

# Building Bone Mineral Density Early Leads to Later Benefits, Study Suggests

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*WRITER'S COMMENT: As an intercollegiate gymnast personally invested in the exercise sciences, I was interested in learning more about how physical activity influences our bones. Due to my lifelong participation in athletics and recent curiosity about bone health, I decided to research the effects of physical activity on acquiring bone mineral density for an assignment in Professor Jared Haynes's UWP 102B class. We were asked to take on the persona of a newspaper journalist who specializes in writing articles about recent discoveries in science for The New York Times. In keeping with this goal, our task was to follow all of the typical stylistic conventions of The New York Times scientific newspaper articles. Through this piece, I hoped to share the results of technical scientific research in a way that would capture the interest of more general audiences. Additionally, I wanted my article to enhance awareness of the incredible impact that physical activity has on the quality of life not only today but also well into the future. I am so grateful for all of the patient guidance that Professor Haynes provided me throughout my writing process. His gracious comments enabled me to grow and build confidence as a writer. Thank you!*

*INSTRUCTOR'S COMMENT: I was glad to see that Erika's newspaper article from my Writing in the Biological Sciences class was accepted into Prized Writing. She wrote a very strong literature review on the same topic during the quarter, but turning the subject matter of such a technical document into a newspaper article for a lay audience is a difficult task. Erika saw what needed to be done in order to make the subject matter accessible to such readers. In class, we examined the style used in New York Times articles on scientific research, and we discussed the kinds of style changes that would need to be made from the more technical piece. I was very impressed at Erika's ability to draw the readers in and to keep feeding the information at a pace that readers could keep up with. I will be happy to have this essay as an example to show to future students.*

—Jared Haynes, University Writing Program

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**W**e have all heard that exercise is a good thing. These days, it seems that we cannot pick up a newspaper or turn a corner without seeing advertisements promoting the health benefits of physical activity.

A new study, published last month in the “European Journal of Clinical Nutrition,” now shows that physical activity during youth not only improves bone strength early, but more importantly, leads to greater bone health during aging.

Lack of physical activity may lead to increased loss of bone mineral density (BMD), predisposing individuals to increased risk of fractures. Osteoporosis, characterized by bone loss and diminished bone strength, is the most common bone disease and a major public health issue worldwide.

In the United States alone, 55% of people aged 50 and older have either osteoporosis or low bone mass.

Many researchers now acknowledge the benefits of physical activity for building increased BMD – the measures of which reflect the calcium content of bones as an indication of bone strength.

In particular, research shows that exercise involving a high degree of weight-bearing activity (like aerobics) leads to higher BMD levels than non-weight-bearing activities (like swimming).

Such weight-bearing physical activities place mechanical stress on the bones, thereby stimulating the processes responsible for bone growth so that we can better tolerate the impact of exercise. Just as lifting weights builds muscle mass, weight-bearing exercise builds bone mass.

Bone is a dynamic tissue that is continuously being altered by our activities. The more we call our bones into action, the more resources our bodies allocate to building bones that will support the activity.

While many studies conclude that physical activity enhances BMD of female athletes in their prime, less is known about BMD in older female athletes.

Could past physical activities really affect bone health later in life?

This is what Dr. Angela Andreoli and her colleagues at the University of Pennsylvania set out to find in their retrospective study.

Forty-eight post-menopausal women ranging from 54 to 73 years of age were included in the

study: 24 previous elite athletes, half swimmers and half runners, and 24 non-athletes of comparable age, weight, and height.

These groups were compared to observe the effect of non-weight-bearing versus weight-bearing activity during youth on the maintenance of BMD during aging in comparison to sedentary control subjects.

Past and present physical activity levels of the participants were assessed through a physical activity questionnaire. The athletes reported details about their workout patterns and training history, including years of participation as well as the frequency and duration of their activities.

Participants were also asked about their menopausal status. At the time the study was conducted, neither the physical activity levels nor the menopausal status differed between the athletes and the control group.

These measures enabled the researchers to create well-matched groups for effective comparison and to more fully understand how their exercise background might impact their current BMD status.

The results of the study indicated that women with a lifetime history of prolonged intense sports

activity had significantly higher BMD than the sedentary controls similar in age and menopausal status. The non-athlete control group showed markedly lower total body BMD than the athlete group.

