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Assessing Acute Muscle Changes Using Ultrasound

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Ultrasound imaging of skeletal muscle is a noninvasive and inexpensive technique that can be used to assess changes in muscle thickness (MT) in response to high impact acute exercise. **PURPOSE:** To assess ultrasound-derived measures of MT of the rectus femoris (RF) quadriceps muscle in response to an acute bout of dynamic body weight exercise in recreationally active young adults. **METHODS:** Ultrasound was used in twenty-one healthy adults (24.8 ± 2 yrs; 10 men/11 women) to capture images of the RF while relaxed and during isometric contraction before, 10-min after, and 24 hrs after an exercise session. The exercise consisted of four rounds of dynamic body weight exercise that emphasized eccentric muscle contractions. Images were analyzed using ImageJ, and passive MT and % change in MT from passive to isometric contraction were calculated. Thigh circumference and knee extensor strength were also assessed. **RESULTS:** Passive RF thickness increased significantly 10-min post exercise compared to baseline (2.64 ± 0.17 cm vs. 2.38 ± 0.16 cm; $P < 0.001$) and was significantly lower 24-hr post exercise (2.39 ± 0.15 cm) compared to 10-min post-exercise values ($P < 0.001$). There was a significant decrease in % change in MT from baseline ($16.80 \pm 2.50\%$) to 10-min post exercise ($12.60 \pm 2.65\%$; $P = 0.02$) that returned to baseline values 24-hrs later ($16.56 \pm 2.4\%$). Thigh circumference increased from 54.98 ± 1 cm at baseline to 55.5 ± 0.97 cm 10-min post-exercise ($P = 0.005$) and was unchanged from 10-min post- to 24-hrs- after exercise (55.5 ± 1 cm; $P = 0.63$ vs. post and $P = 0.03$ vs. baseline). Knee extensor strength was significantly reduced from baseline to 10-min post exercise (102.58 ± 30.88 lb vs. 85.51 ± 27.17 lb; $P < 0.001$). 24-hr knee extensor strength was greater compared to 10-min post exercise (95.02 ± 33.01 lb; $P = 0.01$) but remained lower than baseline ($P = 0.005$). **CONCLUSION:** Passive MT was greater and % change MT was reduced following the acute bout of exercise and returned to baseline 24-hrs post exercise. Additionally, we observed increased total thigh swelling and reductions in knee extensor strength that persisted 24-hrs post exercise. These findings support the use of ultrasound to detect acute changes in MT following dynamic eccentric exercise and are accompanied by short-term reductions in force-production capabilities.