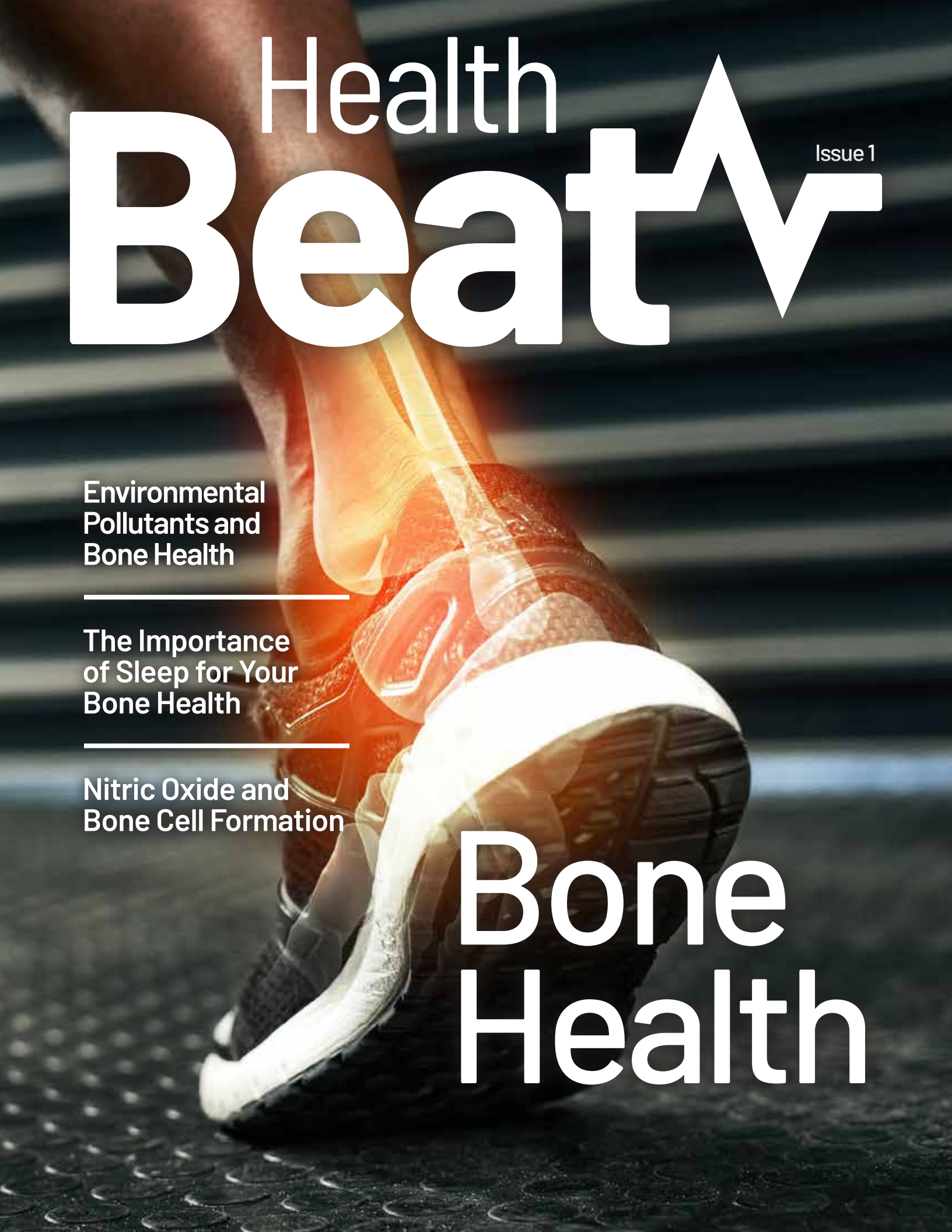
Health Beat

Issue 1



Environmental Pollutants and Bone Health

The Importance of Sleep for Your Bone Health

Nitric Oxide and Bone Cell Formation

Bone Health

Strontium Support II

Promotes healthy bone growth and supports bone mineral density.

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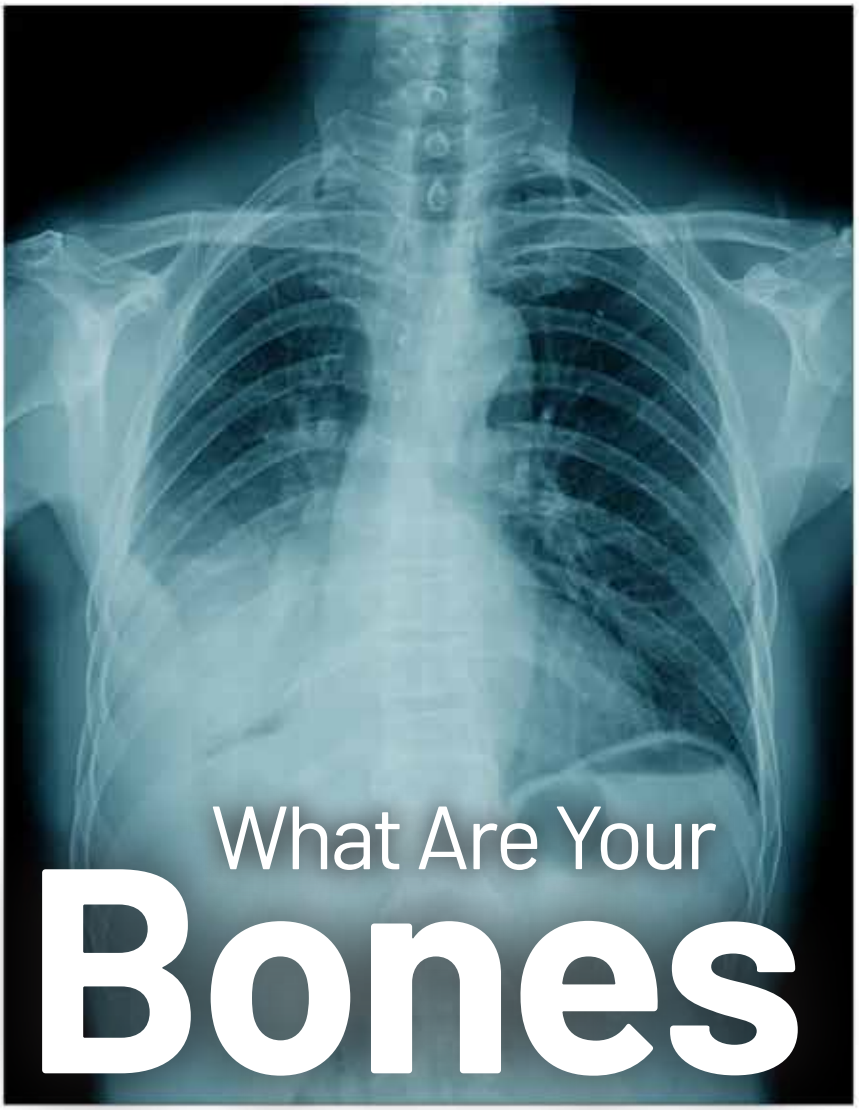
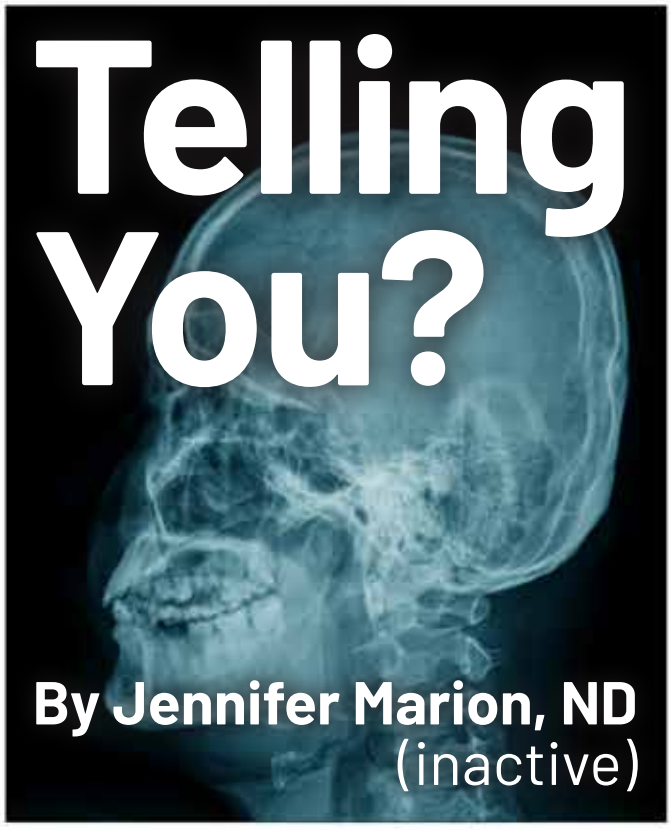


