High-Intensity Interval Walking Training Benefits Middle-Aged and Older People

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Learning Objectives

Upon completion of this activity, participants will be able to:

1. Describe the effect of moderate-intensity continuous and high-intensity interval walking training on lower leg strength and aerobic capacity in middle-aged and older people.
2. Describe the effect of these 2 levels of walking intensity on blood pressure.

Authors and Disclosures

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July 19, 2007 — Elderly patients randomized to receive high-intensity interval walking training have decreases in systolic blood pressure (SBP) and increases in thigh muscle strength and peak aerobic capacity, according to the results of a study published in the July issue of *Mayo Clinic Proceedings*.

"The rapid growth in the elderly population in many countries has highlighted the importance of exercise training to decrease the likelihood of disability and age-associated disease, promote independence, and enhance quality of life," write Ken-Ichi Nemoto, MS, from Shinshu University Graduate School of Medicine in Matsumoto, Japan, and colleagues. "Our study examined the hypotheses that walking training at more than 70% of maximal intensity would result in greater increases in thigh muscle strength and VO_{2peak} [peak aerobic capacity] and a greater reduction in resting blood pressure in older men and women than walking of moderate intensity. If such gains are indeed observed, it would suggest that middle-aged and elderly people could participate in exercise training calibrated to their individual physical fitness to decrease disability and age-associated diseases more effectively."

During a 5-month study period in 2004, 60 men and 186 women were randomized into 3 groups: no walking training, moderate-intensity continuous walking training, and high-intensity interval walking training. Mean age was 63 ± 6 years.

Moderate-intensity continuous walking training consisted of walking at approximately 50% of peak aerobic capacity for walking and using a pedometer to confirm 8000 steps or more per day for 4 or more days per week. High-intensity interval walking training was monitored by accelerometry. This consisted of 5 or more sets of 3-minute low-intensity walking at 40% of peak aerobic capacity for walking followed by 3-minute high-

intensity walking above 70% of peak aerobic capacity for walking per day, for 4 or more days per week. Before and after training, participants underwent measurement of isometric knee extension and flexion forces, peak aerobic capacity for cycling, and peak aerobic capacity for walking.

Training targets were met by 9 of 25 men and 37 of 59 women assigned to no walking training, by 8 of 16 men and 43 of 59 women assigned to moderate-intensity continuous walking training, and by 11 of 19 men and 31 of 68 women assigned to high-intensity interval walking training.

In the high-intensity interval walking training, isometric knee extension increased by 13%, isometric knee flexion by 17%, peak aerobic capacity for cycling by 8%, and peak aerobic capacity for walking by 9% ($P < .001$ for all). All these increases were greater than those observed in the moderate-intensity continuous walking training group ($P < .01$ for all). The high-intensity interval walking training group also had greater reduction in resting SBP ($P = .01$).

"High-intensity interval walking may protect against age-associated increases in blood pressure and decreases in thigh muscle strength and peak aerobic capacity," the authors write. "Guidelines for exercise in healthy older adults should encourage at least some higher-intensity component during walking."

Study limitations include use of different monitoring systems for the moderate-intensity continuous and high-intensity interval walking training groups; subjects in the high-intensity interval walking training group visiting the center more frequently and interacting with the trainer more; failure of 17% to 30% of subjects to return for a physical fitness test after training; and 15% in the no walking training and moderate-intensity continuous walking training groups and 30% in the high intensity interval walking training group not meeting criteria for study inclusion, which created potential selection bias.

"In future studies, we will attempt to minimize inconvenience and improve attainment of study targets by use of the Internet," the authors conclude. "The Internet would allow for remote supervision by a trainer and for self-monitoring of progress by participants, obviating the need for trips to a gymnasium and making attainment of exercise targets more likely. Also, encouraged by the reduction in SBP observed in this study in participants with increased physical fitness, we will examine the effects of genetic background, blood lipid and glucose concentrations, diets, and depressive scores not only on age-associated diseases but also on health care costs."

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In an accompanying editorial, James A. Levine, MD, PhD, from Mayo Clinic in Rochester, Minnesota, cites this and other studies showing that regardless of the study population, walking improves health.

"As recent as 150 years ago, 90% of the world's population lived in agricultural regions, and, like our distant ancestors, walked to work, physically exerted themselves at work, and walked home at the end of the day," Dr. Levine writes. "In the short span of 150 years, we have forsaken our legs as a means of locomotion, work, and leisure. We are designed to walk all day long, and Nemoto's article suggests that we should."

