



EXERCISE AND NUTRITION FOR BUILDING STRONG BONES

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YOUNG REVIEWERS:



FILIP
AGE: 14

Bone health is important for children as they grow, providing them with the strength and support needed for development and everyday activities. Strong bones work together with our muscles to help us move. Exercise and nutrition are critical for building and maintaining strong bones. Participating in activities and sports creates the necessary stress on our bones so they can grow and strengthen over time. Foods rich in calcium, vitamin D and protein provide the nutrients needed for bone development. While these factors contribute to bone health on their own, their combined effect is more powerful. Exercise stimulates bone formation, while proper nutrition provides the necessary resources for this process. Without adequate nutrients, bones cannot fully benefit from the stress of exercise, and without exercise, the body might not effectively use the nutrients we eat. So, regular physical activity *and* a balanced diet

GROWTH PLATES

Soft cartilage area at the ends of bones where new bone forms, allowing them to grow longer.

OSTEOBLASTS

Types of cells that help build and strengthen bones by producing new bone tissue.

COLLAGEN

A protein that forms a supportive framework in tissues like skin, bones, and cartilage. It strengthens and supports bones, keeping them durable and flexible.

PROTEIN

A nutrient found in foods like meat, beans, and dairy that helps build and repair tissues, including bones. It is essential for overall growth and bone health.

CALCIUM

A mineral found in many foods, especially dairy products, that is essential for strong bones and teeth. It helps bones stay strong and healthy.

Figure 1

(A) Healthy/young bone is strong and dense, with tightly packed structures. (B) Unhealthy/old bone is weak and fragile, with fewer structures that are more spread out.

RESORPTION

Process where the body breaks down and absorbs old bone tissue to make way for new bone growth.

help children build and maintain strong bones—essential for their long-term health.

HOW DO BONES GROW?

As kids and teenagers, our bones are in super-speed growth mode, with this rapid development occurring at the ends of our long bones in areas called **growth plates**. Growth plates function like factories where new bone is produced [1]. Inside these plates, cells called **osteoblasts** work to build new **collagen**. Collagen is an important **protein** in our bodies that creates the structure of our bones, providing them with strength and flexibility. Collagen supports the accumulation of minerals like **calcium**, which harden bones and make them dense. So that new bone tissue can be built, bones constantly undergo a process called **resorption**, where old bone is broken down and new bone is created, ensuring continuous growth and a healthy bone structure [1].

WHEN DO BONES GROW?

The most significant and rapid period of bone growth occurs during childhood and adolescence. After this phase, bones continue to grow at a much slower pace throughout early adulthood, and then they start to slowly lose their density and become weak and fragile due to aging (Figure 1) [2]. The rapid growth period, especially during adolescence, is crucial for long-term bone health. It is like building a solid foundation for a house; if the foundation is well-constructed during youth, it remains strong for a long time. Therefore, the period around puberty is considered a “window of opportunity” for building optimal bone health, so that we can delay the bone loss that happens during old age [2].

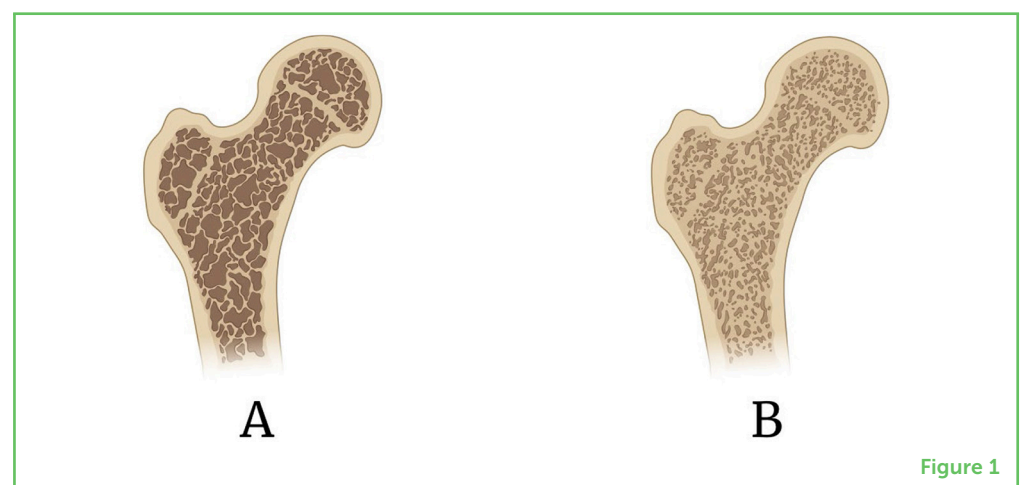


Figure 1

BONE MARKERS

Special signs in the blood that show how the bones are growing and changing. They help doctors understand how healthy a person's bones are.

WHAT ARE BONE MARKERS?

How do our bodies communicate internally to ensure they produce enough bone mass? The answer is "thanks to **bone markers**". Bone markers are substances that circulate in the blood that can indicate how well our bones are growing. Bone markers can show us how much bone we are building and how much old bone is being broken down. There are two main types of bone markers. The first type is collagen-building products, which tell us about bone-building activity and speed. The second type is collagen-breakdown products, which tell us about bone resorption.