What Are Your

Bones

Telling You?



By Jennifer Marion, ND (inactive)

Have you found that you are breaking bones from minor bumps or falls, or has your doctor told you that your bone density is low?

There are several intrinsic and extrinsic factors that can lead to brittle bones. Brittle bones are also known as a disease called osteoporosis. The definition of osteoporosis is the "deterioration in bone mass and micro architecture, with increasing risk to fragility fractures." Below are some of the common reasons people develop brittle bones.

Aging

Within our bones there are cells called osteoblasts and osteoclasts. These cells exist in a delicate balance in the body. Osteoblasts are responsible for building bone and osteoclasts are responsible for resorption of bone. Interestingly, the adult human skeleton fully regenerates, or remodels, itself every ten years. Around middle age, the balance of osteoblast and osteoclast activity begins to shift towards greater osteoclast activity leading to a reduction in bone mass. Bone deteriorates in composition, structure, and function, which can predispose an individual to osteoporosis.

Lifestyle

Diet

Diet and lifestyle are very important for bone health. A diet that is lacking in vitamins and minerals can lead to brittle bones. Calcium and magnesium are two very important minerals for bone health. Below are some examples of foods that contain high amounts of these minerals. Though we can get some of these nutrients from food, since the soil the food is grown in is now unfortunately depleted of minerals, it often becomes necessary to supplement to reach an adequate daily intake.

Calcium Rich Foods:

- Green leafy vegetables
- Seeds (like chia or sesame seeds)
- Beans
- Nuts (particularly almonds)
- Dairy (if you can tolerate it)

Magnesium Rich Foods:

- Seeds (pumpkin)
- Spinach
- Nuts (almonds, peanuts, cashews)
- Beans
- Dark Chocolate

Vitamin D is also very important for bone health. Vitamin D is required for the body to absorb calcium. Most people who live in countries that experience cold and dark winters should supplement with Vitamin D, due to the lack of sun exposure.

Exercise
Another lifestyle factor that is extremely important for bone health is exercise. Peak bone mass is built during youth, and this is one of the reasons it is very important for children to be involved in regular exercise. Weight bearing activities build strong bones. Some examples of good bone building activities are running, tennis, skipping, walking, hiking, and dancing. These types of activities not only build stronger bones, but they also improve coordination and muscle tone, which can help to prevent falls. Though, our peak bone mass is reached in one's youth, it is never too late to start exercising for bone health.

Alcohol and Smoking
Both alcohol and smoking reduce bone density, as well as increase the amount of time it takes for fractures to heal.

Medical Conditions

Poor Nutrient Absorption
There are several medical conditions that can impact bone health. In conditions like Crohn's, colitis, or celiac disease there is damage to the intestinal lining, which can result in poor nutrient absorption and ultimately bones not getting the nutrients they require. In conditions like anorexia and bulimia, there is also a lack of nutrients absorption. We also see a similar outcome with weight loss procedures, like gastric bypass surgery.

Rheumatoid Arthritis (RA)
RA is an autoimmune condition that causes inflammation, pain, and loss of joint function. In this condition it has been found that there is increased osteoclast activity at the affected sites. Further, this condition is often treated with prednisone (a glucocorticoid) which is known to increase the risk of osteoporosis.

Chronic Liver Disease
In chronic liver disease there is often a Vitamin D deficiency as well as reduced bone formation. These individuals also have low sex hormones (correlated osteoporosis). 50% of those with chronic liver disease will develop osteoporosis.

