

# The Doctor Is In

By Tedd Weisman, MD

## Bone Metabolism 101 and Osteoporosis: What You Should Know

**P**ARENTS OFTEN ASK ME whether they should feed their child more milk to heal fractures, especially when their child has had more than one fracture in the past few years. In my role as an orthopedic surgeon, I address their question by first asking: “*Is your young child active? Is your child involved in sports such as football, soccer, gymnastics, or other activities such as rock climbing, skateboarding, or snowboarding?*” Invariably, the answer to that question is “Yes.” Then I explain that unless their child has a rare “brittle” bone disease, such as osteogenesis imperfecta, they should expect this active child to have a higher chance of injury than a more sedentary child. Childhood lacerations, bruises and fractures are associated with an active lifestyle, which ironically, is often a sign of good health. What some of these active children need to do is practice more caution in their activities, not refrain from participating in them.

My next orthopedic response to the question above is that there are no differences in bone health between milk drinkers and non-milk drinkers. In summary, drinking milk does *not*:

- 1) *make bones stronger*
- 2) *positively affect bone growth*
- 3) *hasten bone healing*
- 4) *prevent bone fractures*

In fact, the “got milk?” advertisements were carefully worded to avoid making a direct claim that milk can build strong bones. That is because the science does not prove that statement. The “got milk?” advertisements obliquely touted milk consumption in order to get “strong bones.” The science does not show that milk drinkers have stronger bones than non-milk drinkers, nor is milk consumption correlated with hastening the healing process of fractured bones. In fact, there is clear epidemiologic information which shows the opposite correlation: *hip fracture rates are highest among cultures that consume the most cow’s milk.*

“*If we don’t drink milk, what happens to our bones?*” A study was done to compare the bone density of vegan Buddhist nuns (who are prohibited from consuming dairy products) to a group of non-vegan women. Both groups were controlled for age, height, body habitus and activity routines. In fact, the non-vegan women consumed approximately twice the amount of calcium than the vegan nuns, but the study found *no difference* in the bone mineral density between these two groups of women.

Bone Metabolism 101 is the title of this article, because you are about to get a brief education in orthopedic basic science. This information will help you understand bone growth, bone healing,

and osteoporosis. Armed with this data, you will be better informed during a conversation with your physician about a plan of treatment for your particular bone health needs. There are *three* things to know:

**1. Bone continually undergoes changes.** These changes occur during both childhood and adulthood. In childhood, it is called *bone growth* and *bone remodeling*. In adulthood, it is known as *bone remodeling*. Bone remodels to accommodate the daily physical stresses placed on it by activities done against the force of gravity. Bone remodeling is also how bones heal. Bones can become stronger in active individuals, and weaker in sedentary individuals. Here are examples of how bone undergoes changes:

- Children grow because their bones lengthen and widen.
- Broken (= *fractured*) bones mend and heal.
- Exercise is a potent way of strengthening bones to prevent and treat osteoporosis, while lack of activity can lead to a phenomenon called Disuse Osteoporosis. (Disuse Osteoporosis will be discussed soon.)

**2. Bone is made up of two types of cells: osteoblasts and osteoclasts.** These two cells perform opposite functions. The *osteoblast* cells make bone, and the *osteoclast* cells remove bone. The “bone as a bank” is a metaphor I often use. The *osteoblasts* deposit money to the bone bank, and *osteoclasts* withdraw money from the bone bank.

**3. Bone is a storehouse of calcium and other minerals.** There are hormones and enzymes that direct the *osteoblast cells to make bone*, and there are hormones and enzymes that direct the *osteoclast cells to remove bone, calcium and minerals from bone*. (The human body, in its great wisdom, sometimes needs to remove calcium and minerals from bone when they are needed elsewhere in the body). In general, the level of bone mass remains constant, because the bone-producing effects of osteoblasts equals bone-removing effects of osteoclasts. However, when osteoclast activity outpaces osteoblast activity, bone mineral density decreases. This is what causes osteoporosis.

Osteoporosis is defined by the World Health Organization (WHO) as low bone mass (or low bone density). Low bone density results in decreased bone strength. Therefore, people who are diagnosed with osteoporosis are at an increased risk of having a fracture due to low bone density and strength.

