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# Calcium for Athletes to Improve Bone Strength and Health

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## Introduction

Athletes train to reach their full potential and to compete at the highest level. Many competitive athletes, in a wide variety of sports, train to keep their skeletal muscles and heart healthy and strong to compete. What about their bones? Having healthy muscles and a healthy heart is important, but what if athletes neglect the health and strength of their bones, and their bones break? Bones are the frame and structure of the body and aid in its movement, if one breaks, an athlete may be limited in his/her movements, and may no longer be able to train and/or compete at full capacity until it has healed, and in some cases a broken bone can even be career-ending. Athletes should not only consider keeping their muscles and heart healthy and strong, but also keep their bones healthy and strong so they can be able to train, compete and perform.

Athletes can experience stress fractures while training which occur when the stresses placed on the bones are more than it can endure before fully healing. Currently, it is difficult to determine which specific sports may increase the risk of stress fractures, but they appear to occur more in sports with repetitive weight-bearing physical activity (8). In the lower body, where stress fractures are more common, they typically occur in the tibia, metatarsals, and fibula (8). And in the upper body, they typically occur in the ulna (8). When these stress fractures occur, an athlete must wait for it to heal, which can lead to missing training, practice and/or competition for weeks or even months (8).

Although weight-bearing physical activity from training and competition in sports is widely known to strengthen bones and be beneficial in reducing the risk of stress fractures, it is when weight-bearing physical activity becomes overwhelming and bones are overused that stress fractures occur. Some athletes may find it difficult to modify their amount of weight-bearing physical activity due to

the specificity of their training and sport. Athletes need to increase weight-bearing physical activity to increase bone strength and decrease the risk of stress fractures, or decrease weight-bearing physical activity to prevent overuse. In either case, athletes may consider other options, such as consuming more calcium to help keep their bones healthy and strong to reduce the risk of stress fractures.

## Calcium Amounts and Sources

As athletes may intake additional protein to keep their muscles healthy and Omega-3 fatty acids to keep their hearts healthy, they may also consider taking additional calcium to keep their bones healthy and strong. Depending on age, the Adequate Intake (AI) of calcium, which is the amount of calcium needed each day to offset calcium losses, ranges around 1,000–1,300mg/d. The Upper Level (UL) of calcium, which is the maximum level of daily intake of calcium that is unlikely to cause adverse health effects in the majority of a population, is 2,500mg/d. Good sources of calcium from calcium-rich foods include dairy foods (e.g., milk and cheese), broccoli, leafy greens (e.g., kale, collard, turnip, mustard green) (although spinach is a leafy green known to be high in calcium, its calcium is poorly absorbed due to the presence of oxalate, which hinders the amount of calcium that is absorbed), sardines, canned salmon, and calcium-fortified foods (e.g., calcium-fortified orange juice, yogurt, soymilk, tofu, etc.) (9).

Just as some athletes may not be able to modify weight-bearing physical activity due to the specificity of their training, some athletes may not be able to intake enough calcium from calcium-rich foods due to specific diet regimens. In this case, athletes may consider taking calcium supplements (e.g., calcium pills, chewable and liquid calcium supplements) in amounts of 500mg or less at a time (9). The two most common calcium supplement compounds are calcium citrate and calcium carbonate (3, 9).

Calcium citrate is highly soluble and can be absorbed well when taken with or without meals. Calcium carbonate is insoluble, and should be taken with meals so that stomach acid can break down and absorb that form of calcium (9). But research at the Osteoporosis Research Center at Creighton University found that calcium carbonate, when taken with food, absorbs just as well as calcium citrate (3). Calcium carbonate has also been found to absorb as well as the calcium in milk (6). And as athletes may drink water to keep themselves hydrated, the study also found that the calcium absorbed from high-calcium mineral water is equal, or slightly better, than that of milk (2).

Other nutrients play vital roles in bone health, and while calcium is the most essential micronutrient to bone health, the addition of vitamin D aids in calcium absorption. The AI of vitamin D is 5–15µg/d (200–600 IU/d), with a UL of 50µg/d (2,000 IU/d) (9). Vitamin D can be obtained from sun exposure and/or dietary sources, and is often combined with calcium in supplements (7, 9). But when considering dietary changes for consuming additional calcium and vitamin D, an athlete may want to consult a qualified nutrition professional, such as a Certified Specialist in Sports Dietetics (CSSD).

## Possible Calcium Considerations for Athletes

In a recent joint position statement on “Nutrition and Athletic Performance,” the American College of Sports Medicine (ACSM), American Dietetic Association (ADA), and Dietitians of Canada (DC) deemed that calcium supplementation does not improve performance in individuals who are consuming nutritionally adequate amounts of it in their diets. But calcium is one of the primary minerals low in the diets of athletes, especially female athletes, and state that their “current recommendations for athletes with disordered eating, amenorrhea, and risk for early osteoporosis are 1500mg of elemental calcium and 400–800 IU of vitamin D per day,” (1). But athletes should

not consider taking calcium for the sake of improving performance, but to help their bones stay healthy and strong.