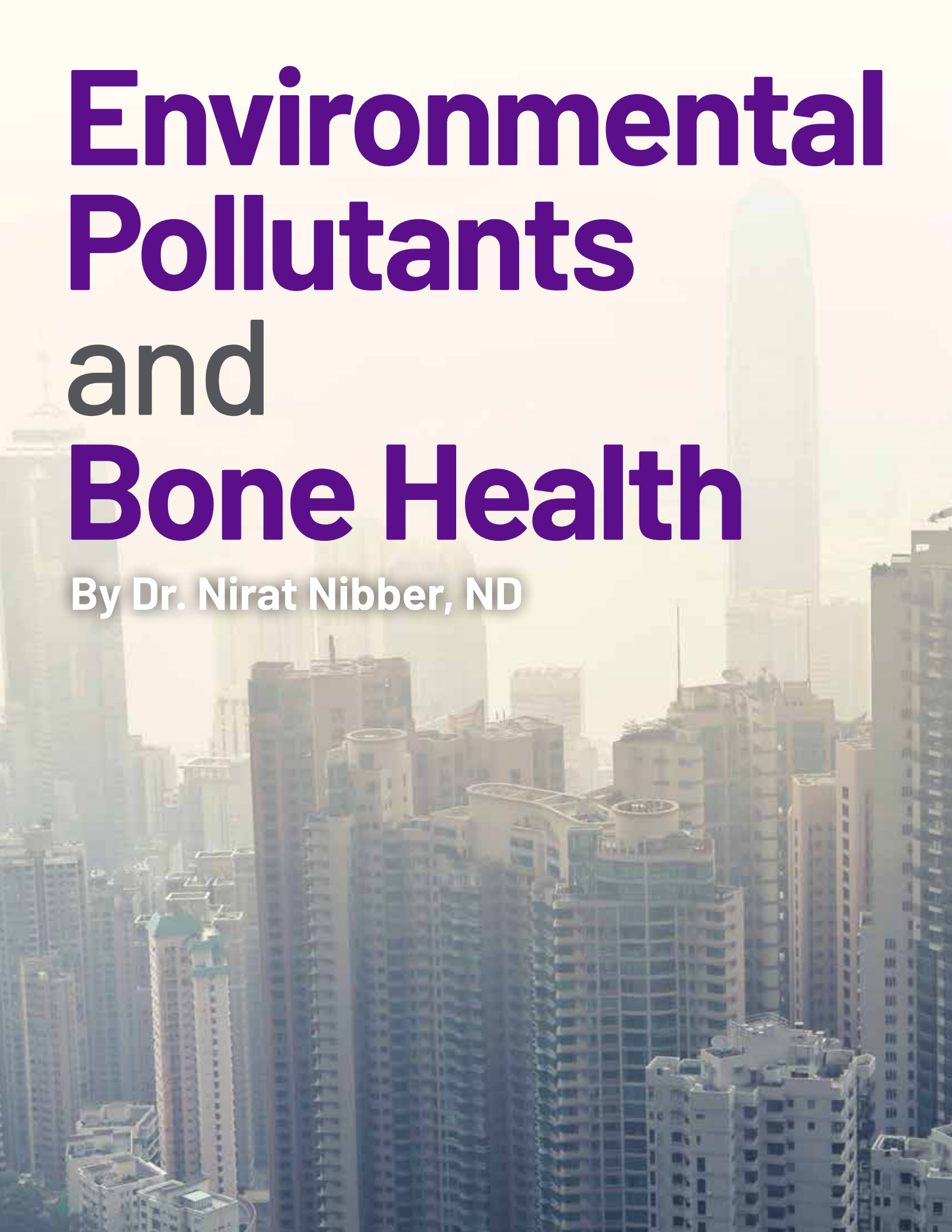
Sex Hormone Deficiency
There are many reasons for low sex hormones, but regardless of the cause, there can often be an impact on bone density. Some of the common causes of low sex hormones are premature menopause, anorexia or exercise induced amenorrhea (often seen in elite athletes with very low body fat) and pituitary disease.

Primary Hyperparathyroidism
The parathyroid gland is found in the neck and its main function is to control blood calcium levels. In hyperparathyroidism, extra parathyroid hormone is released which activates osteoclast activity and results in increased bone turnover, as well as the inhibition of osteoblast activity, which ultimately leads to an increased risk of osteoporosis.

As we have discussed, there are many reasons one might notice that his or her bones are becoming brittle or more easily fractured. If this is a concern, it is important to speak with a medical professional to ensure that the bone loss is not a sign of a more serious illness. Once something more serious has been ruled out, there are still things that can be done to maintain healthy bones as long as possible, like choosing a healthy diet, exercising regularly, quitting smoking and reducing alcohol consumption. Ultimately, the best thing that can be done is to start thinking about your bones in your youth and giving them everything they need to be as strong as they can be.

Environmental Pollutants and Bone Health

By Dr. Nirat Nibber, ND



Pollution is the term we give to harmful agents that are introduced to our environment and produce a negative effect. These can be from a natural disaster, human activity, or both. While there are many different types of pollution and classes of pollutants, they generally upset the ecosystem they are released into. An environmental pollutant is linked back to human activity that caused the release of chemicals which we are then re-exposed to. The effect that humans have had on nature is fast becoming the most important issue of our time and putting into context how that affects our health is important to changing some of these behaviours and practices. We will be focusing specifically what and how toxins and pollutants are harming bones and what preventative options you can take.

Let's start by reviewing some of the basics of bone health. Our bones are complex and dynamic organs- you read that right- bones are ORGANS. Bones have several very important functions. The most obvious being that they give our bodies structure and protection of other organs, so we don't exist as blobs. They also store minerals and house precious bone marrow. They are composed of a hard, compact outer layer (helpful for moving and when getting hit by things) and a spongey bone that surrounds an internal compartment which houses bone marrow. Bone marrow is composed of precious stem cells which can develop into several cell lines. Suffice to say its important and we must protect it!

Much like a house renovation, bones are constantly undergoing remodeling. There are lots of signals that can turn on the bone growth process, stop, slow, or break down (called bone resorption). These signals can be hormonal, such as in puberty and menopause, they can be from a blunt force, and it can be influenced by how much calcium and other minerals are floating around in your body. During periods of high cell turnover such as fetal development, puberty, pregnancy, or menopause bones are most susceptible to the triggers that increase or decrease bone growth.

The worker cells, the osteoblasts and the osteoclasts, are always on high alert and are particularly sensitive to chemical compounds. That can get complicated considering how many chemicals we are exposed to through our clothes, our self-care products, diet, and even from the air we breathe. Sometimes these components are in very miniscule doses and our body can process and excrete them before any damage to bone is done. However, some of these chemicals can build up over time or may hit you when you are most vulnerable and have long-lasting impacts.

Generally, air pollution consists of some debris, water and a mixture of particulate matter that forms a smog. The distribution of air pollution is highly variable across the globe. As anyone who has been stuck in a traffic jam for hours can attest - poor air quality can make you feel downright rotten. In 2020 researchers defined four mechanisms as to why air pollution makes us sick.

1. Chemicals cause a low-grade systemic inflammation, blocking bone metabolism
2. Certain gas and metal compounds damage the airway and bone cells
3. Endocrine disruptors alter the hormonal regulation of bone functioning
4. Air pollution can directly and indirectly cause vitamin D deficiency

Let's investigate the biggest environmental pollutants that have demonstrated a negative impact on bone health.

Metals

While naturally occurring, the accumulation of heavy metals has systemic impacts from cognitive dysfunction to hormonal and developmental abnormalities. Sources of exposure may be related to exhaust from automobiles, paints, and industrial processes.

Cadmium (Cd): this heavy metal is found in low levels in nature but is used in many industrial processes. Cadmium is used in cadmium-nickel batteries, for pigments in paint production, and is released during soldering and welding. It enters the food chain in larger quantities than normal due to fossil fuel use, metal combustion, and burning of wastes, all of which have led to elevated levels. In the 1960's epidemiologists began to correlate kidney and bone dysfunctions to elevated levels of Cd exposure and since then more studies have outlined this relationship. The very long half-life (10-30 years) also contributes to difficulties in predicting complications from exposure. Researchers also found that even with low level exposure bone mineral density was decreased with greater risk for osteoporosis in human and animal models, further chronic exposure appears to negatively impact pulmonary and kidney function.

