



# VITAMIN D/ STRONG BONES

## BEST PRACTICES

### PROVIDER RESOURCE

#### How do stress fractures impact service women and force readiness?

Risk of stress fractures in the military is known to be high, with a disproportionate impact on females and trainees. Rates of up to 5.2% of male recruits and 21% of female recruits have been reported. Stress fractures are the single most costly injury of military training, with an estimated annual cost to the DoD of \$74.5M. Stress fractures are one of the most powerful predictors for attrition from basic training, 4x more likely than uninjured recruits.

#### What can I recommend to service women to increase their bone strength?

- Adequate calcium intake
- Adequate Vitamin D serum levels
- Appropriate physical activity

#### What are modifiable risk factors to bone injury/stress?

**LACK OF WEIGHT-BEARING EXERCISE:** Weight-dependent loading of the skeleton plays an important role in establishing and maintaining bone mass and strength.

**POOR CALCIUM INTAKE:** Calcium is known to be a critical factor in promoting bone health.

**VITAMIN D DEFICIENCY:** Vitamin D deficiency is a critical link to stress fractures.

**LOW OR HIGH BODY WEIGHT:** Obesity and low BMI can have negative impacts on bone health.

**NICOTINE USE:** Nicotine can decrease the body's absorption of calcium, which is critical to bone health.

**EXCESSIVE ALCOHOL USE:** Chronic alcohol consumption can increase the creation of two bone-damaging hormones, cortisol and parathyroid hormone.

**LONG-TERM USE OF CORTICOSTEROIDS:** Corticosteroids can decrease bone formation and increase the natural rate of bone breakdown.

#### What are the calcium needs of healthy adults?

- Calcium is a mineral that is critical for bone strength.
- 3-4 servings of calcium-containing foods each day for recommended 1300-1500 mg per day.
- There is no evidence that consuming calcium at levels higher than the allowance receive any additional skeletal benefit.
- Calcium supplements can cause abdominal discomfort, constipation, or diarrhea. In some patients, calcium supplements can promote the formation of kidney stones and/or ischemic heart disease.

## Vitamin D Information to Strengthen Bone Health

- **Adequate serum levels of Vitamin D** are needed for calcium absorption, optimal bone health, and muscle function.
- Serum Vitamin D levels: >40 ng/mL is ideal, >30 ng/mL is sufficient, 30-20 ng/mL is insufficient, <20 ng/mL is deficient. **Vitamin D deficiency is one of the main modifiable risk factors for stress fracture development** providers can address.
- Sun exposure is a primary source of Vitamin D.
- Exposure of both arms and legs to the sun for 5-30 minutes in the late morning/early afternoon without sunscreen can produce approximately 3,000 IU of Vitamin D.
- **Many factors influence Vitamin D production beyond sunlight:** melanin content, age, sunscreen use, season, time of day, latitude, air pollution, and lack of skin exposure due to uniform requirements or work location.
- For those who do not get adequate sun exposure, supplementation is strongly recommended. **Compensating for suboptimal sunlight with diet alone is very difficult.**
- Natural food sources of Vitamin D: fish, especially high-fat fish such as salmon, herring and mackerel. \*Farmed salmon contains only ¼ the amount of Vitamin D in wild salmon and some can be lost in the cooking process. Eggs are also a good source.
- For many countries, **foods fortified with Vitamin D are the major dietary source of Vitamin D.**

### Supplementing Recommendations:

- If service member is unable to intake 600 IU of Vitamin D through diet, supplemental Vitamin D can be prescribed per standard of care below the tolerable upper limit of 4,000 IU/day.
- For Vitamin D deficiency (<30 ng/mL), prescribe 50,000 IU weekly for 12 weeks then retest serum level. After repletion, recommend maintenance supplementation of 2,000 IU/day.

### Overall Recommendations for Vitamin D:

- Encourage routine Vitamin D supplementation (below 4,000 IU/day) for all military personnel that do not consume a minimum of 600 IU/day through diet.
- Deficiency treatment protocol: 50,000 IU ergocalciferol once weekly for 12 weeks then recheck serum level.
- **Recommend Vitamin D screening for all recruits entering military service.** If deficient, treat per standard of care.

## Exercise Recommendations for Service Members to Strengthen Bone Health

- Regular physical activity is one of the most effective ways to maximize peak bone mass during growth and to prevent bone loss during aging.
- **Exercise programs that combine high-impact activity with high-intensity resistance training appear most effective** in augmenting bone mineral density. High impact programs alone are not as effective as when combined with resistance training.
- By adequately loading our skeletons through impact and weight training, we can stimulate cells in our bones to lay down new layers of stronger bone tissue. **Overloading deficient bones without adequate rest can cause stress injuries.**
- Recommend moderate-high impact weight bearing physical activity or related impact loading sports for at least 30 minutes 3-5 days per week.
- **Include muscle strengthening exercises at least 2 days per week at a high intensity** (60-80% of 1RM), progressing challenge over time and targeting the major muscles around the hip and spine (i.e., spinal extensors, hip extensors and abductors, knee flexors and extensors).

### The impact of selected exercises on bone health

Highly osteogenic	Moderately osteogenic	Low osteogenic*	Non-osteogenic*
Basketball/netball	Running/jogging	Leisure walking	Swimming
Impact aerobics	Brisk or hill walking	Lawn bowls	Cycling
Dancing/gymnastics	Resistance training	Yoga/Pilates/tai chi	
Tennis	Stair climbing		
Jump rope			

\* While certain exercises may have low or no osteogenic benefits, this should not be construed to imply that these exercises do not offer a wide range of other health benefits. ◆

## REFERENCES

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