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## The BEST exercise program for osteoporosis prevention

by Lauve Metcalfe, MS

Osteoporosis is a significant health problem in the United States. More than 25 million people are affected, most of whom (80%) are women. Women who are not receiving hormone replacement therapy, are not consuming adequate amounts of calcium and are inactive can lose 20% to 30% of their bone mass between 40 and 70 years of age. As a result, women have a 40% fracture risk throughout their lifetime, with more than 1.5 million fractures per year attributed to osteoporosis (Going, Lohman, Houtkooper, et al, 2003).

Was it possible to develop a community-based exercise program for postmenopausal women that could improve bone health and prevent osteoporosis? Would these women engage in a vigorous strength-training program 3 times a week for a year? Would this program make a significant difference—beyond bone health—in their lives?

These were the fundamental questions that the research team at the University of Arizona's Center for Physical Activity and Nutrition considered prior to the development of the Bone, Estrogen, Strength Training (BEST) study. Ten years later, we have a resounding Yes! Yes! and Yes!

Not only was it possible to develop such a program and recruit women to engage in strength training, but the outcomes went far beyond significant improvements in bone mineral density (BMD) to truly impact overall quality of life.



## Special considerations for postmenopausal women

Previous research focusing on strength training for postmenopausal women found that bone mass could be significantly increased by a strength-training regimen that used high-load, low repetitions (but not by an endurance regimen that used low-load, high repetitions).

The primary considerations were to:

- exercise at an intensity sufficient to increase BMD in the hip and lumbar spine
- select exercises specifically designed for function and mobility (leg strength for activities of daily living; for instance, squats, leg press)
- counter the changes in the curvature of the spine and posture of the body that occur with aging (lordosis)
- develop the small muscle groups of the back that are used for stability, spinal support and posture

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- exclude exercises that are counterproductive to maintaining a healthy posture and that put participants at risk for fracture (for example, the chest press, which pulls the shoulders forward).

### What the study found

The most extensive clinical trial of its kind in the United States, the BEST study began in 1995 to examine how strength training affects changes in bone density in 2 groups of postmenopausal women: those who were taking hormone therapy and those who were not.

During the first year, 266 Tucson-area women ranging in age from 45 to 65, who were 3 to 10 years postmenopausal, were recruited. The participants were postmenopausal, sedentary, non-smokers, with no history of bone fractures or osteoporosis. The women were randomly assigned to either a control group or an exercise group. All participants took Citracal® calcium citrate supplements twice daily to provide 800 mg of calcium a day.

Those in the exercise group performed supervised aerobic, weight-bearing and strength-training exercises, 3 times per week, in community-based exercise facilities. Study participants performed 2 sets of 6 to 8 repetitions.

Fifteen to 20 minutes of cardiovascular weight-bearing activity, such as stair climbing, treadmill walking with a weighted vest and postural stretches, rounded out the study regimen. Participants lifted increasingly heavier weights, with the amount of weight lifted in correct form emphasized over number of repetitions.

After 12 months, the core strength training exercises combined with calcium supplementation significantly improved bone mineral density at skeletal sites at risk for osteoporotic fractures in postmenopausal women (Going, Lohman, Houtkooper, et al, 2003). Women taking hormone therapy were most successful at maintaining or increasing bone mineral density, although

exercise without hormone therapy also showed positive results.

The 4-year data showed that the women (167 remained in the study) who regularly took the recommended level of 800 mg of calcium supplement daily and continued to consume calcium in their meals showed greater improvement than those who consumed less calcium, and women who kept up with the exercises showed greater improvement than less frequent exercisers (Cussler, Going, Houtkooper, et al, 2005).

Those exercisers who attended more exercise sessions and lifted more weight increased their BMD the most (1% to 2%).

Muscle strength improved by 28% to 67% in women who exercised and used hormone replacement therapy and 25% to 75% in women who exercised without using hormone replacement therapy. The increases in muscle strength with exercise were statistically significant for exercisers in both groups.

Exercisers significantly increased strength, whereas the strength of control subjects did not change. The impressive gains in strength assisted the women to maintain their “sternum up” posture throughout the day and provided valuable assistance in carrying out daily chores.

Psychological and social improvements in body image and positive body perception were also observed. The 4-year data showed that exercisers who maintained higher levels of exercise frequency were associated with significant improvements in body satisfaction related to: physical stamina, muscular strength, energy level, self-confidence, athletic skills, gracefulness, ability to discipline self, and degree of self-consciousness.

The Center for Physical Activity and Nutrition research team continues to track participants, many of whom are in their tenth year, to observe the long-term effects of exercise on fracture risk as well as other quality of life and psychosocial measures.

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## Participant feedback

Several key issues that contributed to the success of the program were consistently mentioned in evaluations.

