

Fitness Newsletter # 3

ASK THE TRAINER

Hi all. Feel free to share the content with others.

QUESTION: “Dear Dan. Thanks for the newsletters. Here is my question: Is it true that most people lose muscle tissue as they age? And if so, is there anything that can be done about it?” – A.P.

RESPONSE: Yes, it is true. Loss of muscle and strength is called sarcopenia and starts around the age of 30 and progresses throughout the remainder of one’s life. The amount of muscle tissue and the number and size of muscle fibers gradually decrease. Some 20 – 40 percent of muscle tissue can actually be lost. This term also refers to the decreased quality of muscle tissue often seen in older adults. Fortunately, this muscle loss can be partially overcome or at least significantly delayed by **regular exercise**. A number of studies have revealed that strength exercises can partly restore muscles and strength, often very quickly. In one study, nursing home residents 80 years and older progressed from using walkers to using canes after doing simple muscle-building exercises for just 10 weeks.

Four types of exercise are important for staying healthy and independent: strength exercises, balance exercises, stretching exercises, and endurance exercises. Below are a couple of fairly recent studies that you may find very interesting.

Study # 1: Older Adults Improve Strength, Rejuvenate Muscle, Reverse Aging With Exercise.

This study was co-led by Buck Institute faculty member Simon Melov, PhD, and Mark Tarnopolsky, MD, PhD, of McMaster University Medical Center in Hamilton, Ontario.

After training, the strength of the older adults improved about 50%. Not only does exercise make most people feel better and perform physical tasks better, it now appears that exercise – specifically, resistance training, actually rejuvenates muscle tissue in healthy senior citizens.

This study involved before and after analysis of gene expression profiles in tissue samples taken from 25 healthy older men and women who underwent six months of twice weekly resistance training, compared to a similar analysis of tissue samples taken from younger healthy men and women.

The study examined the gene expression profile, or the molecular “fingerprint”, of aging in healthy disease-free humans. Results showed that in the older adults, exercise resulted in a remarkable reversal of the genetic fingerprint back to levels similar to those seen in the younger adults.

The study also measured muscle strength. **Before exercise training, the older adults were 59% weaker than the younger adults, but after the training the strength of the older adults improved by about 50%, such that they were only 38% weaker than the young adults.**

“We were very surprised by the results of the study,” said Melov. “We expected to see gene expressions that stayed fairly steady in the older adults. The fact that their ‘genetic fingerprints’ so

dramatically reversed course gives credence to the value of exercise, not only as a means of improving health, but of reversing the aging process itself, which is an additional incentive to exercise as you get older.”

The study participants were recruited at McMaster University. The younger (20 to 35 with an average age of 26) and older (older than 65 with an average age of 70) adults were matched in terms of diet and exercise; none of them took medication or had diseases that can alter mitochondrial function. The older participants, while generally active, had never participated in formal weight training.

Tissue samples were taken from the thigh muscle. The six-month resistance training was done on standard gym equipment. The twice-weekly sessions ran an hour in length and involved 30 contractions of each muscle group involved, similar to training sessions available at most fitness centers. The strength test was based on knee flexion.

In a four month follow up after the study was complete, he said most of the older adults were no longer doing formal exercise in a gym, but most were doing resistance exercises at home, lifting soup cans or using elastic bands. “They were still as strong, they still had the same muscle mass,” said Tarnopolsky. “This shows that it’s never too late to start exercising.”

“The vast majority of aging studies are done in worms, fruit flies and mice; this study was done in humans,” said Melov. “It’s particularly rewarding to be able to scientifically validate something practical that people can do now to improve their health and the quality of their lives, as well as knowing that they are doing something which is actually reversing aspects of the aging process.”

Joining Melov and Tarnopolsky as co-authors of the paper are Alan Hubbard and Krysta Felkey of the Buck Institute, and Kenneth Beckman of the Children’s Hospital of Oakland Research Institute. The work was supported by the National Institutes of Health, a Nathan Shock Award to the Buck Institute, a Ellison Medical Foundation Senior Scholar award to Simon Melov and a grant to Mark Tarnopolsky from the Canadian Institute for Health Research. The Buck Institute is an independent non-profit organization dedicated to extending the healthspan, the healthy years of each individual’s life. The National Institute of Aging designated the Buck a Nathan Shock Center of Excellence in the Biology of Aging, one of just five centers in the country. Buck Institute scientists work in an innovative, interdisciplinary setting to understand the mechanisms of aging and to discover new ways of detecting, preventing and treating age-related diseases such as Alzheimer’s and Parkinson’s disease, cancer, stroke, and arthritis.