IMPORTANCE OF EXERCISE IN BONE HEALTH

Exercise is one of the most important factors for bone health because it applies the necessary stress to stimulate bone formation [3]. Two major categories of exercises can help make our bones stronger: those that build more muscle (resistance/weight training) and those that work against gravity (high-impact/weight-bearing activities; [Figure 2](#)).

Figure 2

Different types of exercises and their impact on bone health. **(A)** Weightlifting exercises. **(B)** High-impact exercises. **(C)** Resistance Exercises. **(D)** Low-impact exercises. As for how much exercise is good for overall health, the [Canadian 24-hour movement guidelines](#) recommend that preschoolers should spend 180 min per day performing physical activities, and children 5–17 years should do 60 min per day of moderate to vigorous physical activity, and several hours of light activity.

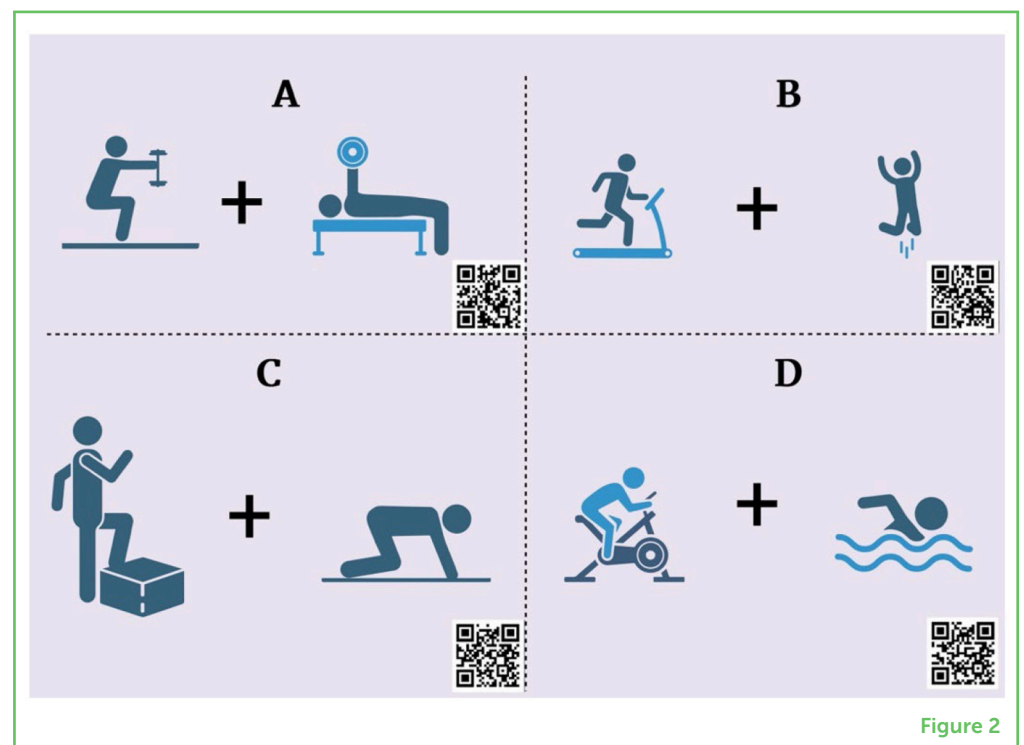


Figure 2

Muscle-building exercises help strengthen our bones. When we engage in activities and sports that require our muscles to work hard, like lifting weights or doing push-ups, our muscles pull on our bones. This extra pull creates more stress on the bones, encouraging them to grow denser and stronger [4].

BONE DENSITY

A measure of how strong and dense bones are. Higher bone density means stronger bones.

Exercises that work against gravity include running, jumping, and dancing. These activities and sports are called high-impact and weight-bearing because our bones must support our weight as we move. Moving our bodies against gravity increases the impact and stress on our bones, making them denser and more resilient [4]. For example, when you run, your legs and spine support your body's weight with each step, which helps make your bones stronger. In contrast, low-impact exercises and activities exert less force on the skeleton and require higher intensity and longer time to benefit our bones [1, 4].

NUTRITION FOR STRONG BONES

Proper nutrition is also a very important factor in building and maintaining strong bones. Essential nutrients like calcium, vitamin D, and protein are vital for developing dense and resilient bones [2].

