

# Fast Facts on Osteoporosis

**Definition** Osteoporosis, or porous bone, is a disease characterized by low bone mass and structural deterioration of bone tissue, leading to bone fragility and an increased susceptibility to fractures of the hip, spine, and wrist.

**Prevalence** Osteoporosis is a major public health threat for more than 28 million Americans, 80 percent of whom are women. In the U.S. today, 10 million individuals already have the disease and 18 million more have low bone mass, placing them at increased risk for osteoporosis.

- 80% of those affected by osteoporosis are women.
- 8 million American women and 2 million men have osteoporosis, and millions more have low bone density.
- One out of two women and one in eight men over age 50 will have an osteoporosis-related fracture in their lifetime.
- 10% of African-American women over age 50 have osteoporosis; an additional 30% have low bone density that puts them at risk of developing osteoporosis.
- While osteoporosis is often thought of as an older person's disease, it can strike at any age.
- Osteoporosis is responsible for more than 1.5 million fractures annually, including:
  - 300,000 hip fractures;
  - 700,000 vertebral fractures;
  - 250,000 wrist fractures, and
  - 300,000 fractures at other sites.

**Cost** The estimated national direct expenditures (hospitals and nursing homes) for osteoporotic and associated fractures is \$13.8 billion (\$38 million each day) and the cost is rising.

**Symptoms** Osteoporosis is often called the "silent disease" because bone loss occurs without symptoms. People may not know that they have osteoporosis until their bones become so weak that a sudden strain, bump, or fall causes a fracture or a vertebra to collapse. Collapsed vertebrae may initially be felt or seen in the form of severe back pain, loss of height,

or spinal deformities such as kyphosis or stooped posture.

**Risk Factors** Certain people are more likely to develop osteoporosis than others. The following risk factors have been identified:

- Being female
- Thin and/or small frame
- Advanced age
- A family history of osteoporosis
- Postmenopause, including early or surgically induced menopause
- Abnormal absence of menstrual periods
- Anorexia nervosa or bulimia
- Use of certain medications, such as corticosteroids and anticonvulsants
- Low testosterone levels in men
- An inactive lifestyle
- Cigarette smoking
- Excessive use of alcohol
- Being Caucasian or Asian, although African Americans and Hispanic Americans are at significant risk as well

Women can lose up to 20% of their bone mass in the 5-7 years following menopause, making them more susceptible to osteoporosis.

**Prevention** By about age 20, the average woman has acquired 98% of her skeletal mass. Building strong bones during childhood and adolescence can be the best defense against developing osteoporosis later. A comprehensive program that can help prevent osteoporosis includes:

- A diet rich in calcium and vitamin D
- Weight-bearing exercise
- A healthy lifestyle: no smoking, limited alcohol intake, and
- Bone density testing & medication when appropriate

National Institute of Health - Osteoporosis and Related Bone Diseases - National Resources Center, 1232 22nd Street NW, Washington DC 20037-1292  
<http://www.osteoporosis.org/osteofastfact.html>

Study Aid:

1. To know if you are developing osteoporosis, what symptoms should you watch for?

*Excerpted from*

## **The effects of aging and training on skeletal muscle.**

Donald T. Kirkenall, and William E. Garrett, Jr.

### **Body Composition**

Aging usually leads to an increase in the amount of body fat and a decrease in fat-free lean body mass of a person.

Maintaining a balance between fat and muscle mass throughout life is crucial because the loss of muscle mass is implicated in variables of metabolic rate and physical activity, and increases in body fat are associated with diabetes, hypertension, certain cancers, and coronary artery disease. Muscle loss leads to a reduction in muscle function; therefore, muscle mass should be maintained throughout life to maintain function.

### **Age Related Changes to Muscle**

**Muscle Fiber Distribution.** The earliest studies on aging and muscle fiber composition suggested that slow twitch fiber percentage increases with aging. Subjects in their 20s had 39% slow twitch fibers while subjects in their 60s had 66% slow twitch fibers. Other research based on sampled whole muscle tissue from autopsy material found that the slow twitch distribution was 49% for men in their 20s; men in their 50s and late 70s had 52% and 51% slow twitch fibers, respectively. These are small changes, probably reflective of the likely changes in fiber distribution.

