DATA SET
ELABORATE LESSON 30

Food and Agriculture Center for Science Education

Muscle morphological and strength adaptations to endurance vs. resistance training

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Overview of the Study

The purpose of this study was to compare muscle strength and morphological adaptations of 10 weeks of endurance cycling with 10 weeks of lower body resistance training, with a focus on potentially long-term changes to muscle strength and muscle cross-sectional area. Eighteen untrained, young, healthy male subjects volunteered to participate in the training study. They were split into two groups. The first group completed endurance training (END), and the second group completed resistance training (RT), performed in 3 training sessions per week for 10 weeks.

The RT group completed a training program consisting of 3 different lower body exercises (leg press, hamstring curl, and knee extension), each performed as 3–5 sets of 4–10 repetitions. The recovery time between sets was set to 2 minutes during the first 15 training sessions, increasing to 3 minutes for the remaining 15 training sessions.

The END group completed a training program performed on stationary bicycles. Each session began with a 5-minute warm-up on the bike followed by 1 of 3 different weekly exercise sessions. At the end of all the sessions, the subjects performed 5–10 minutes of light cycling. The first weekly session consisted of continuous cycling of 30–45 minutes at 60–75% of watt-max. The second weekly session consisted of 2 intervals of 20 minutes at 70–80% of watt-max interspaced by 5 minutes of light cycling. The third weekly session consisted of eight 4-minute intervals at 80–90% of watt-max interspaced by 1 minute of light cycling.

To assess the change in size of muscle fibers, scientists obtained leg muscle biopsies before and after the training program. They use a microscope to view the muscle fiber structures and compare their sizes. To assess the change in whole muscle mass, scientists used MRI scans of the whole left leg and compared the cross-sectional area of the pre-and post-workout leg MRI images. To determine participants' one rep maximum, subjects completed 3RM and 1RM lifts on the incline leg press, 3RM on the hamstring curl machine, and 3 RM on the knee extension machine.

Results

Figure 1: Fiber cross-sectional area (CSA). Values for m. vastus lateralis mean fiber, type I and type II CSA (µm2) ± SEM pre- and post-10 weeks of either endurance training (END) or resistance training (RT). The results from 2-way analysis of variance are shown in the upper right corner. *Significant difference pretraining vs. posttraining for RT ($p < 0.05$)

