], G.Y. Nadasy[2], M. Bakos[1], M. Torok[1], N. Sydo[3], T. Radovits[3], B. Merkely[3], N. Acs[1], S.Z. Varbiro[1], [1]Semmelweis University, II. Department of Obstetrics and Gynecology - Budapest - Hungary, [2]Semmelweis University, Semmelweis University, Institute of Clinical Experimental Research - Budapest - Hungary, [3]Semmelweis University, Semmelweis University, Heart and Vascular Center - Budapest - Hungary,

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Introduction: Physical activity increases the microcirculation of muscles. As a result of regular sport, segmental remodeling can be observed in the wall of the arteries.

Purposes: Our hypothesis is that “athlete's heart” is associated with the complex remodeling of the arteries manifested as “athlete's artery”. Our aim was to study the morphological remodeling, reactivity and gender differences of exercise adaptation in muscular arteries in a rat model.

Methods: In our experiment, we studied the biomechanical features of gracilis arteries, which supply the adductor muscle, on 12 male and 12 female Wistar rats after a 12-week swimming training program. In the swimming group (6 male and 6 female rats), swimming time was increased to 200 minutes per session 5 days per week, while the control group (6 male and 6 female rats) swam 5 minutes a day 5 days a week. After preparation of the arteries, we studied their reactivity to pressure (Δμm 0–150 mmHg) with a microangiometer in normal Krebs and noradrenalin medium. External and internal diameter and wall thickness were measured on videomicroscope images. Differences were tested with 2-way ANOVA. Significance was set at $p<0.05$.

Results: Male and female trained groups had lower body weight (male: 417.5±27.6g vs. 470.5±21.0g and female: 283.1±13.3g vs. 289.2±14.8g, $p<0.001$) and higher heart weight (male: 1.64±0.24g vs. 1.59±0.09g and female: 1.27±0.10g vs 1.09±0.05g, $p<0.001$) compared to controls. In the male control group, the external diameter of gracilis artery was the smallest and significantly smaller compared to the female controls (177.3±21.0μm vs. 245.5±10.7μm, $p<0.0001$) and the swimming males (177.3±21.0μm vs. 229.2±26.7μm, $p<0.001$). Male controls have the greatest wall thickness which was significantly greater compared to the female controls (25.9±2.4μm vs. 16.9±1.4μm, $p<0.001$). There was no difference in wall thickness between male and female swimming groups. In line with our results of the artery morphology, the reactivity to pressure in the noradrenalin medium was the lowest in male controls compared to the other groups. Distensibility was significantly higher in swimming groups compared to controls.

Conclusions: As a result of regular exercise, structural and functional remodeling can be observed on gracilis artery, as “athlete's artery”. Male trained rats showed more pronounced vascular adaptation to exercise with increased external diameter and decreased wall thickness versus trained females. Differences in proportion of muscle and elastic fibers, and hormonal and autonomic mechanisms may be responsible for these characteristic vascular adaptation changes.