Lead (Pb): accumulates in the bones blocking other minerals (specifically calcium) from being absorbed and deposited. In fact, several studies link Pb exposure to lower bone mineral density (BMD) and higher accumulation of lead was seen in osteoporosis.

Mercury (Hb): poisoning, often occurring from fish sources as methylmercury, decreases two indicators of osteoclastic and osteoblastic activity damaging bone by increasing oxidative stress and the alteration of the estrogenic signaling.

Tin (Sn): is used as an antifouling paint for ships and fishing nets leading to contamination of marine areas. Like mercury, tin accumulates in fish and can cause toxicity in humans relating to developmental delays and skeletal damage.

Endocrine Disruptor Chemicals (EDC's)

EDC's are a class of chemicals that have known impacts on the hormonal regulation of bone growth and remodeling. These chemicals all share similar structure to bone regulatory hormones and appear to have dose dependent relationships and specifically regulate osteoblast and osteoclast function. Further, prenatal and postnatal periods of bone development appear to be most dramatically impacted by EDC's.

Alkylphenol Ethoxylates (APEs): are chemicals used during manufacturing of plastics, detergents, paints, and pesticides. APE's reduce bone volume by depressing critical factors involved in osteoblasts and osteoclasts cell development.

Bisphenol A (BPA): possibly the most notorious of the EDC's, BPA is found in many plastic products and extensively used in the food packaging industry. It is considered a harmful estrogen mimic (known as xenoestrogen) because it binds much more strongly to the estrogen receptor. While natural estrogen has a protective effect, hyperactivation of the estrogen receptors with BPA is not protective and adversely impacts bone development.

Polychlorinated Biphenyls (PCBs): are widely used as diluents, flame retardants, fluids for capacitors and transformers and depending on the individual can be estrogenic or anti-estrogenic Exposure was related to delayed sexual maturation in adolescents living in areas contaminated by PCBs and dioxins likely due to reduced thyroid hormone and vitamin D levels. PCB's are particularly harmful for adolescents where they were shown to bioaccumulate in tissue and have longer lasting impacts. Particularly concerning as puberty is a vulnerable time for bone development.

Phthalate Esters: are used in the production of polyvinyl chloride (PVC) and building materials and have been found at low levels in food. They were shown to have a dose-dependent fetal toxicity that caused severe skeletal malformations and imbalance of bone homeostasis.

Polycyclic Aromatic Hydrocarbons (PAHs): are often the most common component of environment air pollution and result from the incomplete combustion of fossil fuels, wildfires, and cigarette smoke. Particularly concerning during wildfire season, these chemicals are often part of why individuals are recommended to stay indoors. PAH's prevent you from properly depositing the minerals onto bone thus making them weaker and more brittle.

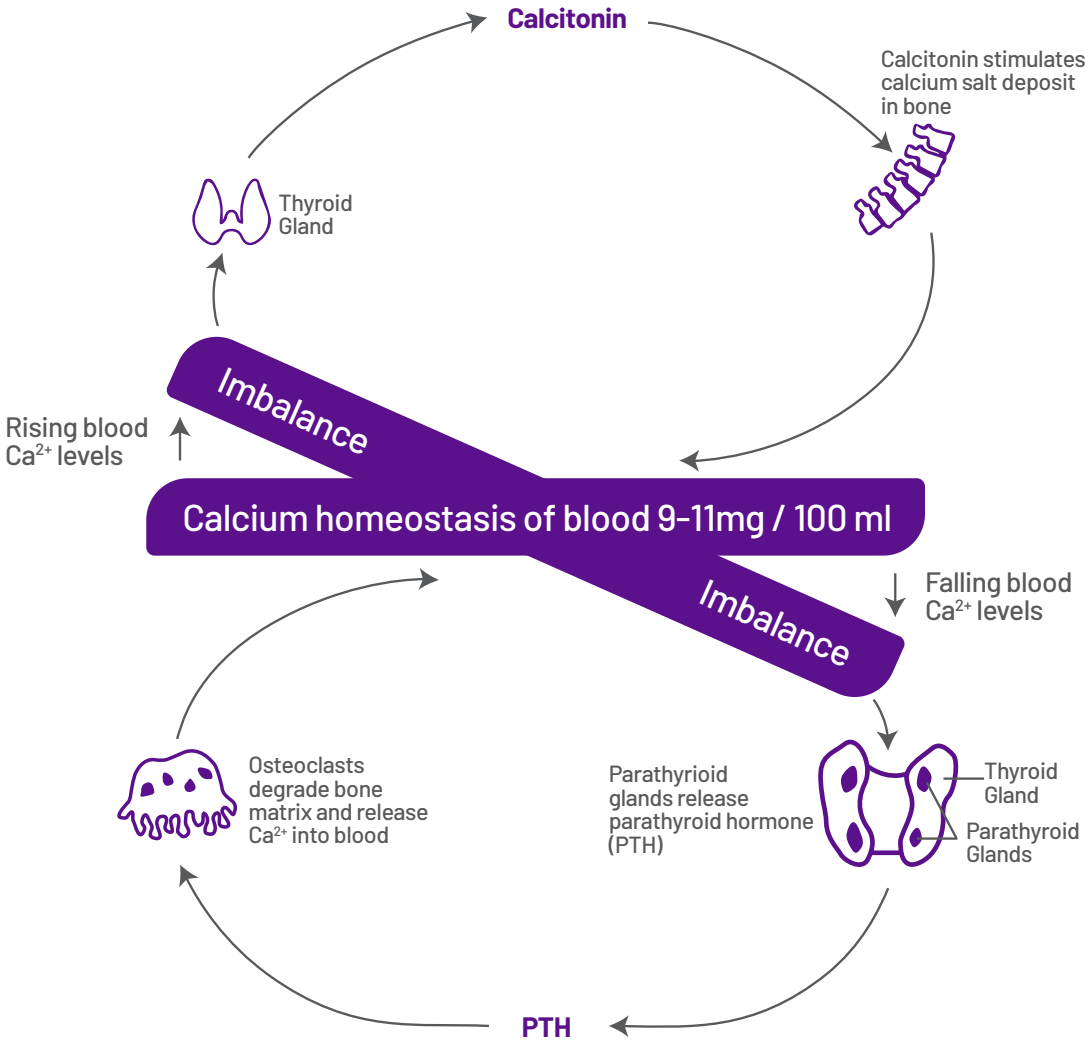
The Regulators

Parathyroid Hormone (PTH): released by the four parathyroid glands, PTH responds to low levels of blood calcium, and will stimulate degradation of the bone matrix to release more calcium into the blood.