### **Concern over the health risk of osteoporosis for all women.**

Contributing to the body of scientific knowledge was an important motivator for many women joining the program and continuing with the study, not just for their personal health but concern for their daughters and granddaughters.

**Establishing self-efficacy.** The BEST program nurtured a positive environment where participants felt they could be successful in accomplishing the program's and their own personal goals. The program was designed to create early success for each woman; from the first exercise session they developed a positive mindset that they could lift heavy weights and be regular exercisers.

'WoMentors' (participants who completed their first phase of exercise matched with women just starting the program) were developed to provide support for one another.

### **Creating an atmosphere of fun.**

Opportunities to encourage fun were constantly explored and implemented by the BEST training and lab staff. The intervention support program was invaluable to keeping the women motivated throughout the program.

## Intervention support programs

The primary goals of the support programs were to create a fun, social environment and to challenge the women to improve their daily exercise performance. Behavioral change is more likely to occur when individuals clearly perceive the personal and social benefits of the expected behavior. Participation was based on individual improvement rather than competition among participants.

The BEST intervention support program encompassed a variety of interpersonal, intrapersonal and environmental reinforcement strategies to motivate participants and promote high levels of retention. Some examples of the intervention support programs included:

**Orientation workshops** created a knowledge base for the program philosophy and started to develop social networks for exercise. At this time the women signed personal contracts committing to exercise for one year.

**Monthly newsletters and bulletin board** information provided tips for healthy living, recognized participants, shared news from participants and created a sense of community.

The women were tested for **Personal Best** every 2 months to monitor progress. The test was a 1 RM (repetition maximum) of the core exercises to chart progress and make any necessary adjustments to the program. The Personal Best also provided the basis for goal setting.

**Motivational meals** were scheduled every 2 months to foster camaraderie and give recognition to the women. These were held at local restaurants or were pot lucks.

A popular event was a 6-week **Olympic Challenge** where the women teamed up to earn points for strength and aerobic challenges. The event ended with an Olympic picnic in the park with their families.

Another program that was very well-received was a **Murder Mystery**, where the trainers were suspects in the murder of the owner of the fitness facility. The participants were deputized to help solve the mystery using clues that were given out at each workout.

The Murder Mystery Motivational Meal gave a re-enactment of the murder, the participants presented their theories on

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## Resources

National Osteoporosis Foundation  
Education, resources for professionals and consumers  
[www.nof.org/](http://www.nof.org/)

The BEST Exercise Program for Osteoporosis Prevention  
Training protocols, specific programming, motivational strategies  
[www.cpanarizona.org](http://www.cpanarizona.org)  
CEC course  
[www.dswfitness.com](http://www.dswfitness.com)

ICAA member discounts available for book and CEC course  
[www.icaa.cc/Education/thebestosteoporosis.htm](http://www.icaa.cc/Education/thebestosteoporosis.htm)

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how the murder happened, and prizes were awarded for most creative, most accurate, and so forth.

These types of programs and events clearly take time, energy and imagination to develop and implement, but they are worth every ounce of perseverance by the team. There is a magic that happens when people come together for a common cause and share in the experience.

These intervention support programs and processes allowed our participants to feel a sense of community at the same time they allowed the trainers and the exercise facilities to feel engaged in the process and take ownership over the outcome. Too often we put so much emphasis on the specific behavior (exercise) that we lose sight of the overall goal: to create a lifelong experience that will provide an opportunity to improve health and quality of life.

If we engage at the emotional, social, intellectual, physical, environmental and spiritual levels we can have lasting impact on a participant and the choices they make on a daily basis.

I have NEVER had a participant drop out of a program because they were having TOO MUCH FUN! Create a fun, energized, welcoming environment and watch what happens.

## Take action to support bone health

Building bone mineral density is important in preventing osteoporosis, which often results in fractures of the hip, spine and wrist. Adequate calcium intake and exercise throughout life help prevent bone loss, and these measures also can help the millions of people already diagnosed.

Given the financial cost associated with osteoporosis, and the need for long-term program adherence to have an impact on fracture risk, concentrating funds, staff and resources on developing intervention programs similar to the BEST program are not only realistic, but also essential to

reduce the impact of osteoporosis on public health. The best treatment is prevention, and women of all ages should be concerned about their bone health and take action to stay active and improve their nutrition and bone strength.

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**Appropriate for**



**Athlete**



**Active now**



**Getting started**

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**BEST exercise program**

The BEST study findings led to the development of The BEST Exercise Program for Osteoporosis Prevention. What sets the BEST regimen apart are the 6 core strength training exercises that help build bone in the wrist, hip and spine—3 key fracture sites.

It previously was thought that any type of exercise was helpful, but now we understand that strength training and weight-bearing exercise are essential to maintaining and building bone. The BEST program has proven to be beneficial and represents a shift in prior bone health recommendations.

