IJAE
Vol. 120, n. 1 (Supplement): 206, 2015
ITALIAN JOURNAL OF ANATOMY AND EMBRYOLOGY

Contextualization of new biological evidence on the adult stem cell's role in super-compensation and overtraining

Filippo Macaluso[1], Kathryn H. Myburgh[2], Ashwin W. Isaacs[2], Felicia Farina[3], Giovanni Zummo[3], Valentina Di Felice[3]

[1] Scienze delle Attività Motorie e Sportive, Università degli Studi eCampus, Como, Italy - [2] Department of Physiological Sciences, Stellenbosch University, Stellenbosch, South Africa - [3] Dipartimento di Biomedicina Sperimentale e Neuroscienze Cliniche, Università degli studi di Palermo, Palermo, Italy

Adult stem cells are crucial for the repair of a variety of tissues, and also play a role in adaptation to localized stressors. Skeletal muscle tissue is highly adaptable in response to stress, such as exercise, and this adaptive capacity relies mainly on resident progenitor cells, in particular satellite cells (5). Variations in exercise training regimens (intensity, frequency and volume), influence the extent of adaptation and, when these variables are applied correctly, they may induce tissue adaptation to exercise stress (super-compensation). The incorrect application of these variables including insufficient recovery time following training may result in tissue damage due to overtraining. Human subjects underwent a single bout or repetitive bouts of eccentric exercise (plyometric jumps and downhill running) to study the role of satellite cells in super-compensation and overtraining phases (1-4). The results indicated a satellite cell pool expansion after a single bout or repetitive bouts of exercise. After a single bout, the number of satellite cells increased 1 day post-exercise, peaked 3-4 days post-exercise and thereafter declining. During repetitive bouts of exercise, the satellite cell pool expanded gradually and thereafter declined gradually to baseline values.

The proposed benefits of this phenomenon "super-compensation of satellite cells", i.e. expansion of adult stem cell pool, may be relevant for a new therapeutic approach to accelerate the healing process after surgery, pre-operative exercise.

References

[1] Macaluso F, Brooks NE, van de Vyver M, Van Tubbergh K, Niesler CU, Myburgh KH. Satellite cell count, VO(2max) , and p38 MAPK in inactive to moderately active young men. Scand J Med Sci Sports. 2012 Aug;22(4):e38-44.
[2] Macaluso F, Isaacs AW, Myburgh KH. Preferential type II muscle fiber damage from plyometric exercise. J Athl Train. 2012 Jul-Aug;47(4):414-20.
[3] Macaluso F, Brooks NE, Niesler CU, Myburgh KH. Satellite cell pool expansion is affected by skeletal muscle characteristics. Muscle Nerve. 2013 Jul;48(1):109-16.
[4] Macaluso F, Isaacs AW, Di Felice V, Myburgh KH. Acute change of titin at mid-sarcomere remains despite 8 wk of plyometric training. J Appl Physiol (1985). 2014 Jun 1;116(11):1512-9.
[5] Macaluso F, Myburgh KH. Current evidence that exercise can increase the number of adult stem cells. J Muscle Res Cell Motil. 2012 Aug;33(3-4):187-98.

Keywords
Exercise; satellite cells; stem cells; skeletal muscle