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Effects of high-intensity resistance training on untrained older men. I. Strength, cardiovascular, and metabolic responses.

Hagerman FC, Walsh SJ, Staron RS, Hikida RS, Gilders RM, Murray TF, Toma K, Ragg KE.

Department of Biomedical Sciences, Ohio University, Athens 45701, USA. hagermaf@ohiou.edu

Abstract

Most resistance training studies of older subjects have emphasized low-intensity, short-term training programs that have concentrated on strength measurements. The purpose of this study was, in addition to the determination of strength, to assess intramuscular and transport factors that may be associated with strength increments. Eighteen untrained men ages 60-75 years volunteered for the study; 9 were randomly placed in the resistance-training group (RT), and the other half served as untrained (UT) or control subjects. RT subjects performed a 16-week high-intensity (85-90% 1 repetition maximum (RT]) resistance training program (2 x/wk) consisting of 3 sets each to failure (6-8 repetitions based on 1 RM of 3 exercises): leg press (LP), half squat (HS), and leg extension (LE) with 1-2 minutes rest between sets. Pre- and post- training strength was measured for the 3 training exercises using a 1 RM protocol. Body fat was calculated using a 3-site skinfold method. Biopsies from the vastus lateralis m. were obtained for fiber type composition, cross-sectional area, and capillarization measurements. Exercise metabolism, electrocardiography, and arterial blood pressure were observed continuously during a progressive treadmill test, and resting echocardiographic data were recorded for all subjects. Pre- and post-training venous blood samples were analyzed for serum lipids. Resistance training caused significant changes in the following comparisons: % fat decreased in the RT group by almost 3%, strength improved for all exercises: LE = + 50.4%, LP = + 72.3%, HS = + 83.5%; type IIB fibers decreased and IIA fibers increased; cross-sectional areas of all fiber types (I, IIA, IIB) increased significantly, and capillary to fiber ratio increased but not significantly. No differences were noted for ECG and echocardiographic data. The RT group significantly improved treadmill performance and VO2max. Pre- and post-training serum lipids improved but not significantly. No significant changes occurred in any pre- to post-tests for the UT group. The results show that skeletal muscle in older, untrained men will respond with significant strength gains accompanied by considerable increases in fiber size and capillary density. Maximal working capacity, VO2max, and serum lipid profiles also benefited from high-intensity resistance training, but no changes were observed for HR max, or maximal responses of arterial blood pressure. Older men may not only tolerate very high intensity work loads but will exhibit intramuscular, cardiovascular, and metabolic changes similar to younger subjects.

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