**Size of Muscle Fibers.** Slow twitch fibers are little affected by aging. Fast twitch fibers seem to bear the brunt of age-related changes in cross-sectional area. Biopsy studies show 15% to 25% reductions in the fast twitch cross-sectional area. A large proportion of the age-related loss of muscle mass is the result of the reduction in fast twitch muscle fiber size.

**Number of Muscle Fibers.** Research on the number of fibers from the vastus lateralis muscle of six men between the ages of 30 and 74 found that the oldest man had about 25% fewer muscle fibers than the youngest man did.

This research suggested that the loss of muscle fibers begins at about age 25 and that total fiber number would decrease about 39% by age 80. A similar study looking at the pectoralis muscle of women showed that fiber numbers began to decrease at 60 years of age (similar to the onset of protein losses), with a 25% reduction in fiber number by the 7th decade.

### **Aging Muscle and Endurance Training**

When following accepted training prescriptions, maximal oxygen consumption can increase by 20% to 30% in adults 60 to 80 years of age. This is related to the muscle's ability to generate energy aerobically.

An important adaptation to endurance training is the increase in capillary density in the active muscle. An increase in the capillary-to-fiber ratio decreases the diffusion distance for oxygen and may be one of the most important adaptations to physical training.

The percentage of slow twitch muscle fibers does not change with training in either younger or older subjects. With endurance training, fast twitch fibers become more aerobic.

Controlled studies on the effect of years of training by humans have not been reported. The best descriptions involve follow-up assessment of competitive athletes who have continued to train after their competitive years have passed. With training, the expected age-related decline in maximal oxygen consumption was reduced or even eliminated.

### **Aging Muscle and Resistance Training**

Resistance training improves the ability of muscle to develop tension. Contractile proteins that affect tension production are the main beneficiaries of resistance training. For resistance training to be effective, the program cannot be a short-term one. Studies of 12- to 24-week training periods at lower intensities tend to show some improvements in muscle mass, but no increase in strength. However, if the training program is longer and of sufficient intensity and duration, the elderly may also

demonstrate adaptations typically seen in younger participants.

In a study of 66-year-old men who trained at 80% of the maximum they could lift for 12 weeks, strength improved by roughly 5% per day, similar to data on younger subjects. Cross-sectional area of muscles of the thigh increased significantly. In addition, capillary density and some aerobic enzymes also were increased.

If done with sufficient intensity, even the frail elderly respond to a resistance training program much like their younger counterparts.

### Summary

Much of the decline in skeletal muscle function with aging seems to be related to the progressive reduction in the demands on muscle and thus does not appear to be inevitable. Changes that are evident with aging can be minimized with training; aging muscle responds to training in a similar manner to the muscle of younger subjects.

For both endurance training and resistance training, skeletal muscle responds according to the demands placed on it. Reduce the demand on skeletal muscle and it will adapt to the new lower requirement; increase the demands and the declines due to aging can be minimized, if not eliminated. A lifetime of physical activity appears to be the critical factor in maintaining the structure and function of skeletal muscle.

Kirkenall, Donald T.; Garrett, William E., Jr. The effects of aging and training on skeletal muscle. (Current Concepts) American Journal of Sports Medicine v26, n4 (July-August, 1998):598 (5 pages). COPYRIGHT 1998 American Orthopaedic Society for Sports Medicine

### Study Aid:

1. As people age, what normally happens to their muscles?

2. For both endurance training and resistance training in older humans, skeletal muscle responds according to the demands placed on it. So to have strength and endurance as you age, what should you do?

## Strong Medicine

Sharon Doyle Driedger

Aches and pains, a little stiffness. They're just a normal part of aging, right? Not for Edwina Scott. When muscle soreness began to slow her down, the 81-year-old grandmother followed her doctor's advice and signed up for a strength training course at Ottawa's Carleton University. At first, the fit-ness centre's massive exercise machines-loaded with heavy metal chains, clanging weights and pulleys intimidated the petite, five-foot senior. But she persevered, followed an instructor through a series of warm-up exercises and started a modest regime with two-pound weights. That was three years ago. Now, pumping iron is a twice-weekly routine for Scott - as well as for several fellow residents of her retirement home who were so impressed with her new stamina that they decided to heft dumbbells along with her. "We do arm curls and work on our biceps and triceps," explains Scott, who has progressed to eight-pound weights. "It helps the soreness tremendously - and I have more energy, strength and better balance."