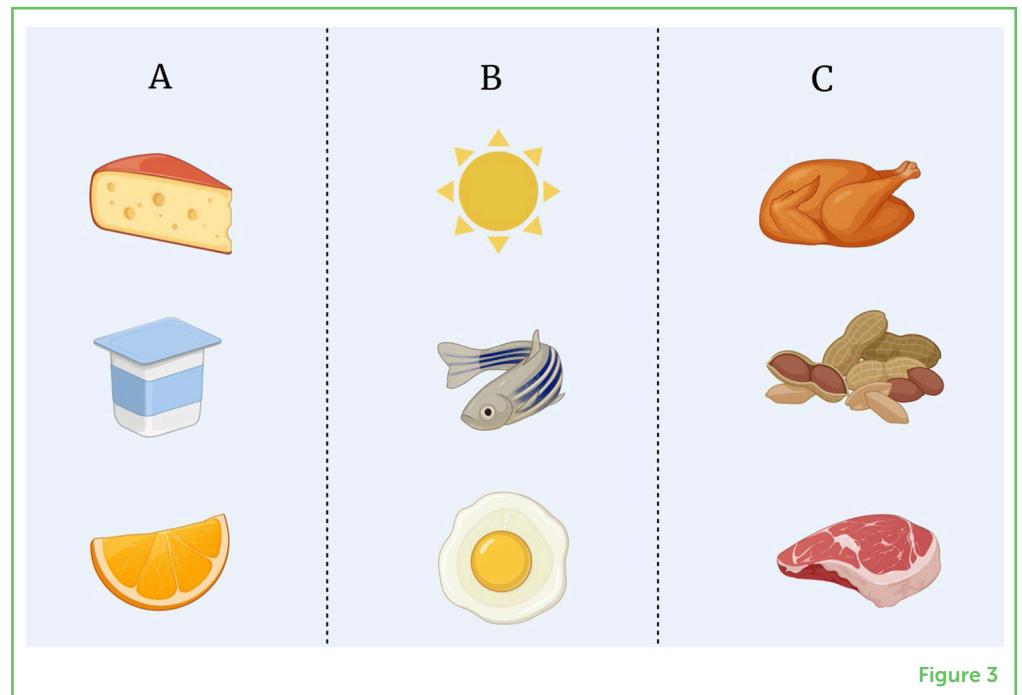
Calcium is one of the most important nutrients for bone health because, combined with phosphorus, it is the mineral that makes up ~65% of bone tissue [5]. So, calcium helps build **bone density**, which makes our bones stronger and less likely to break. Dairy products such as milk, cheese, and yogurt are excellent sources of calcium. Research studies have shown that kids and teens who consume plenty of dairy products have higher bone density and growth [5]. But dairy is not the only source of calcium. Foods like leafy green vegetables, almonds, orange juice, and lentils also provide the calcium our bones need (Figure 3). Including these foods in our diets helps ensure that we get enough calcium to support healthy bone development. The recommended daily intake of calcium is 700 mg for children aged 1–3, 1,000 mg for children aged 4–8, and 1,300 mg for children aged 9–18 (<https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/dietary-reference-intakes/tables/reference-values-elements.html>).

Vitamin D is another important nutrient important for bone health because it helps our bodies absorb the calcium from the foods we eat [2]. Without enough vitamin D, even a calcium-rich diet would not be effective. We can get vitamin D from sunlight, fatty fish, and egg yolks (Figure 3). Spending some time outdoors each day and eating a balanced diet helps maintain healthy vitamin D levels. The recommended daily intake for vitamin D is 400–1,000 International Units (<https://www.healthandbone.ca/en/living-with-osteoporosis/nutrition/>).

Finally, protein is also important for our bones' health because proteins are the building blocks of the body. Both meat and plant-based proteins support bone health by aiding in bone growth and repair. Research shows that getting enough protein is particularly crucial for boys and girls just before puberty, as it influences overall bone

Figure 3

Foods for strong bones are those that include **(A)** calcium, **(B)** vitamin D, and **(C)** protein.

**Figure 3**

strength [2]. Eating a variety and adequate amount of protein sources rich in calcium and vitamin D, such as meat, beans, nuts, and tofu, contributes to healthier bones (Figure 3). The recommended daily intake for and protein is 1.05 g/kg/day for children aged 1–3, 0.95 g/kg/day for children aged 4–13, and 0.85 g/kg/day for children aged 14–18 (<https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/dietary-reference-intakes/tables/reference-values-macronutrients.html>).

CONCLUSION: COMBINING EXERCISE AND NUTRITION

In conclusion, building strong bones during childhood and adolescence is crucial for long-term health, and it requires a combination of regular exercise and proper nutrition. Regular exercise, particularly weight-bearing and muscle-strengthening activities such as walking, running, jumping, and resistance training, is equally important for bone health. A balanced diet rich in calcium, vitamin D, and protein plays a vital role in developing dense and resilient bones.

Therefore, for optimal bone health and growth, children should engage in regular physical activity and maintain a nutritious diet. Parents can support their children by integrating these practices into daily life. Remember, the best time to build strong bones is during youth. By taking good care of your bones now, you ensure they will take good care of you throughout your life!

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YOUNG REVIEWERS

FILIP, AGE: 14

I am a successful football player, interested in sport, healthy diet and lifestyle. Maths/chemistry/physics are my good friends. In the future I will be professional footballer or sport related person.

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Melina is a high-performance tennis player and volunteer researcher at the Centre for Bone and Muscle Health at Brock University. Currently, she is working under the supervision of Dr. Panagiota (Nota) Klentrou in sports bioscience and exercise nutrition. Melina has a very strong interest in the biomedical field and the health sciences. She is also passionate about transmitting the value and importance of healthy lifestyle choices to young kids.

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