Study # 2: Older Adults Avoid Growing Frail With Aerobic Exercise

Why do older people tend to lose muscle mass and grow frail? One important factor identified by medical science is the reduced ability of the elderly to respond to the muscle-building stimulus of the hormone insulin. New research, however, shows this drop in insulin response in senior citizens can be modified by just moderate aerobic exercise, such as a 45-minute walk.

Insulin is best known for its link to diabetes – a condition in which either a complete lack of insulin or systemic resistance to the hormone’s activity (as in type 2 diabetes) causes blood sugar levels to soar out of control. Recent studies have shown, however, that insulin also provides crucial assistance in building muscle, and that its ability to do so drops off dramatically in the elderly. Now, a small but provocative study by medical researchers in Texas and California suggests that a simple, cost-free therapy appears to largely overcome that drop-off in insulin response: moderate aerobic exercise such as walking.

Experiments at the University of Texas Medical Branch at Galveston (UTMB) and the University of Southern California, Los Angeles conducted on 13 healthy volunteers in their late 60s showed that 45 minutes of walking, 20 hours before exposure to insulin, restored the muscle-growth-stimulating effects of the hormone to levels comparable to those seen in normal young adults. Prior research had suggested that a large part of the problem older people experience lies in the tiny blood vessels that feed the muscles protein-building amino acids, glucose and insulin (which itself also works within muscle cells as a powerful protein growth factor). In young adults, these normally closed vessels open wide in response to the insulin increase generated by a meal, providing clear passage for muscle-making materials. In elderly people, however, this process, known as "vasodilation," is much less pronounced.

"We thought, let's see what happens if we use aerobic exercise, one of the interventions that has been shown in the past to improve vasodilation, to find out whether we can get insulin to stimulate muscle synthesis in older people," said UTMB professor Elena Volpi, senior author of a paper on the experiments appearing in the June issue of the journal Diabetes. "It turned out that a fast walk restored the insulin response quite well."

To test their hypothesis, the researchers first required six of their 13 subjects to walk for 45 minutes on a treadmill quickly enough to keep their hearts beating at 70 percent of their maximum rate – the same aerobic intensity level recommended to maintain cardiovascular fitness. The other seven subjects simply rested. On the following morning, the researchers sampled the blood going into and coming out of thigh muscle in each of the volunteers, while supplying via the femoral artery a concentration of insulin similar to that released after a typical meal. They also took three small muscle tissue samples from each subject.

Tracer techniques enabled the scientists to track amino acids (the building blocks of muscle proteins) and determine muscle-protein synthesis and breakdown rates from the blood and muscle samples, while measuring blood flow at the same time. These revealed that the volunteers who exercised had both higher blood flow and net muscle protein growth. In addition, the researchers screened the muscle biopsy samples for signals associated with insulin's ability to stimulate the assembly of muscle protein from amino acids. This test also showed that exercise boosted insulin's role as a muscle protein growth factor.

"We already know that moderate aerobic exercise reduces cardiovascular disease, improves glucose uptake, and improves endurance," Volpi said. "Now it looks like it may also slow the rate of muscle loss in aging. We need to test this hypothesis further with larger trials, but still, it's one more reason why elderly people ought to be regularly walking, swimming or cycling."

Other authors of the Diabetes paper are UTMB postdoctoral fellows Satoshi Fujita and Jerson Cadenas, associate professor Blake B. Rasmussen, physical therapy graduate students Micah J. Drummond and Erin L. Glynn, and USC-Los Angeles professor Fred R. Sattler. This research was supported by two grants from the National Institute on Aging, including UTMB's Claude D. Pepper Older Americans Independence Center; the Robert E. and May R. Wright Foundation; the National Institute for Arthritis and Musculoskeletal and Skin Diseases; and the NIH-funded General Clinical Research Centers at UTMB and USC.

CONCLUSION: Resistance Training AND Aerobic Training can definitely help us age more productively so that we may enjoy a better quality of life.

I hope this helped. Dan

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