Underfueling and Bone Health

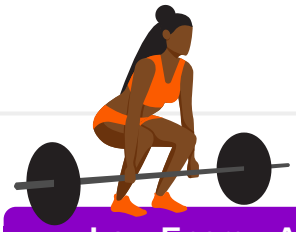
Underfueling can negatively impact bone health through several physiological problems, which can compound quickly.

Underfueling → Low Energy Availability (LEA) → Amenorrhea

**See "Underfueling and RED-S"*

**See "What is Amenorrhea"*

↓ Bone Mineral Density



Low Energy Availability

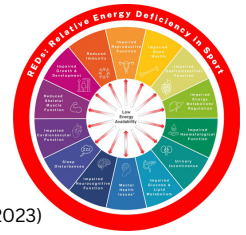
- Our muscles need energy to train, recover, and adapt. Without enough energy, all three will suffer.
- You may be familiar with the repair that our muscles go through following training. But, ***our bones undertake a very similar process!***
- Our bone responds to repetitive mechanical loading by ***increasing bone formation.*** With proper training & nutrition, bones become stronger over time.
- Bone formation requires calcium, phosphorus, and other minerals, as well as ***energy.***
- If we do not provide the body with ***enough*** energy to undergo this process, we diminish our ability to adapt to microscopic wear and tear and decrease our ability to repair bone and recovery from training & injuries.

TheThyroid Gland

- The thyroid gland plays a critical role in ***metabolism & energy regulation.***
- Through hormone regulation, an ***over-active*** thyroid gland ***increases*** energy expenditure. While an ***under-active*** thyroid ***decreases*** energy expenditure.
- With ***LEA***, the thyroid gland ***decreases energy expenditure,*** via hormonal changes, ***to preserve energy.***
- A decrease in thyroid hormone activity impairs reproductive function, contributing to amenorrhea.
- The thyroid also releases two critical hormones for calcium and bone regulation: Calcitonin (calcium retention) & PTH (calcium release).
- Dysregulation of the thyroid gland can impact our ability to store and retain calcium in our bones.

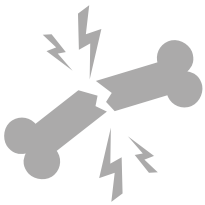
Amenorrhea

- Amenorrhea is defined as the absence of menstruation.
- Menstrual irregularity and ***amenorrhea*** is one of the hallmarks of REDs.
- The menstrual cycle is critical in the proper regulation of hormones, including estrogen, progesterone, androgens, and more.
- These hormones also regulate calcium absorption (storing calcium in the bone) and resorption (releasing calcium from the bone)
- An absent menstrual cycle can disrupt the regulation of these hormones.
- This results in an increase in calcium loss from bone and impaired calcium retention.



(Figure Mountjoy et al 2023)

↓ Bone Mineral Density → ↑ Risk of Fracture



Fueling for Bone Health

How you can eat to optimize your bone health

What is energy availability?

Dietary energy intake minus exercise energy expenditure adjusted for muscle mass.

In other words, how much energy for important physiological functions, like **maintaining good bone health**, is left over after you have exercised

Focus on a varied, nutrient-dense diet of fruits and vegetables, whole grians, lean proteins, and good calcium sources with adequate protein and calories.

High Energy Availability

- Eating enough calories will ensure high energy availability, which is necessary in avoiding decreases in bone mineral density
- Impaired bone health is linked to low energy availability
- Low carbohydrate intake is linked to poor bone health

Protein

- Protein is part of the matrix of bone matter.
- Higher protein intakes may increase calcium absorption from foods.
- Bones are constantly turning over, building and rebuilding especially for athletes. Eating sufficient protein will reduce negative effects on bone turnover.

- Examples: Meat, poultry, fish / Dairy products (milk, yogurt, cheese) / Beans and lentils / Nuts and seeds

Calcium and Vitamin D

- Calcium and vitamin D are vital for making strong bones.
- Bones have 99% of calcium body stores.
- If low in calcium, the body might breakdown the calcium that is in bones which decreases bone mineral density.
- Eating a meal rich in calcium before training can lead to a reduction of negative effects on bone from exercise

- Examples:
- Calcium: Dairy products (milk, yogurt, cheese), dark leafy greens, soy products
- Vitamin D: Fatty fish, cheese, egg yolks, fortified grains/cereals, sunlight

Other Considerations

- Taking an iron supplement - avoid taking it with calcium
- Resistance training increases bone mineral density
- Get regular bloodwork done to test for vitamin D status. If deficient. supplement with vitamin D to maintain good bone health!