Calcitonin: elevated blood calcium levels signal the thyroid to release calcitonin, which then stimulates calcium deposition onto bone.

Sex Steroid Effect: Sex hormones such as estrogen and androgens (testosterone and DHEA) are important regulators in bone health. Estrogen and testosterone from the gonads inhibit bone remodeling through a number of complex mechanisms.

Hormonal Mimetics: These molecules look an awful lot like hormones and can even bind to and activate the same receptors. This can be helpful or not, improving the hormonal response, blocking the receptors, or sometimes backfiring by causing a response without the proper environmental cues.



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A to Z of Healthy Bones

By Chantal Ann Dumas, ND

A good night sleep is not only an important component of our quality of life but also necessary for our physical and mental health.[1] Unfortunately, insufficient sleep has become a pervasive and prominent problem in our modern, 24 hour society. According to the Center for Disease Control and Prevention (CDC), sleep disorders are so prevalent in the United States that they are now considered a public health epidemic.[2] Short sleep duration has been associated with adverse health conditions. For example, in a recent prospective, population based cohort study involving 52,599 Chinese adults, sleep duration trajectories with lower or unstable patterns were significantly associated with increased risk of cardiovascular events and mortality.[3] Although the negative impacts of sleep duration or disturbances on our overall health are well-documented, the association between sleep and bone health is not as well-known. Thankfully, recent studies are shedding light on this important topic.

The Process of Bone Remodeling

Bone remodeling occurs throughout life as a tightly regulated process that balances bone resorption performed by cells called osteoclasts, and bone formation performed by osteoblasts. Bone turnover serves to regulate calcium balance to repair micro lesions sustained during normal daily activities and to heal fractures. An imbalance between bone resorption and formation results in fragile bones (osteoporosis) and an increased risk of fracture. The imbalance occurs with different factors including aging, sex hormone deficiency, or use of medications that alter bone metabolism (e.g., glucocorticoids).[4] New evidence suggests that both sleep duration and timing may be important for optimal bone health as well.

The Impact of Shorter Sleep Duration

A study published in The Journal of Bone and Mineral Research in 2020, the researchers tested the associations of usual sleep behavior and bone mineral density (BMD) and osteoporosis. In a sample of 11,084 postmenopausal women from the Women's Health Initiative, they performed a cross-sectional study of the association of self-reported usual hours of sleep and sleep quality with BMD in four sites (whole body, total hip, femoral neck, and spine), bone mass, and

osteoporosis. After adjustments were made for various variables such as race, menopausal symptoms, smoking, physical activity, sleep medication use, etc., the researchers found that women who reported sleeping five hours or less per night had a significantly lower BMD at all four sites compared with women who reported sleeping seven hours per night. They also had higher odds of low bone mass and osteoporosis of the hip and spine.[5]

Not Just How Much, but When

The timing and duration of sleep are influenced by environmental factors such as light/dark cycles, work schedules, duration of prior wakefulness as well as by our internal, biological timing (circadian cycle). Disturbances in the timing and duration of sleep have the potential to disrupt the rhythmicity of bone turnover markers (BTMs), the balance between bone resorption and formation, and consequently bone mass/quality and fracture risk.[6] Epidemiological studies demonstrate that night-shift work, which causes both circadian misalignment and sleep disruption, is associated with lower BMD and increased fracture risk.[7] The famous Nurse's Health Study published in Osteoporosis International in 2009 involving 38,062 postmenopausal nurses working full or part time on rotating nightshift work was the first to address this question, adding to the growing list of ailments that have been associated with shift work. The study revealed that over 20 years of nightshift work was associated with a significantly increased risk of wrist and hip fractures over eight years of follow-up compared with women who never worked night shifts. The risk was strongest among women with a lower body mass index (<24) who never used hormone replacement therapy.[8]

So, What is the Connection?

The exact mechanisms by which sleep duration affects bone metabolism and bone density have not been identified yet. Possible mechanisms proposed include alterations in the normal rhythmicity of bone cells, hormone levels (e.g., sex steroids, cortisol), increases in sympathetic activity, metabolic derangements, or fatigue/physical inactivity.[9] The role of the central nervous system in regulating bone metabolism may be particularly important in the skeletal effects of disrupted sleep because of the sympathetic nervous system (SNS) activation associated with sleep and circadian disruption. The SNS can influence bone cell clock genes and negatively impact bone metabolism through a complex network. Inflammation could be another culprit. Studies indicate that both acute total and short-term partial sleep deprivation resulted in elevated high-sensitivity C-reactive protein concentrations, a stable marker of inflammation.[10] According to another study published in Osteoporosis International, persistently elevated CRP seem to be detrimental to bone health and may be associated with a higher rate of bone loss.

Conclusion

Regardless of the precise mechanisms, we know that the timing and duration of sleep play an important and often overlooked role in bone health. Given the prevalence of sleep disturbances and the high incidence of osteoporosis and other bone ailments in the Western world, a greater emphasis should be placed on the importance of a good night sleep to preserve healthy bones. Besides a healthy lifestyle and a proper diet providing enough proteins, targeted nutritional supplements might help improve the quality and quantity of sleep. A good quality B Complex vitamin, in their bioactive forms, and a magnesium formula will act as cofactors in the production of melatonin, the sleep hormone. Moreover, these supplements are also involved in supporting bone health. Melatonin might also be used as a safe nutritional supplement to improve both bone density and sleep quality.[12]

