FAST WITHOUT FRACTURES

How calcium, estrogen, and caloric intake factor into the bone health of female endurance athletes

By Jen Guidera

When it comes to bone health, the distance runner faces a tough dilemma. The ability to run depends on healthy bones. However, the very act of running can compromise bone health if the distance is too far or the pace too fast. An endurance runner may take more than 10,000 steps in an hour long run, loading the bones of the lower leg and thigh with each step. Too much repetitive stress causes bone cells to be resorbed at a faster rate than they can be replaced, leading to tiny cracks in the bone (1). Over time, these tiny cracks can turn into stress fractures.

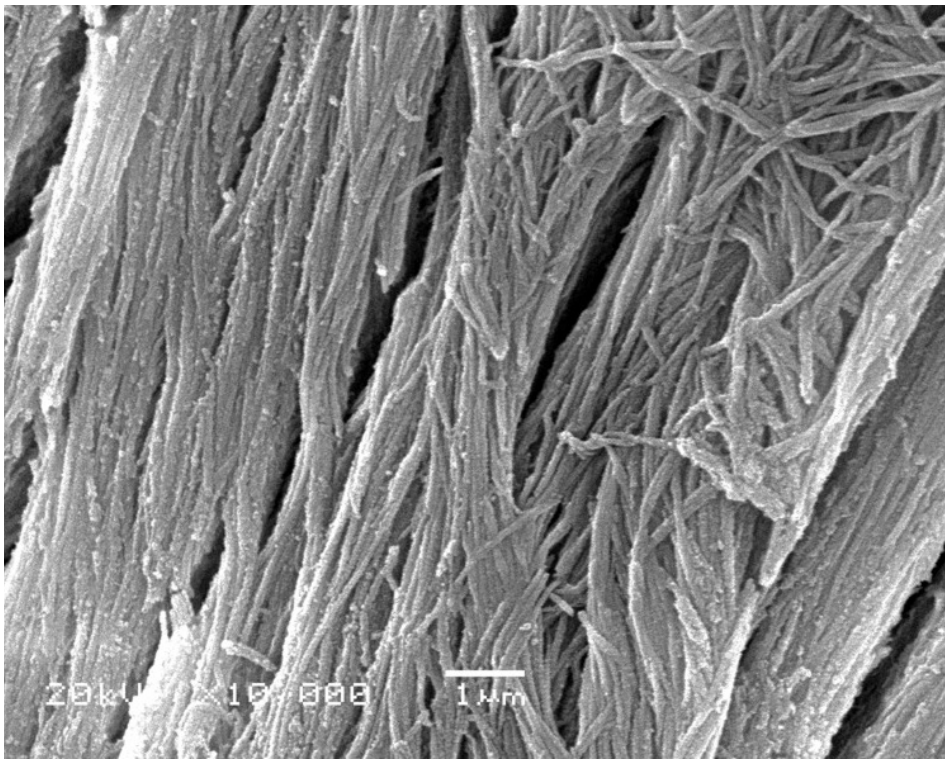
The simplest way for a runner to avoid a stress fracture is to run less. Of course, this is not the path most distance runners want to take. Nutrition provides an alternate avenue to build healthier, stronger bones that are more likely to maintain integrity and resist fractures. For a long time it has been known that calcium is an essential nutrient for maintaining bone health (2). However, for female endurance athletes, the relationship between nutrition and bone health is more complex than just getting enough calcium.

Estrogen, the female sex hormone produced during menstruation, is also thought to factor into bone health. Many studies have found a link between the loss of menstrual cycle, called amenorrhea, and stress fractures in female runners (3) (4) (5) (6) (7). Another study found that amenorrheic athletes tend to have lower bone mineral density than those with a normal menstrual cycle (8).

The situation gets even more complicated in light of the fact that low levels of estrogen are not only associated with reduced calcium absorption, but also restricted caloric intake (9). The important question is how these three variables, estrogen, caloric intake, and calcium absorption, are related to each other and to bone health. Do lower estrogen levels cause reduced calcium absorption? Or is caloric restriction the real culprit, and lower estrogen levels simply another consequence of not getting enough calories? Even if estrogen has a separate role in calcium absorption, can this role only be fulfilled when the body is not in a starved state?