This editorial was supported by the Minnesota Obesity Center, the US Public Health Service, the Mayo Foundation, and by a grant to the Mayo Foundation from Robert Stuart.

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Learning Objectives for This Educational Activity

Upon completion of this activity, participants will be able to:

1. Describe the effect of moderate-intensity continuous and high-intensity interval walking training on lower leg strength and aerobic capacity in middle-aged and older people.
2. Describe the effect of these 2 levels of walking intensity on blood pressure.

Clinical Context

According to the authors of the current study, exercise has been shown to decrease disability, improve muscle strength, reduce blood pressure, and reduce cardiovascular risk, and higher intensity and duration of exercise is associated with greater protection, However, it is unclear how different levels of intensity of walking impact muscle strength and aerobic capacity in older adults. Walking is associated with a low rate of injuries and is accessible to many adults, unlike intensive athletic activities.

This is a trial of older adults who participated in no walking training, moderate-intensity continuous walking training, or high-intensity interval walking training for at least 4 days per week for 5 months to examine effects on lower leg strength, aerobic capacity, and blood pressure.

Study Highlights

- 60 men and 186 women with a mean age of 63 years (range, 44 - 78 years) with no history of cardiovascular disease were divided into 3 groups: no walking training, moderate-intensity continuous walking training, and high-intensity interval walking training.
- Although randomization was attempted, some reassignments occurred because of specific requests, such as from couples.
- 25 men and 59 women were assigned to no walking training, 16 men and 59 women to the moderate-intensity training, and 19 men and 68 women to the high-intensity walking training for 5 months.
- The nonwalking group was instructed to maintain a sedentary lifestyle, and those who participated in walking were excluded from analysis, for a final number of 9 men and 37 women.
- The moderate-intensity group received instruction to walk more than 8000 steps daily at 50% of peak oxygen capacity for a minimum of 4 days per week, and they used a pedometer to monitor steps.
- After excluding participants who did not record their steps, 8 men and 43 women were included in the final analysis from this group.
- The high-intensity group received instruction to do 5 or more daily sets of 2- to 3-minute low-intensity walking intervals (at 40% of maximal oxygen capacity) followed by a 3-minute interval of high-intensity walking (between 70% and 85% of peak oxygen capacity) for at least 4 days per week.
- The high-intensity walking group was monitored by accelerometer and a pedometer.
- Subjects were closely monitored for the first month until they mastered high-intensity interval walking.
- Data from tracking devices were entered into a central server, and trainers used the data to track daily walking intensity.
- After excluding participants with missing data, 11 men and 31 women were analyzed in the high-intensity group.
- Blood pressure, isometric knee extension and flexion forces, knee flexion, and cycling maximal oxygen capacity were measured before and after the program.
- For peak aerobic capacity by graded walking, participants rested for 3 minutes, wore a triaxial accelerometer, and walked for 3 minutes on a flat floor for 3 graded velocities (slow, moderate, and fast) and oxygen consumption rate was calculated.
- For peak aerobic capacity while cycling, graded cycling with expired gas analysis was used.
- SBP and diastolic blood pressure (DBP) were measured at rest sitting in a room with constant ambient temperature and humidity.
- The high-intensity group spent 83% of the time of the moderate-intensity group on walking, but total energy expended was similar because of higher intensity.
- After the program, body mass index deceased significantly in women in both the moderate-intensity and high-intensity groups and increased in the nonwalking group.
- Peak aerobic capacities and thigh muscle strength were significantly higher in men than women at baseline.

- At the end of the program, muscle strength for knee extension and flexion increased significantly in the high-intensity group (by 13% for extension and 17% for flexion) vs both the nonwalking and the moderate-intensity groups.
- There was significant increase in peak oxygen capacity for walking (increased by 9%) and cycling (increased by 8%) in the high-intensity group vs the nonwalking and the moderate-intensity groups.
- SBP and DBP decreased significantly (by 9 mm Hg and 5 mm Hg, respectively) in the high-intensity group, and the decrease was significantly greater vs the nonwalking and moderate-intensity groups.
- SBP decreased in 25 of 33 participants with increased peak oxygen capacity for walking in the high-intensity group, which suggests a correlation between the blood pressure and peak oxygen capacity.