It may take much more calcium, by calcium supplementation to maintain bone health and strength, and thus, reduce the risk of stress fractures. Researchers at the University of Memphis found that athletes (male basketball players) lost a large amount of calcium in sweat (dermal loss) during intense training and had lower bone mineral content (BMC) (4). But when they increased dietary calcium through calcium supplementation, their BMC increased over time, which suggests increased calcium needs during intense training are beyond the current recommendations. The athletes with calcium intakes of 2,000mg or more during intense training were associated with increases in BMC for the total body and legs, while those with calcium intakes less than 2,000mg were associated with decreases in BMC for the total body and legs. The researchers suggest that calcium needs during intense exercise have been underestimated, and should be increased to perhaps 2,000mg/d to preserve bone health and strength, especially during extremely intense training, and under hot and humid conditions.

As for consuming 2,000mg/d of calcium through supplementation, researchers at the Osteoporosis Research Center at the University of Creighton found that female Navy recruits who consumed 2,000mg of calcium and 800 IU of vitamin D per day had a decreased incidence of stress fractures, 21% lower than those who took a placebo, which were mostly in the tibia and fibula and some in the pelvis and femur (5). Although both studies suggest a calcium intake of 2,000mg/d as being effective in promoting bone health and strength and reducing the risk of stress fractures, which is well above the AI and that recommended by the ACSM, ADA, and DC, it is still under the UL, and should still be a safe level of calcium intake. However, more research is needed to determine if calcium needs need to be increased for athletes and those who partake in vigorous physical activity.

## Summary

If athletes may take additional protein for their muscles and Omega-3 fatty acids for their hearts, they should also consider taking calcium for their bones. Without consuming adequate calcium for healthy and strong bones, athletes place themselves at higher risk for stress fractures. Stress fractures ought to be avoided, because they take weeks or even months to heal, which may prohibit athletes from training and competing at their full capacity (8). If athletes intake more calcium, they can reduce the risk of getting stress fractures by helping keep their bones healthy and strong, which allows them to keep performing. ■

## References

1. American College of Sports Medicine, American Dietetic Association, and Dietitians of Canada. Joint Position Statement: Nutrition and Athletic Performance. *Medicine & Science in Sports & Exercise*. 41(3), 709 – 731. 2009.
2. Heaney, RP. Absorbability and utility of calcium in mineral waters. *The American Journal of Clinical Nutrition*. 84(2): 371 – 374. 2006.
3. Heaney, RP, Dowell, MS, and Barger-Lux, MJ. Absorption of calcium as the carbonate and citrate salts, with some observation methods. *Osteoporosis International*. 9(1): 19 – 23. 1999.
4. Klesges, RC, Ward, KD, Shelton, ML, Applegate, WB, Cantler, ED, Palmieri, GMA, Harmon, K, and Davis, J. Changes in bone mineral content in male athletes: mechanisms of action and intervention effects. *The Journal of the American Medical Association*. 276(3): 226 – 230. 1996
5. Lappe, J, Cullen, D, Hayatzki, G, Recker, R, Ahlf, R, and Thompson, K. Calcium and vitamin D supplementation decreases incidence of stress fractures in female navy recruits. *Journal of Bone and Mineral Research*. 23(5): 741 – 749. 2008.

6. Mortensen, L, and Charles, P. Bioavailability of calcium supplements and the effect of vitamin D: Comparisons between milk, calcium carbonate, and calcium carbonate plus vitamin D. *The American Journal of Clinical Nutrition*. 63(3): 354 – 357. 1996.

7. Nieves, JW. Osteoporosis: The role of Micronutrients. *The American Journal of Clinical Nutrition*. 81(5): 1232S – 1239S. 2005.

8. Snyder, RA, Koester, MC, and Dunn, WR. Epidemiology of stress fractures. *Clinics in Sports Medicine*. 25(1): 37 – 52. 2006.

9. Wardlow, GM, Hampl, JS, and DiSilvestro, RA. Perspectives in Nutrition (6th ed.). New York: McGraw-Hill. 2004.

**Table 1. Calcium and Vitamin D Amounts**

	Calcium	Vitamin D
Adequate Intake (AI)	1,000–1,300mg/d	5–15µg/d (200-600 IU/d)
Upper Level (UL)	2,500mg/d	50µg/d (2,000 IU/d)

mg/d: milligrams per day  
 µg/d: micrograms per day  
 IU/d: International Units per day