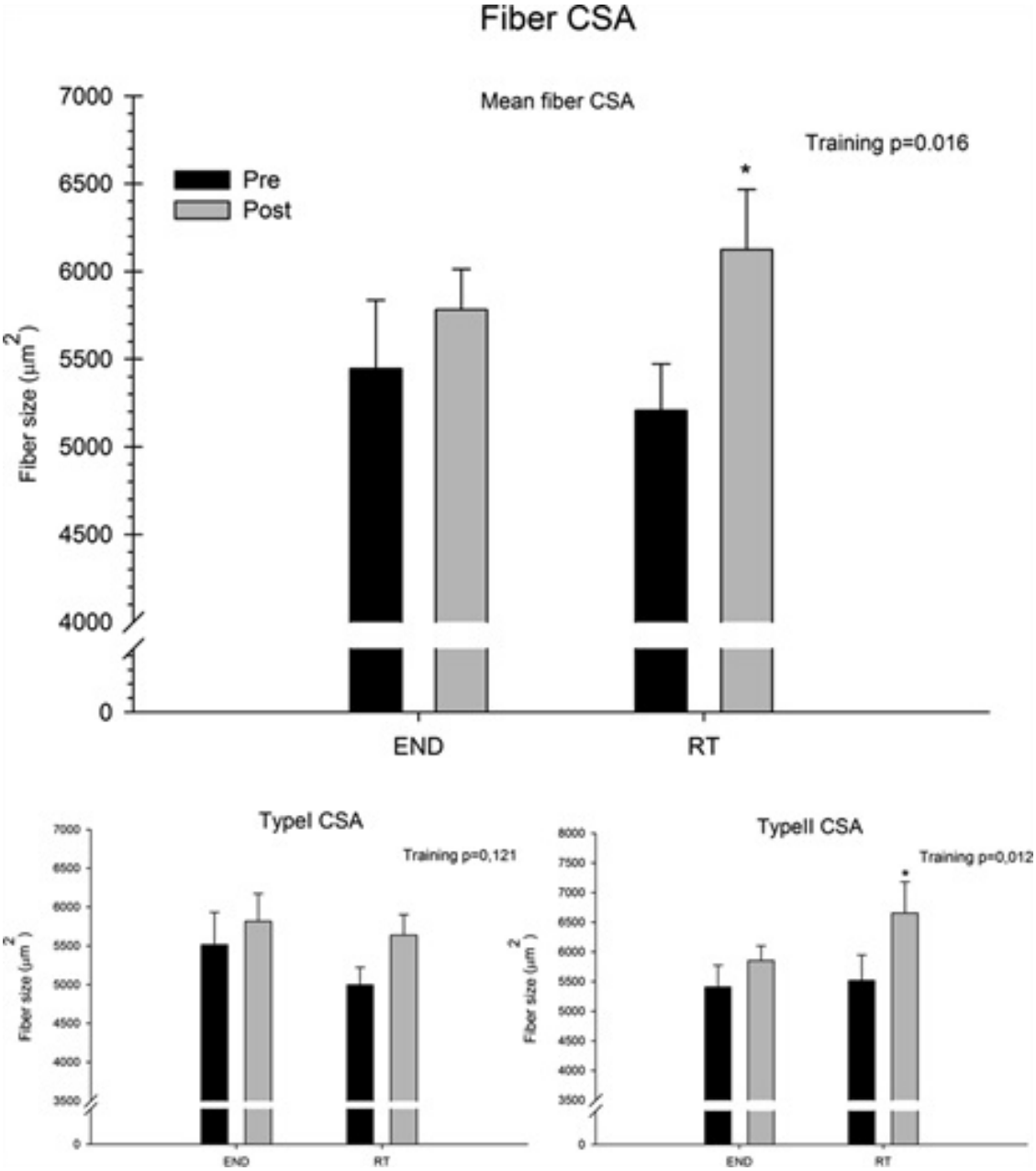

Figure 2: Anatomical cross-sectional area (CSA). Values for knee extensor and total thigh anatomical CSA (cm^2) ± *SEM* pre- and post-10 weeks of either endurance training (END) or resistance training (RT). The results from 2-way analysis of variance are shown in the upper right corner. *Significant difference pretraining vs. posttraining for RT ($p < 0.01$).

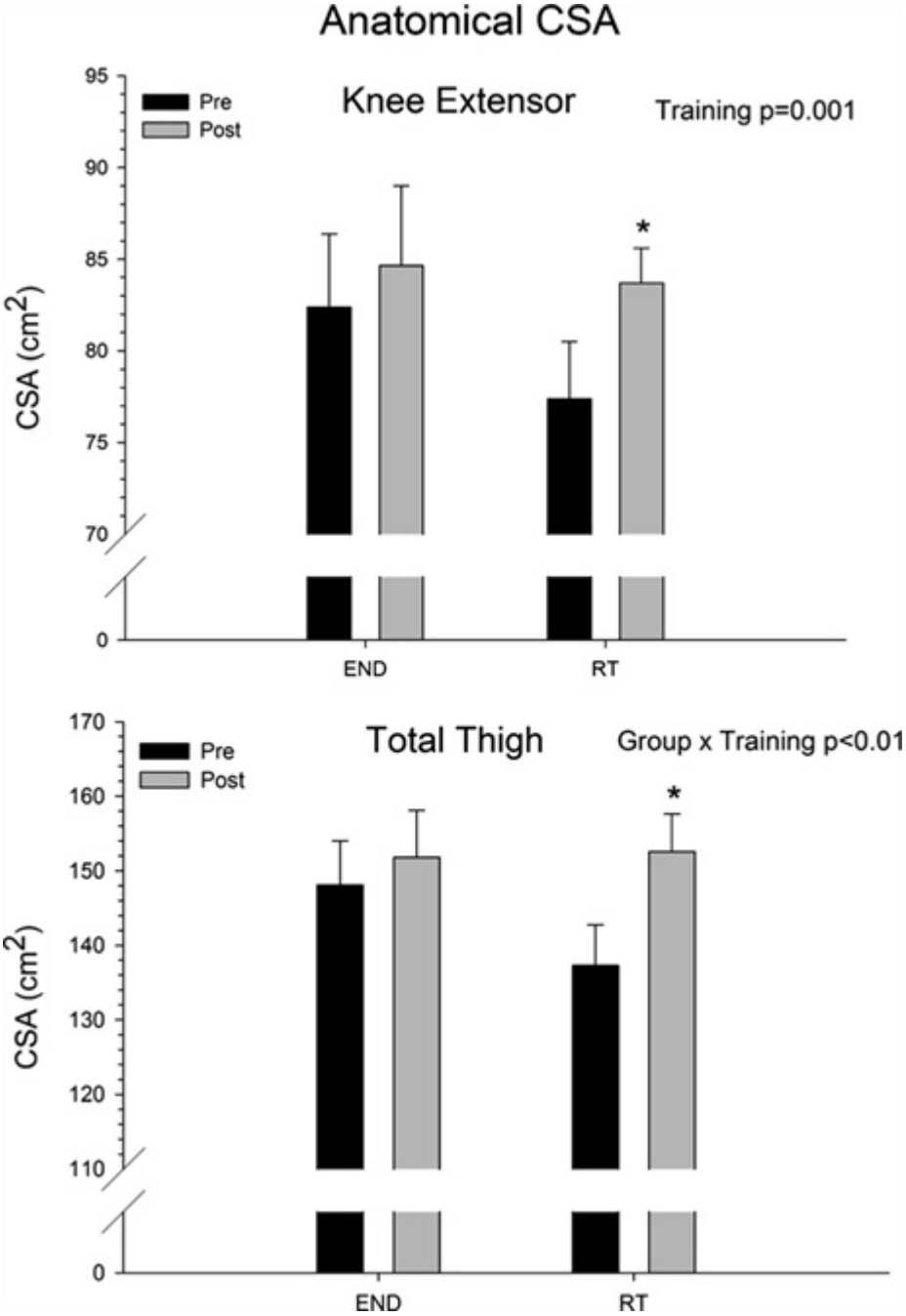

Figure 3: Repetition maximum (RM). Values for 1 and 3RM (kg) ± SEM pre- and post-10 weeks of either endurance training (END) or resistance training (RT) in knee extension, hamstring curl, and leg press. The results from 2-way analysis of variance are shown in the upper right corner. *Significant difference pretraining vs. posttraining within group ($p < 0.001$). #Significant group differences posttraining ($p < 0.01$).