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Physiological and psychological effects of low volume high intensity interval exercise in young and older men

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INTRODUCTION:

High-intensity interval training (HIIT) induces modifications in type I ryanodine receptor, which can cause Ca²⁺ leakage from the sarcoplasmic reticulum at rest and reduce Ca²⁺ release during muscle contractions (1). These intrafibrillar Ca²⁺ cycling disturbances significantly reduce muscle contraction force and power, but also trigger beneficial adaptations. Despite the well-documented HIIT benefits to fitness, it also induces unpleasant sensations related with build-up of metabolites (2). The aim of the present study was to search for HIIT modalities that are both enjoyable and time efficient, yet still confer substantial benefits for health and exercise capacity.

METHODS:

Young (age 22.3 ± 4.6 years) and older (age 69.9 ± 6.3 years) men performed three interval cycling sessions which differed in intensity and duration: 6 sets of 5 s all-out; 3 sets of 30 s all-out, or 3 sets of 60 s submaximal, each performed 5 weeks apart in randomized order. Isometric maximal voluntary contraction and 20 (P20) and 100 (P100) Hz electrical stimulation evoked knee extension torques were measured at baseline and then immediately, 1 h, and 24 h after exercise. Concentrations of blood lactate and testosterone were measured and rating of perceived exertion, enjoyment and preferred exercise type were assessed.

RESULTS:

Peak and average power were higher during 5 s sprints, followed by 30 s sets, and the smallest during the 60 s bouts in both groups. Younger group developed higher power while lactate concentration was higher in the young than in the older group in response to all three sessions ($p < 0.05$). The increase in testosterone concentration was evident immediately (5 min) after the exercise in both groups in response to 3 x 60 s session and also in response to 3 x 30 s in young subjects. Sessions of 3 x 30 s and 3 x 60 s evoked larger degree of stimulated torque and MVC depression in both groups as compared to 6 x 5 s session. Old men ranked the 6 x 5 s session as the most preferred for further training, while the 3 x 30 s session was most frequently preferred by young subject.

CONCLUSION:

The study confirmed that as little as 6 x 5 s all-out cycling induces not only metabolic perturbations but also depression of muscle contractile function in both young and old men. The findings also indicate that the reduced ability to exert maximally in older people may require them a larger overall duration of intense exercise to achieve the same cumulative stress and health benefits as of younger exercisers.

1. N. Place, et al., Proc. Natl. Acad. Sci. 112, 15492-15497(2015).

2. M.J. Gibala, et al., J. Physiol. 590, 1077–1084 (2012).

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