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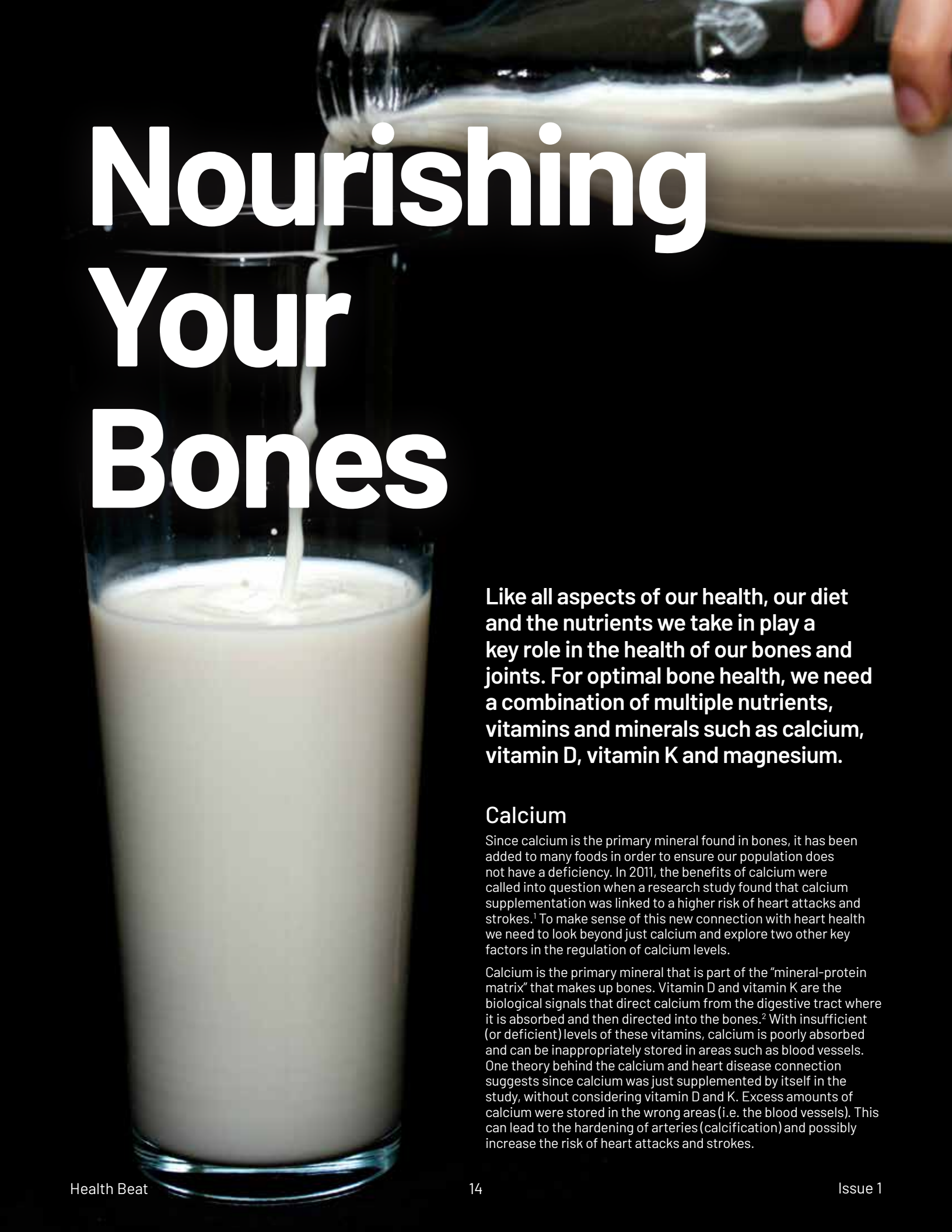

Nourishing Your Bones

Like all aspects of our health, our diet and the nutrients we take in play a key role in the health of our bones and joints. For optimal bone health, we need a combination of multiple nutrients, vitamins and minerals such as calcium, vitamin D, vitamin K and magnesium.

Calcium

Since calcium is the primary mineral found in bones, it has been added to many foods in order to ensure our population does not have a deficiency. In 2011, the benefits of calcium were called into question when a research study found that calcium supplementation was linked to a higher risk of heart attacks and strokes.[1] To make sense of this new connection with heart health we need to look beyond just calcium and explore two other key factors in the regulation of calcium levels.

Calcium is the primary mineral that is part of the "mineral-protein matrix" that makes up bones. Vitamin D and vitamin K are the biological signals that direct calcium from the digestive tract where it is absorbed and then directed into the bones.[2] With insufficient (or deficient) levels of these vitamins, calcium is poorly absorbed and can be inappropriately stored in areas such as blood vessels. One theory behind the calcium and heart disease connection suggests since calcium was just supplemented by itself in the study, without considering vitamin D and K. Excess amounts of calcium were stored in the wrong areas (i.e. the blood vessels). This can lead to the hardening of arteries (calcification) and possibly increase the risk of heart attacks and strokes.

Vitamin D

Vitamin D plays a critical role in controlling calcium and phosphate levels. If these levels are not adequately controlled, bone conditions such as rickets in children or osteoporosis in adults may occur.[3] Though foods containing vitamin D are limited, some to consider including in your diet would be salmon, dark colored mushrooms, eggs and enriched milk products, in addition to sun exposure. For those of us living in the northern hemisphere, limited sun exposure means no vitamin D is produced in skin from November to April.[4]

Vitamin K

While the connection between vitamin D and calcium levels for bone health is well known, the relationship of vitamin K and calcium is newer. One of the main biological roles of vitamin K is that it is responsible for a process called carboxylation. This process is essential for proteins to become activated. In relation to bone health, vitamin K regulates osteocalcin, a protein important for bone mineralization.[5,6]

Magnesium

Magnesium is important in reducing the risk of bone fractures and osteoporosis. Research has found that both excess magnesium and deficiencies have harmful effects on the bones. Magnesium deficiency contributes to osteoporosis directly by acting on crystal formation and on bone cells and indirectly by impacting on the secretion and the activity of parathyroid hormone and by promoting low grade inflammation.[7]

Essential Fatty Acids

Beyond the aforementioned vitamins and minerals, emerging clinical and molecular evidence suggests that inflammation also exerts significant influence on bone turnover, inducing osteoporosis. Essential fatty acids are known to be helpful in fighting inflammation. This is one of the many health benefits of the Mediterranean diet along with weight loss, heart and brain health, cancer prevention, and diabetes prevention and control. A recent long-term, pan-European clinical trial has indicated that sticking to a diet rich in fruit, vegetables, nuts, unrefined cereals, olive oil and fish can reduce hip bone loss within just 12 months in those with osteoporosis.[8]

Protein

Bone mineral density (BMD), which is an important determinant of bone strength, appears to be positively associated with dietary protein intakes. Additionally, hip fracture risk is modestly decreased with higher dietary protein intakes, provided calcium intakes are adequate, and is needed for optimal bone growth in children and the maintenance of healthy bone at all ages. Protein and calcium combined in dairy products have been shown to have beneficial effects on calciotropic hormones, bone turnover markers and BMD.[9]

Polyphenols

Polyphenols are antioxidants that may help to reduce joint inflammation and slow the breakdown of cartilage. They may also improve bone strength and help the body fight off infections, which may be helpful for patients with rheumatoid arthritis. Researchers in Hong Kong have recently reported new evidence that the polyphenols found in green tea, epigallocatechin (EGC), gallocatechin (GC), and gallocatechin gallate (GCG), boosted the activity of a key enzyme that promotes bone growth by up to 79%.[10]

Learning about the foods that are rich in calcium, vitamin D and other nutrients that are important for your bone health and overall health will help you make healthier food choices every day. If you eat a well-balanced diet with plenty of protein, nuts and seeds, fruits and vegetables, you should get enough of the nutrients you need every day. In the event that you're not getting the recommended amount from food alone, you may want to consider supplementing your diet with high quality nutraceuticals.

