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Effects of Exercise During Pregnancy on CaV1.2 Channel in Mesenteric Artery from SHR Offspring

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Objective To investigate the effect of exercise during pregnancy on L-type Ca^{2+} ($Ca_V1.2$) channel in mesenteric artery from spontaneously hypertensive rats (SHR) offspring.
Methods Female (11 weeks old) and male (12 weeks old) SHR, female (11 weeks old) and male (12 weeks old) WKY rats were selected to use for breeding. The day when the vaginal bolt was found was considered day 1 of gestation. The pregnant rats were randomly divided into four groups: WKY sedentary group (WKY-SED), WKY exercise group (WKY-EX), SHR sedentary group (SHR-SED) and SHR exercise group (SHR-EX). The exercise groups were subjected to swimming at the first day of pregnancy, 1h/d，6 days/week for 3 weeks. The 6-month-old male offspring were operated with femoral arterial and venous cannulation, and the blood pressure after intravenous (i.v.) injection of $Ca_V1.2$ channel opener BayK8644 and blocker nifedipine were monitored in vivo. In vitro study, the mesenteric arteries were removed and used for isometric contraction studies. The non-selective NOS inhibitor N^{ω}-nitro-L-arginine methyl ester (L-NAME, 100 μM) was added after 60mM KCl measurement. To investigate the contribution of $Ca_V1.2$ channels in vascular tone regulation, the vascular responses to nifedipine (10^{-9}–10^{-5}M) were examined. Western blot was applied to examine the protein expression levels of $Ca_V1.2$ channel.
Results (1) The mean arterial pressure(MAP) were higher in the 6M offspring of SHR-SED group than that of WKY-SED group ($P<0.01$), but there was no significant difference between the 6M offspring of SED and Ex groups. (2) The pressor responses induced by i.v. injection of BayK8644（0.1mg/Kg）were increased in the 6M offspring of SHR-SED group ($P<0.05$) compared with the WKY-SED group. Exercise during pregnancy markedly decreased the pressor responses in 6M offspring of SHR-EX group ($P<0.05$). (3) Compared with the 6M offspring of WKY-SED group, the depressor responses induced by i.v. injection of nifedipine（1mg/Kg）were increased in the 6M offspring of SHR-SED group ($P<0.01$). Exercise during pregnancy markedly attenuated the depressor responses in 6M offspring of SHR-EX group ($P<0.05$). (4) The isometric contraction study revealed that nifedipine induced concentration-dependent vasorelaxation in mesenteric artery precontracted with noradrenaline. The sensitivity of tissues to nifedipine in 6M offspring of SHR-SED group was significantly higher than that of WKY-SED group ($P<0.01$). Exercise during pregnancy normalized the increased sensitivity of tissues to nifedipine in 6M offspring of SHR ($P<0.05$). (5) Compared with the 6M offspring of WKY-SED group, the protein expression of $Ca_V1.2\alpha1C$ was significantly increased in SHR-SED group($P<0.01$). Exercise during pregnancy markedly inhibited the expression of $Ca_V1.2\alpha1C$ in 6M offspring of SHR-EX group ($P<0.05$).
Conclusions Pregnancy exercise has no significant effect on basic blood pressure in 6M offspring of SHR; but the increased function and protein expression of $Ca_V1.2$ channel in 6M offspring of SHR may be normalized by exercise during pregnancy.