Weightlifting octogenarians like Scott have little chance of - or interest in - bulking up like senior Schwarzeneggers, but they are shattering the myth that aging leads to inevitable physical decline. The first scientific studies showing that resistance training can reverse muscle loss and renew strength in healthy seniors appeared in the late 1980s. But it was a landmark paper published in the New England Journal of Medicine in 1994 that firmed up the power of exercise. The authors, based at Harvard and Tufts universities in Massachusetts, found remarkable gains in elderly, frail and chronically ill nursing home residents after only 10 weeks of weight training. Most of the participants - aged 72 to 98 - more than doubled their muscle strength. A few even discarded walkers and canes. Now, scientists are focusing on the potential of resistance training to reduce the risk of heart disease, osteoporosis and adult onset diabetes,

as well as to relieve arthritic symptoms and depression, and enhance the immune system in adults of all ages.

Still, to the dismay of many fitness experts, relatively few Canadians have responded to the growing body of evidence on strength training. "It's increasing in popularity," says Greg Poole, who helped set up Carleton's program for seniors. "But there are still not enough people doing it." According to the latest poll from the Canadian Fitness and Lifestyle Research Institute, 23 per cent of Canadians did some form of weight training in 1995, compared with a mere five per cent in 1981. Still, only nine per cent of those aged 45 to 64 made the effort - and the numbers in the over-65 category were negligible.

And exercisers of all ages overemphasize aerobics. "One problem is that people are all tied up with cardiovascular fitness," says Eric Banister, a professor of kinesiology at Simon Fraser University in Burnaby, B.C. "That is all well and good, but they neglect strength and it begins to fall off." Many people mistakenly believe that walking is all they have to do to stay fit, says Poole. "But it's not enough to delay the erosion of strength and muscle." Heavy chores like shovelling snow or washing floors might help, "if you work hard at it." But such tasks, he points out, typically involve too few muscles: "You wash the floor with one arm, not two."

To stay strong, two types of muscle cells - slow-twitch and fast-twitch fibres - must be activated regularly. Slow-twitch fibres, used in normal daily activities, contract slowly and show remarkable endurance. Fast-twitch fibres - key to muscle strength - click in for brief intervals, only with moderate to strenuous exertion, and they tend to disappear if they are not used. "Even a brisk walk will not use fast-twitch fibres," notes Poole. "And if you don't use it, you lose it." In fact, the reason most people slow down as they age is that they lose about a third of their muscle mass by the age of 80.

But lost muscle can be regained - by almost anybody. "It used to be taboo for people with

heart disease to lift weights because it was believed to push blood pressure through the roof," says Neil McCartney, a McMaster University kinesiologist, and a pioneer in strength training for cardiac patients. Heart patients, and others suffering from chronic conditions, such as osteoporosis, need supervision initially, he says, perhaps an individual "prescription." But they can achieve significant health benefits from strength training, says McCartney. "In fact," states Tufts University researcher Miriam Nelson in her new book, *Strong Women Stay Young*, "the weaker you are, the more you need it. What's risky is not exercising."

Philip Spaulding, a 74-year-old retired Calgary professor, started his first regular strength training program two years ago, just a few months before a hip replacement. The training, he believes, speeded his recovery and gives him the energy for hiking and skiing. But, most importantly, he says, "It keeps my morale up. Prior to this I was scared to death of getting old." Spaulding, and other active seniors, are discovering that if strength training can't turn back the clock, it can at least slow it down.

Driedger, Sharon Doyle Strong medicine. (weight training for the elderly) Maclean's v110, n12 (March 24, 1997):60 (1 pages). COPYRIGHT 1997 Maclean Hunter (Canada)

#### Study Aid:

1. " .. if you don't use it, you lose it." Given our understanding of different types of muscle fibers, why is it that aerobic exercise such as a brisk walk is not enough to maintain muscle strength?