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Pumping iron at 70: Long-term benefits of heavy resistance training in older adults

Original paper


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Quick Summary

In this randomized controlled trial, heavy resistance training for 1 year maintained muscle strength and lean body mass in older adults over the subsequent 3 years, whereas moderate-intensity training and no training did not.

What was studied?

The effect of heavy resistance training on long-term muscle strength and body composition, including lean body mass and visceral fat mass.

The primary outcome was leg extensor power, expressed as the best single value recorded from either leg and as the value for both legs added together with and without division by body mass. The secondary outcomes included body composition and maximal isometric quadriceps torque, or the maximum force generated by the quadriceps muscle without movement.


Who was studied?

369 older adults (age range of 64–75; 61% women, 39% men) without apparent health conditions.

How was it studied?

This study was a long-term follow-up of the Live Active Successful Ageing (LISA) study,^[1] a randomized controlled trial designed to compare the effects of heavy, moderate, and no resistance training by older adults on muscle strength over a period of several years.

For this purpose, the participants randomized into 3 groups: heavy resistance training (6–12 repetitions at 70%–85% of their *one-repetition maximum* 1RM), moderate-intensity training (10–18 repetitions at 50%–60% of their 1RM), and a nonexercising control group. The heavy resistance training group conducted their exercises under supervision using machines in private fitness centers. In contrast, the moderate-intensity resistance training group performed supervised resistance training once a week in a hospital and twice a week at home. Both groups followed a prespecified progression program, including exercises such as leg press, chest press, knee extensions, low rowing, leg curls, ankle plantar flexion, hip abductions, abdominal crunches, and lower back exercises.

The researchers measured muscle strength, body composition, and other metrics at baseline, after the 1-year intervention, and at 2 and 4 years after the start of the study. This study reports the results for the follow-ups at 2 and 4 years. 

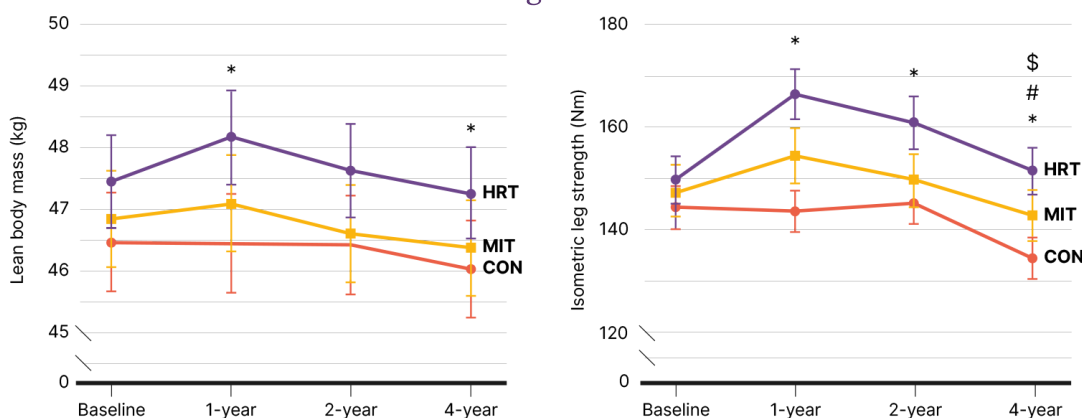
What were the results?

After 4 years, isometric leg strength was maintained (unchanged) in the heavy resistance training group. In comparison, isometric leg strength decreased in both the moderate-intensity training group (-3%; not statistically significant at $p=0.28$) and the control group (-7%).

Lean mass levels were also maintained in the heavy resistance training group after 4 years, whereas lean mass decreased in both the moderate-intensity training group (by -0.9 pounds or -0.4 kilograms) and the control group (-1.1 pounds or -0.5 kilograms).

These results indicate that 1 year of heavy resistance training was more effective for maintaining muscle strength and muscle mass over 4 years compared to moderate resistance training with elastic bands or no resistance training at all.

One year of heavy resistance training leads to long-term improvements in lean mass and strength in older adults



HRT=Heavy resistance training; MIT=Moderate-intensity training; CON=control (no training); * = statistically significant increase compared to baseline; # = greater than with MIT; \$ = greater than with CON

Visceral fat levels remained stable in both the heavy and moderate-intensity groups after 4 years but increased in the control group by 8%.

The big picture

Relevance and implications

Maintaining muscle strength in older adults is crucial because it directly correlates with mobility, independence, and overall quality of life.^[3] This study provides robust evidence that heavy resistance training can sustain muscle function well beyond the active training period.