These findings lend support to the common saying, “use them or lose them.” Athletes who underwent high levels of activity early in life, and thus used their bones to a greater degree, built increased BMD relative to the less active individuals.

Of specific interest, the runners who engaged in frequent weight-bearing activity during youth, placing greater than normal stresses on the lower limbs, had higher leg BMD than the swimmers who engaged in non-weight-bearing activity. This illustrates that BMD increases most at the sites of maximum stress and further supports the importance of weight-bearing activity for building and maintaining BMD.

Not only is bone sensitive to mechanical stresses resulting from weight-bearing activity, but it is also responsive to muscular contraction forces, or the forces exerted on the bones when we contract our muscles.

The researchers found that not only did the runners display higher leg BMD, but they also showed a higher degree of leg muscle mass.

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This result makes intuitive sense since one would expect increased leg training to result in increased muscle mass in that region.

Andreoli and her colleagues found this observation particularly relevant because it is likely that the increased leg BMD of the runners was due to the collaborative effects of their weight-bearing activity and greater muscular contraction forces acting on the bones.

A lifetime history of physical activity appears to prevent later bone damages in a three-fold manner. In addition to increasing BMD via the stresses of weight-bearing activity and muscular contraction forces, the increased muscle mass that develops with exercise helps to provide a cushion for bones if one should fall.

It is like placing a plush pillow under a porcelain vase that is tumbling from a mantel. Enhanced muscle mass would soften the impact of a fall, thereby lessening bone damage.

Furthermore, increased physical activity promotes better balance and posture to help prevent falls in the first place. Thus, early physical activity acts to preserve bone health during aging by increasing BMD and strengthening bones, enhancing balance to help prevent

falls, and giving the bones adequate muscle mass to cushion bones from damage in the event of a fall.

Dr. Susan E. Brown, PhD and bone health expert, notes a favorite quotation by the Founding Director of the National Institute on Aging: "If doctors could prescribe exercise in a pill form, it would be the single most widely prescribed drug in the world." These words demonstrate just how effective exercise and physical activity are in promoting bone health during aging.

So if bone is this responsive to exercise, why is it that we cannot simply spend our youth lying out in the sun and relaxing and then decide to begin strenuous weight-bearing activity to build bone later in life when we are at greater risk of bone loss and developing osteoporosis?

The answer lies in the fact that early in life there is a window of opportunity for building up BMD. According to the New York State Department of Health, we typically reach our maximum BMD between 18 and 25 years of age. Initiating physical activity early is therefore especially important for acquiring bone mass.

As an Exercise Biology Professor at the University of

California Davis and expert in the area of BMD acquisition, Dr. James Shaffrath emphasizes that “prevention of osteoporosis or pathological fractures requires that a young woman (consciously, or not) prepare her skeleton for the rigors of aging during her childhood and young adult years.”<sup>1</sup>

He went on to assert, “twenty-five to thirty percent of a woman’s adult bone mass is built in the two-year period that straddles her adolescent growth spurt. Nutrition, focused on calcium and vitamin D, as well as exercise to stimulate bone deposition, are critical during these years.”

During childhood and young adulthood, physical activity actually helps us to build stronger bones as evidenced in the current research of Dr. Andreoli and her colleagues. While exercise during youth appears to lay the foundation for long-term benefits for bone health, physical activity during adulthood and aging only seems to help preserve these early acquired benefits and to partially reduce the bone loss that inevitably comes with aging.

The effect of early exercise on life-long bone strength is like the importance of laying a very

strong foundation when building a new home. A strong base early in the building process is vital for the home to last throughout the years of wear-and-tear to come. Future renovations to prevent the house from falling down can only do so much without a strong foundation.

Dr. Shaffrath agrees: “After menopause, women lose approximately 1% of their skeletal mass each year. This provides perspective on the importance of building bone mass in the teen and early adult years.”

The conclusions of Dr. Andreoli’s findings underscore the role of early physical activity, particularly weight-bearing, in helping to maintain BMD and muscle mass later in life. This study’s assertions highlight the importance of exercise for preventing declines in bone strength and muscle mass that are often precursors to osteoporosis.

These implications become astonishing when viewed from Dr. Shaffrath’s perspective: “A young woman who has added to her bone mineral density by just 10% has effectively postponed the onset of pathological fractures or osteoporosis in later life by 10 years!”

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<sup>1</sup> Personal communication. 2012.

### **Literature Cited**

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