UNIVERSITÀ DEGLI STUDI DI VERONA

CARDIOVASCULAR AND SKELETAL MUSCLE RESPONSES TO CHRONIC CONCURRENT EXERCISE USING FLYWHEEL TECHNOLOGY IN OLD MEN

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Afit
ASTRONAUT EXERCISE PRESCRIPTIONS PROMOTING HEALTH AND FITNESS ON EARTH

BACKGROUND

The physiological responses of healthy humans during adaptation to either real (space flight) or simulated (head down tilt bed rest) microgravity (µG) mimics accelerated aging. The mechano-skeletal and vestibulo-neuromuscular stimuli that are below threshold in space result in an about 10 times faster onset and time course of muscle atrophy and bone loss in space than those occurring with aging and concur to the development of balance problems, cardiovascular deconditioning and exercise incapacity upon return to Earth. Similar adaptations have been commonly shown also during head-down tilt bed rest in humans.
Consistent evidence has been accumulated that regular exercise training can increase muscle strength and mass, aerobic capacity and then counteract physical frailty and delay physical dependence. The design of the most optimal type, frequency, duration and intensity of exercise for the prevention of frailty and physical dependence is still debated. Recently, High-intensity Interval Training (HIT) and Flywheel Resistance Training (RT) have been used as an alternative to traditional training to improve cardio-respiratory fitness and counteract the loss of muscle function and mass during long-term bed-rest and exposure to µG.

PURPOSE

This study aimes at assessing the effects of various exercise training programs on functional physiological outcomes and expression of genes reflecting immune response, in healthy old men. We will evaluate the effects of physical training programs based on the Flywheel technology compared with those induced by cycling HIT and the efficacy of this two training protocols in preventing or delaying some specific consequences of aging (sarcopenia, immunosenescence and functional decay).

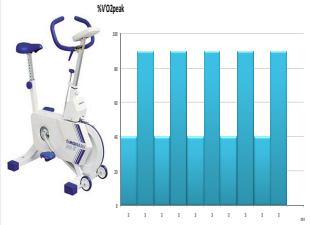
METHODS

Thirteen volunteers healthy old men (age (yy) 68.3±4.3; BW (kg) 78.1±10.2; h (cm) 172.2±5.7) were recruited according this inclusion criteria: normal anamnestic and clinical examination; absence of diagnosis of cardiovascular, osteo-articular, neurological, respiratory and metabolic diseases; absence of uncontrolled hypertension; absence of anti-coagulants and anti-aggregant therapy; absence of moderate-severe renal failure; absence of difficulty in walking or cycling.

Training

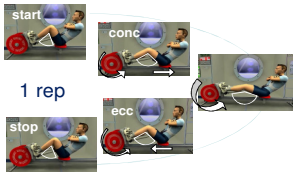
AEROBIC TRAINING

Training session will be composed by warm-up (15min), HIT (30min) and cool down (15min) 3time/wk for 8wk.
During each session, the subject will pedal for 3min at an intensity equal to 40% of V'O_2peak alternated with 3min of pedaling at intensities equal to 80-90% of V'O_2peak (workout lasting about 30min).



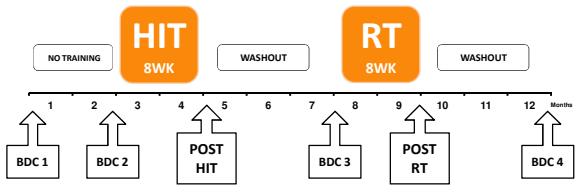
RESISTANCE TRAINING

Each training session will be composed by warm-up (15min), RT (30min) and cool down (15min) 3time/wk for 8wk.
RT on Yo-Yo Multigym Device, will consists in 4-5 series of 7 maximal flexion-extension repetitions, with 3min rest between sets.



"Yo-yo system" converts and stores energy produced during the concentric action to be absorbed or resisted in the subsequent eccentric action.

Experimental Design



Assessment Procedures

Volunteers will be investigated in 6 occasions: 2 Baseline Data Collections (BDC 1 and 2), after HIT (POST HIT), after 12wk of recovery and before RT (BDC 3), after RT (POST RT) and, finally, after the final 12wk of recovery after RT (BDC 4).
In each occasion, the subjects will be studied during five subsequent experimental sessions:
1.Body composition and maximal aerobic power
2.Muscle strength, neuromuscular activation, power, architecture of the limb extensors
3.Cardiovascular response to moderate aerobic exercise
4.Venous blood samples will be collected for subsequent microarray analyses of blood cells to reveal potential changes in gene expression
5.Muscle size and CSA

EXPECTED OUTCOMES

- This project aims to assess the feasibility and effectiveness of two different exercise protocols (HIT vs RT).
- The multidisciplinary approach will improve the database of information available on the interactions between activity/inactivity on skeletal muscle functions and immune responses.
- The analysis of the biological effects of the training programs will allow us to identify which adaptations are systemic and which are tissue-specific.
- The approach of large-scale microarray could identify new connections between immune responses and muscle loss in the elderly.

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