This study also highlights the value of incorporating heavy resistance training into the regular exercise routines of older adults. It demonstrates that even a relatively short period of intensive training can have long-lasting benefits, helping to maintain strength and physical function, which are essential for independence and a good quality of life. Considering that muscle strength has been shown to predict mortality in adults without apparent health conditions,^[4] these results are promising.

Coaches and fitness trainers can use these findings to design effective training programs for older clients by prioritizing heavy resistance exercises to maximize long-term benefits. Ensuring proper technique and supervision can help maximize these benefits, allowing older adults to maintain their independence and reduce the risk of age-related muscle decline.

Health care professionals, including medical doctors, should consider recommending heavy resistance training as part of a comprehensive health plan for older patients. Understanding that these exercises can lead to sustained improvements in muscle strength and body composition may help in advising older adults on the most effective ways to maintain their health and mobility as they age.

Mechanisms of action

The preservation of muscle strength in the heavy resistance training group, despite a general decline in lean leg mass, suggests that neural adaptations play a significant role.^{[5][6]} Resistance training enhances neuromuscular function, which helps maintain strength even when muscle mass decreases. This includes increased motor unit recruitment and improved neuromuscular junction function. Prolonged training can lead to elevated acetylcholine receptors and improved neuromuscular function,^[7] contributing to sustained muscle performance beyond muscle size itself.

However, although leg strength was maintained in the heavy resistance training group, handgrip strength — a prognostic value of overall muscle strength^[8] — was not influenced by any of the training regimes. This discrepancy suggests that

different muscle groups may respond differently to resistance training, which emphasizes the importance of targeted exercises to maintain overall muscle function.

Visceral fat and body composition

Both the heavy resistance training and moderate-intensity training groups maintained their visceral fat levels from baseline to year 4, whereas the control group had an increase. This indicates that certain body composition parameters, such as visceral fat, may not be as dependent on the load or intensity of exercise in the long term. This observation is in line with previous research showing that resistance training can effectively reduce visceral fat,^[9] or (as in this case) prevent an increase in visceral fat. Avoiding excess accumulation of visceral fat is crucial for reducing the risk of metabolic diseases such as cardiovascular disease, type 2 diabetes, and metabolic syndrome, making this finding significant for older adults.^[10] An increase in visceral fat, as observed in the control group, is associated with worse health outcomes and a higher risk of these diseases,^[10] highlighting the protective effect of resistance training against central obesity and its complications.

Comparisons with existing research

This study adds to the growing body of literature demonstrating the benefits of resistance training in older adults. Previous studies have shown that short-term resistance training (6–9 months) can improve muscle strength and function,^{[11][12]} but long-term follow-ups have been sparse. To date, only one study investigated the long-term effects of combined resistance training and aerobic exercise on muscle strength in older adults, showing that a 1-year resistance training intervention can improve muscle performance 7 years after enrollment.^[13] The summarized study now provides long-term evidence comparing heavy and moderate resistance training, highlighting the benefits of heavy resistance training. Overall, the findings also align with research in younger adults indicating that high-intensity resistance training is more effective than moderate-intensity training in maintaining muscle strength.^[14]

Study strengths and limitations

This study had several strengths, including a large sample size, long intervention duration, and multiple follow-ups, with an 82% attendance rate at year 4. However, the study also has limitations. First, the study participants were generally healthier and more active than the average older adult population, which may influence the generalizability of the findings. Second, the drop-out rate of 18% could have affected the results; the participants who remained in the study might differ significantly from the participants who did not complete the follow-up assessments, as they had higher body weight, BMI and waist circumference. Third, the moderate resistance training group used elastic bands, whereas the heavy resistance training group used machines in private fitness centers. It's unclear whether resistance training with moderate loads using machines would yield similar results as heavy resistance training.

Overall, the study provides strong evidence that heavy resistance training can have lasting benefits on muscle strength and body composition in older adults. These findings support the inclusion of heavy resistance training in health recommendations for older adults, highlighting its role in promoting long-term health and independence.

Anything else I need to know?

The study's authors planned further follow-ups at 7 and 10 years to assess the long-term sustainability of the observed benefits.^{[2][1]} This future research will provide even more comprehensive insights into how prolonged resistance training affects older people over an extended period.

It's worth noting that most participants in the summarized study walked nearly 10,000 steps per day. This suggests that combining resistance training with regular physical activity can be a holistic approach to maintaining health and mobility in older age.

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Citation

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