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Steak and Broccoli

As we age our natural supply of collagen begins to decline. What better way to naturally promote your bodies collagen production then with this tasty "beef and broccoli" recipe? A simple recipe you can pop in the slow cooker and forget about, rich in collagen boosting ingredients like bone broth and broccoli, that tastes great.

Ingredients:

2 lbs steak, thinly sliced

2 cups bone broth

½ cup low sodium soy sauce

1/3 cup brown sugar

1 ½ tbsp minced garlic

1 tbsp sesame oil

2 tbsp cornstarch

1 head broccoli, chopped

2 cups quinoa

Directions

1. Mix the bone broth, soy sauce, brown sugar, garlic and sesame oil in large bowl.
2. Place the steak inside slow cooker, then pour the mixed contents overtop. Cook on a low temperature for six hours.
3. Once steak is cooked, remove one cup of the sauce and mix in cornstarch. Stir a few times before placing the contents back into the pot to cook for another half an hour.
4. While sauce is thickening, cook your quinoa according to package directions and steam the broccoli. Plate the quinoa, broccoli and then pour the steak overtop.

Did you know both broth contains calcium, magnesium, phosphorous, collagen, glucosamine, chondroitin, amino acids, and many other nutrients that support healthy bones and joints?

Grilled Salmon with Sweet Potato Wedges and Sautéed Spinach

Incorporating more collagen boosting foods into your diet can be easy and delicious. This simple dinner includes grilled salmon, sweet potato wedges and a side of spinach sautéed with garlic and lemon. All these ingredients are nutrient rich and contribute to your body's production of collagen. This meal serves six.

Salmon

Ingredients

1½ lbs salmon fillets

6 cloves garlic, chopped (divide and use the rest to sauté the spinach)

2 tbsp olive oil

3 lemons, sliced (divide and use in spinach)

Lemon pepper and salt to taste

Directions

1. Season salmon fillets with lemon pepper, garlic and salt.
2. Preheat grill to medium heat
3. Lightly oil grill grate. Place salmon and lemons on the preheated grill. Remove lemons once they have grill marks. Cook salmon for 6 to 8 minutes per side, or until the fish flakes easily with a fork.

Sweet Potato Wedges

Ingredients

3 large sweet potatoes, peeled, cut into 1x3-inch wedges

3 tbsp olive oil

½ tsp sea salt

½ tsp freshly ground black pepper

Directions

1. Position rack in upper third of oven and preheat oven to 425 degrees F. Spray baking sheet with non-stick spray.
2. Place sweet potatoes and olive oil in large bowl, toss lightly. Sprinkle with salt and pepper.
3. Arrange potatoes in a single layer on prepared baking sheet, being sure not to overcrowd.
4. Bake until tender and golden brown, turning occasionally. Cooking time is 18 to 24 minutes.

Sauteed Spinach

Ingredients

3 (10 oz) bags fresh spinach

2 tbsp olive oil

Remaining chopped garlic

Remaining grilled lemons

Salt and pepper to taste

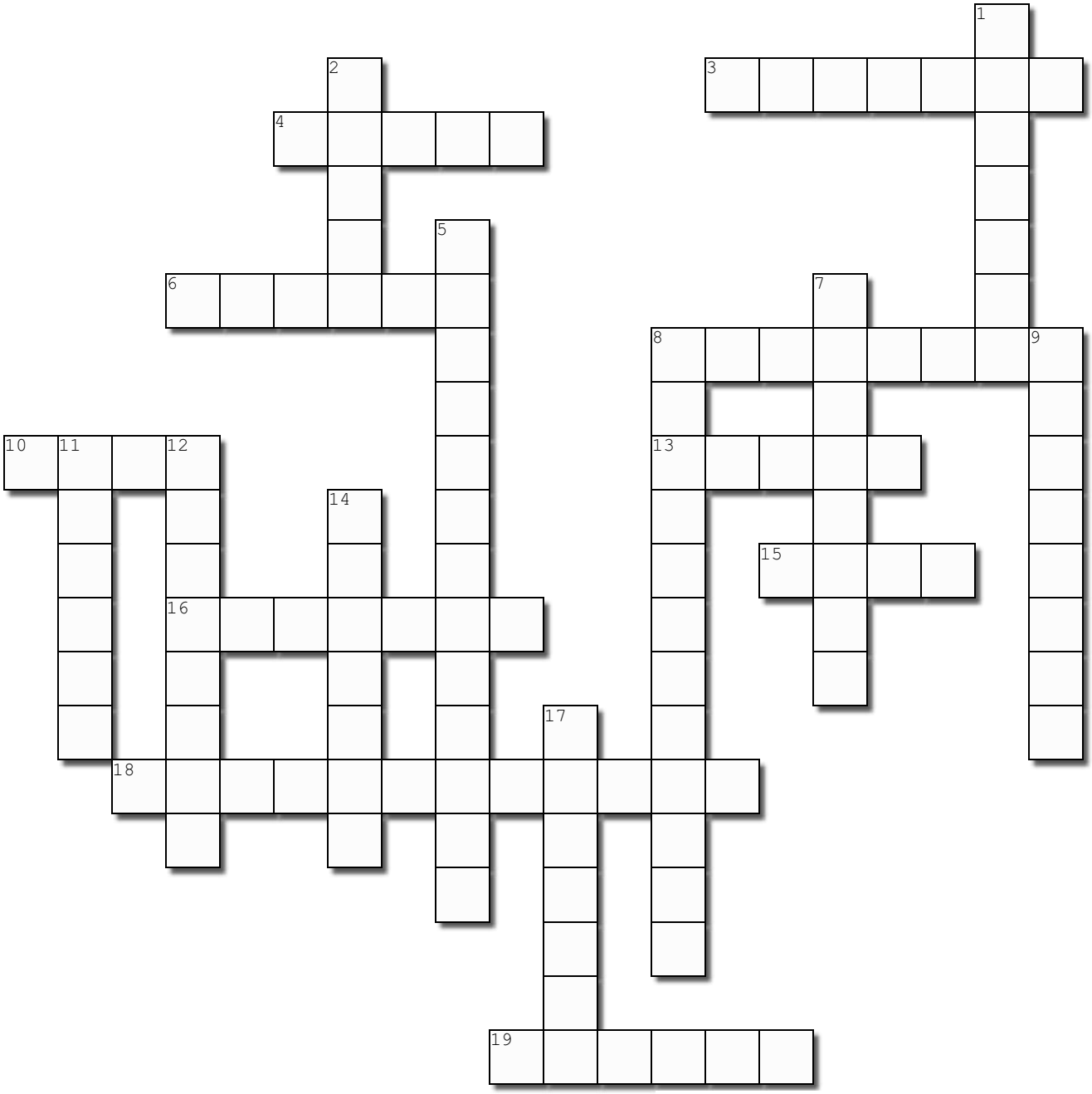
Directions

1. Position rack in upper third of oven and preheat oven to 425 degrees F. Spray baking sheet with non-stick spray.
2. Place sweet potatoes and olive oil in large bowl, toss lightly. Sprinkle with salt and pepper.
3. Arrange potatoes in a single layer on prepared baking sheet, being sure not to overcrowd.
4. Bake until tender and golden brown, turning occasionally. Cooking time is 18 to 24 minutes.

