Astaxanthin Reduces High Intensity Training Induced Myocardial Cell Apoptosis Via Activating Nrf2 in Rats

Xian Guo1, Jianmin Cao1, Yi Wang1, Haitao Zhou2,3, Jing Zhang2,3, Yanlong Niu1, Ge Hu1
1. Beijing Sport University
2. Beijing Union University
3. Key Laboratory of Bioactive Substances and Functional Foods, Beijing Union University
4. Gannan Medical University

Objective Long-term intensive training may lead to ischemia oxygen reaction and increase the ROS. Astaxanthin, as the super antioxidant, was investigated to against anti-oxidative stress. By supplementing the astaxanthin, we wanted to observe if it can mediated Nrf2 reduces myocardial cell oxidative injury in rats after high intensity training of 6 weeks.

Methods 7-week SD male rats were divided into 3 groups randomly: control group (C group, n = 10), high intensity training group (HT group, n = 15), astaxanthin and high intensity training group (HTA group, n = 15). The rats in HTA group were given with astaxanthin 20 mg/kg·d and in HT group were given with oil during the training day. The serum cTnI, myocardial apoptosis index, the expression of myocardial BAX, Bcl2, Nrf2, HO-1, myocardial MDA, SOD and T-AOC activity were measured 24 hours after the last training.

Results After 6-week training of high intensity, compared with group C, the serum cTnI, myocardial apoptosis index, the expression of BAX and myocardial MDA were significantly higher in group HT (P<0.01). The Bcl2/Bax, the expression of HO-1, SOD and T-AOC activity were significantly declined (P<0.01). After the intervention of 6-week astaxanthin, compared with group HT, the serum cTnI, myocardial MDA, the myocardial apoptosis index, the expression of BAX were significantly lower in HTA group (cTnI(ng/ml): 1.16±0.27 VS 2.47±0.39, P<0.05; myocardial apoptosis index: 164.27±3.98 VS 196.20±9.65, P<0.01; BAX: 58.40±5.95 VS 78.03±6.69, P<0.01). Finally, Bcl2/Bax, SOD, T-AOC activity, the expression of Nrf2 and HO-1 were significantly higher (Bcl2/Bax : 1.92±0.10 VS 1.19±0.18, P<0.01; SOD(U/mg): 52.38±6.15 VS 38.32±3.36, P<0.01; T-AOC(U/mg): 30.22±4.07 VS 23.76±3.20, P<0.01; Nrf2: 93.61±8.53 VS 74.26±6.69, P<0.01; HO-1: 84.99±13.78 VS 64.22±11.39, P<0.05).

Conclusions The supplement of astaxanthin can mediate Nrf2 signaling pathway, and elevate the expression of Nrf2 and HO-1. Then it can increase the activity of SOD and T-AOC and reduce the myocardial oxidative level and myocardial apoptosis in rats caused by 6-week high intensity training. Finally, the structure and function of heart tissue are back to normal.