A recent study attempted to distinguish between the effect of caloric restriction and the role of estrogen in calcium absorption (10). The study compared levels of calcium absorption in two different groups of rats. The first group had a restricted diet and lower levels of estrogen. The second group had a restricted diet but normal levels of estrogen, achieved with an estrogen supplement. The third group had both normal caloric intake and normal levels of estrogen and served as a control. The results were striking—rats that had restricted caloric intake but normal level of estrogen had comparable levels of calcium absorption to rats in the control group with normal energy balance and normal estrogen levels. Meanwhile, rats in the first group, with restricted caloric intake and lower levels of estrogen, absorbed significantly less calcium.

Figure 1: Scanning electron micrographs show the mineral composition of bone structures. ***Photo by the Wikipedia.***



Based on these findings it seems that estrogen has a special role in contributing to bone health that is separate from energy intake.

These results are surprising and should be interpreted with caution. A dangerous reading of these results is that female endurance athletes can starve themselves and maintain bone health simply by supplementing with estrogen. Perhaps the gravest error of such a reading is that it fails to take into account the overall health of the female endurance runner. Even so, the idea that caloric intake does not contribute to bone health actually contradicts other recent research on bone health. A 2012 study found that dietary restriction has a significant effect on bone mineral density—in fact an even larger effect than calcium restriction (9). Meanwhile, the idea that estrogen will restore normal levels of calcium absorption in female athletes is not set in bone. A 2003 study of humans found that estrogen supplementation does not prevent bone loss in amenorrheic female athletes (11).

At the end of the day, the relationship between calcium, estrogen and bone health is still unclear. So what steps can a female runner take to maximize bone health? Talking to a physician is probably the best road to take. With this in mind, it is still true that calcium is thought to contribute to the bone health of athletes and non-athletes alike. Getting enough calcium seems to be one simple step a female endurance athlete can take towards healthy bones.

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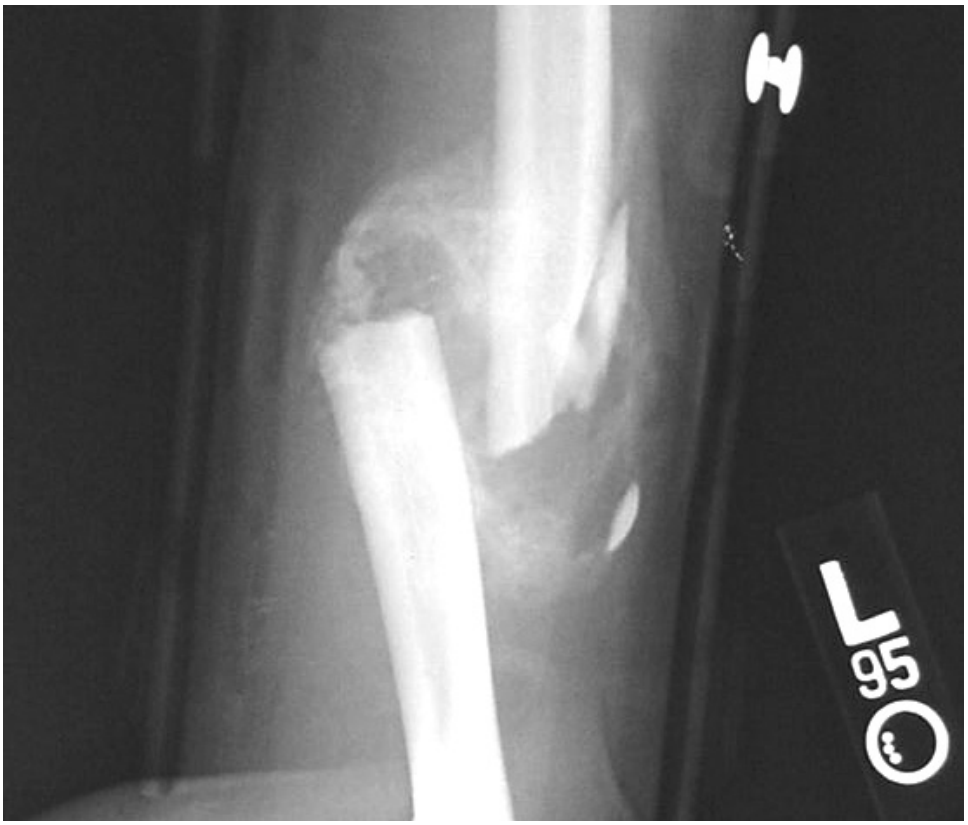

Figure 2: Extended stress can often lead to bone fractures. ***Photo by Wikipedia.***

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