It is a known fact that women are diagnosed with osteoporosis more frequently than men. The primary reason is that the average

woman is smaller than the average man. Therefore, women start out in life with less bone mass than men. As we age, the rate of bone loss occurs about equally between men and women. However, if you start with less, you end with less. (This is the “money in the bank” metaphor at work again. For example, if person A starts out in life with more money in the bank than person B, and both person A and person B withdraw the same amount of money each year, the one who started with more (person A), ends with more.) The statistics bear this out, since wrist and hip fracture rates are known to be higher in woman over age fifty than men over age fifty. The osteoporosis-related fracture ratio of women to men is 3:1. In my practice, between 2012 and 2017, I operated on hip fractures in women compared to men at the rate of 3 ½ :1, which is consistent with this statistical ratio. Further, in the past five years, I have treated wrist fractures in women compared to men (over age 50) at a ratio of almost 5:1.

Calcium in foods is not concentrated as they are in supplements, so they are absorbed into the bloodstream more slowly and gradually. Therefore, it is beneficial to get calcium more naturally from foods.

While milk and cheese products contain calcium, so do other foods that contain less toxins and certainly less saturated fats. For example, almond milk supplies more calcium per 8 oz. glass than cow’s milk. Below is a list that compares (from higher to lower) the approximate calcium content of some foods to that of milk and a slice of cheddar cheese.

**FOOD AND CALCIUM CONTENT**

Watercress 1,000 mg/serving
Tofu 500 mg/cup
Almond milk 370 mg/glass
Almonds 350 mg/cup
OJ (calcium fortified) 300 mg/8 oz. glass
Soybeans 300 mg/cup
Cow’s milk 300mg/8 oz. glass
Cheddar cheese 200 mg/1 oz. slice

Disuse Osteoporosis is a term which teaches us the importance of exercise as a natural way to prevent *and* treat osteoporosis. Disuse osteoporosis occurs when there is insufficient weightbearing stress on bone. In other words, bones lose mineralization and bone density if not stressed by exercise and weightbearing activities. This is the “use it or lose it” phenomenon. Disuse osteoporosis occurs when the body, in its physiologic wisdom, gets a message that the bones are not being normally stressed by activity. Our body determines that if bone doesn’t weight bear, then calcium and minerals should be removed from bone so they can be used elsewhere in the body for other important functions.

As a common example of disuse osteoporosis, we can look no further than to see what happens when a patient suffers an ankle fracture. The patient is instructed by the orthopedist not to weight

bear on that injured extremity, usually for many weeks until their bone heals. Within a few weeks of non-weightbearing, the patient’s x-rays can show findings of *disuse osteoporosis*. Disuse osteoporosis has the x-ray appearance of “washed out” or faded looking bone. (This finding is also seen on x-rays of paraplegic and quadriplegic patients who cannot weight bear permanently.) When the fracture heals, and the patient is allowed to resume normal weight-bearing activities, the bone begins to reincorporate calcium and minerals. The bone then naturally strengthens, and the x-rays eventually show resolution of disuse osteoporosis.

NASA physicians caring for the astronauts in the early era of spaceflight missions had diagnosed disuse osteoporosis. Even astronauts, this elite group of physically fit human beings, were found to be susceptible to disuse osteoporosis when they returned to earth from zero-gravity space. The problem was time-dependent, meaning that the longer the time spent in zero-gravity, the worse the disuse osteoporosis condition became. NASA scientists have since learned how to avoid, or at least modify this condition. In more recent space missions, you may have noticed video feeds of astronauts from the ISS (International Space Station). The videos show footage of them floating in the ISS compartments rather than sitting. These astronauts might be seen pushing off the walls, mimicking push-ups, or performing other acrobat-like activities such as “floating” somersaults. This looks like fun, but NASA scientists had learned from experience about the importance of movement and activity for bone health, even when gravity is “out of the picture.”

Our earthbound routine of daily activities (such as walking, climbing stairs, or carrying and lifting objects) are usually sufficient to fend off disuse osteoporosis. These daily activities of using and moving our arms and legs against gravity often supply enough bone resistance forces to avoid disuse osteoporosis. The important point about activity recommendations is to be *consistently active*. That means that is best to try to be active frequently during the day, and every day. But staying active does not mean one has to do the weight-lifting equivalent of curling 100 lb. barbells or running a marathon. It simply means that choosing activity over being sedentary is important. Observational, retrospective, and prospective randomized trials have demonstrated this in a number of studies. These studies have shown the beneficial effects of exercise on bone accumulation during growth, with particular benefit from maintaining activity and exercise throughout life.

Prevention of osteoporosis with activity is critically important, since hip fractures are a frequent occurrence in postmenopausal osteoporotic patients. Based on decades of research, a sad statistic is that approximately one out of three patients who suffer a hip fracture will die within the first year of that injury. This post-hip fracture mortality statistic has not changed over the past few decades despite advances in life-saving medical treatments and use of state-of-the-art surgical bone fixation devices. \*

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*Excerpted from Dr. Weisman’s forthcoming book, Have You Got Milk? Not For Bone Health*