This program was designed as an osteoporosis prevention program, not a program for women with osteoporosis. The distinction is important. Women over 50 without osteoporosis may perform this exercise program if they are in the Athlete, Active Now or Getting Started functional levels. It would be helpful to have the assistance of a trainer who is well versed in the principles of safely exercising with high loads and low repetitions.

It is critical that the exerciser maintain correct form and alignment. Progression and alignment are the safe ways to lift heavier loads.

Women who already have osteoporosis, or have low levels of physical capacity, should consult their physicians who can recommend an appropriate exercise program.

In the study, the women lifted their personal best, or 70% to 80% of 1 RM, which was the maximal load that could be lifted once using the correct lifting technique. Moderate loads (70% to 75% 1 RM) were lifted twice per week, and heavy loads (80%) once per week.

Target population: Healthy women without osteoporosis or fracture

Style: Supervised to ensure each woman lifts an appropriate weight with correct alignment

Frequency: 3 times a week

Intensity: 2 sets, 6 - 8 repetitions  
Moderate loads twice/week  
Heavy load once a week

Core strength exercises:

- one-arm military press
- leg press
- wall squat, progressing to the Smith squat
- back extension
- lat pulldown
- seated row

**One-arm military press**

*Function:* Develops strength for lifting items overhead and adds shoulder shape and size.  
*Targeted muscles:* front and middle deltoid, triceps, erector spinae  
*Targeted bones:* spinal vertebrae, lumbar spine



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## Glossary

### Muscles:

biceps  
(upper arm)

brachialis  
(inner arm by elbow)

brachii  
(upper inside of arm)

erector spinae  
(lower spine)

front and middle deltoid  
(shoulder muscles)

gluteals  
(rear hip)

hamstrings  
(large tendons at the  
back of the knee)

latissimus dorsi  
(outer back)

middle trapezius  
(upper back/lower  
neck)

posterior deltoid  
(rear shoulder)

quadriceps  
(thigh muscle)

rhomboids  
(between shoulder  
blades and spine)

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## Wall squat

*Function:* Strengthens and defines lower body, strengthens gluteals; takes pressure off the lower back. Used as an introduction to squats before performing the Smith squat.

*Targeted muscles:* quadriceps, hamstrings, gluteals

*Targeted bones:* femur, femoral neck, trochanter, spinal vertebrae, lumbar spine



## Smith squat

*Function:* Develops leg strength. A good power move for sports and hiking. Develops a shapely thigh.

*Targeted muscles:* quadriceps, hamstrings, gluteals

*Targeted bones:* femur, femoral neck, trochanter, spinal vertebrae, lumbar spine



## Leg press

*Function:* Develops leg strength for walking, climbing and running.

*Targeted muscles:* quadriceps, gluteals, hamstrings

*Targeted bone:* femur, femoral neck



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## Lat pulldown

*Function:* Develops strength in the muscles in the upper back and develops the latissimus dorsi, which helps give the torso a flattering V shape.

*Targeted muscles:* latissimus dorsi, biceps, brachii, forearm, posterior deltoid

*Targeted bones:* spinal vertebrae, lumbar spine



## Glossary

Bone:

femoral neck  
(connects ball of hip to femur)

femur  
(thigh bone)

lumbar spine  
(lower portion of spine)

spinal vertebrae  
(spine)

trochanter  
(top part of femur)

## Back extension

*Function:* Provides back stability, which lifts the torso into extension.

*Targeted muscles:* erector spinae, gluteals, hamstrings

*Targeted bones:* spinal vertebrae, lumbar spine

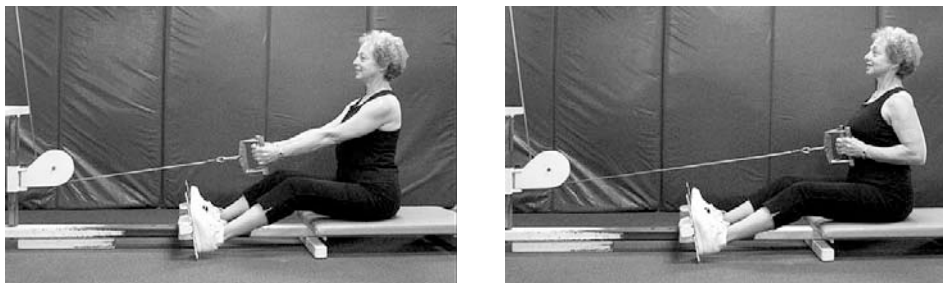


## Seated row

*Function:* Develops strong back muscles to assist in pulling actions, and general torso stability, which contributes to a V-tapered torso and strong posture.

*Targeted muscles:* latissimus dorsi, middle trapezius, rhomboids, biceps, brachialis, forearm flexors

*Targeted bones:* spinal vertebrae, lumbar spine



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