Prolonged nandrolone treatment modifies heart proteomic profile of rats subjected to acute stress

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There is an increasing prevalence of anabolic-androgenic steroid (AAS) abuse in sport context, in order to potentiate the physiological effects of physical exercise and tolerance to high-intensity training, condition that involves prolonged activation of adrenoceptors such as stress. Intake of AAS has been associated with vascular complications, cardiomyopathy, coronary atherosclerosis, cardiac hypertrophy and acute myocardial infarct. Nandrolone (ND), an AAS strongly associated with detrimental cardiovascular effects including sudden cardiac death, is commonly abused by professional athletes and amateurs. A previous work of our laboratory (Penna et al., 2007) reported that ND administered at high doses induced modulation of rat heart response to stress. To study ND action on stressed heart, proteomic strategy was applied to evaluate whether supratherapeutic doses of ND could modify the cardiac protein profile. Proteins extracted from heart left ventricle of male Sprague Dowley rats weighing 300g, exposed to stress (VS) and to the association ND treatment+stress (NS) were analyzed by two-dimensional gel electrophoresis and then identified by mass spectrometry. We found that 2 out of 4 proteins expressed predominantly in NS- peroxiredoxin 6 (PRX6) and α-B crystalline (α-Bcry)- are involved in the response to oxidative stress. The differences observed in protein expression between NS and VS samples could suggest an ND involvement in oxidative stress. To verify this hypothesis, we measured concentrations of two oxidative stress markers, malondialdehyde (MDA) and hydroxinonenal (HNE), in plasma and heart samples derived from four groups of rats: V (control), VS (exposed to stress), N (treated with ND) and NS (ND treated and stressed). It emerged that stress increased the MDA and HNE levels, the pure ND administration did not modify these parameters, while it prevented the effect of stress.
Our findings indicate a protective action of ND against oxidative stress. Therefore the question is: is ND beneficial for heart? In a previous work we observed that 14 days of ND treatment at the same dose used in the present study made rat hearts more resistant to ischemia/reperfusion (I/R) injury after a postconditioning protocol (Penna et al., 2010). However a 10 week treatment undid the cardioprotection and I/R injury increased. Our hypothesis is that dose and time of ND administration are very important in determining its beneficial versus detrimental effects. In conclusion ND is able to modify heart protein profile, supporting an antioxidant response. Probably this effect is strictly dependent on treatment schedule.

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2. Penna C, Tullio F, Perrelli MG, Moro F, Abbadessa G, Piccione F, Carriero V, Racca S, Pagliaro P. Ischemia/reperfusion injury is increased and cardioprotection by a postconditioning protocol is lost as cardiac hypertrophy develops in nandrolone treated rats. Basic Res Cardiol. 2011;106 (3): 409-20.