Did you know spinach belongs to the amaranth family and is related to beets and quinoa? It also is high in insoluble fibre along with vitamins A, C, K1, B9, iron, magnesium and calcium.

Bone and Joint Health

Crossword Puzzle



Use your bone and joint health knowledge to complete the crossword puzzle below. When you're finished, check your answers with the key on page 25.

Across

3. Good _____ helps guard your hip joints and back muscles.
4. Osteoarthritis (OA) is the most common _____ disorder.
6. Women have less bone _____ than men which puts them at a higher risk of developing osteoporosis.
8. Causes of OA include fractures or other joint _____, overuse and family history.
10. Most people reach their peak bone _____ around age 30.
13. Stronger abs and back muscles help you keep your balance and prevent _____ that can damage your joints.
15. Eating a well-balanced _____ is important for your bone, joint and muscle health.
16. Weight training exercises help keep your _____ and surrounding ligaments strong
18. Research suggests vitamin C and other _____ can help keep your joints healthy
19. Yoga and Pilates are low _____ exercises that are excellent for core-strengthening which protects us against falls.

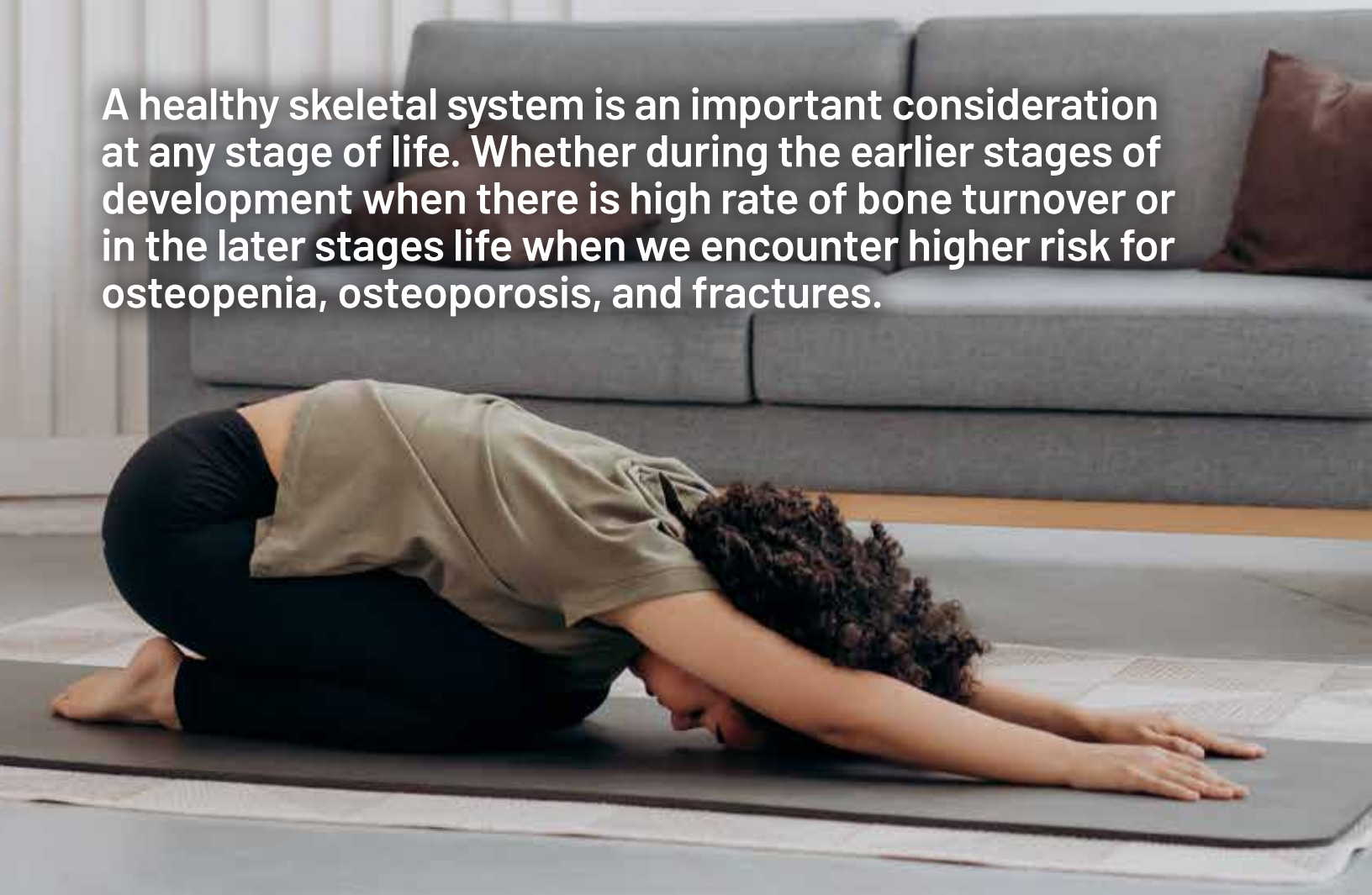
Down

1. Osteoporosis is a disease in which bones become _____ and more likely to fracture.
2. The human body has more than 200 _____
5. Strengthening muscles around _____ joints can help to prevent OA
7. Physical activity, especially weight bearing activity, is important in _____ and maintaining strong bones.
8. Omega-3 fatty acids may be helpful for reducing the _____ of rheumatoid arthritis.
9. Bursitis is the _____ and irritation of a bursa, which cushions the joints
11. Vitamin D helps your body _____ calcium from the foods you eat.
12. Low-impact exercises such as _____ or cycling are good for sore joints
14. Tobacco and excessive _____ consumption can lead to bone density loss.
17. Make sure you get enough _____ every day from foods like milk, yogurt, broccoli, kale, figs and some fortified foods

Exercising Your Bones

By Muzammal Chaudhry, MD, ND

A healthy skeletal system is an important consideration at any stage of life. Whether during the earlier stages of development when there is high rate of bone turnover or in the later stages life when we encounter higher risk for osteopenia, osteoporosis, and fractures.



The skeletal system is a living system. It consists of osteocytes, a dense matrix of minerals, connective tissue, networks of nerves and blood vessels. The skeletal system is constantly being remodelled. The physiological process of bone remodeling is a fine and intricate system dependant on the osteoclastic and osteoblastic activity. Osteoclastic activity breaks down bone, predominates in the later stages of our life, more prevalent in conditions such as osteopenia and osteoporosis. Osteoblastic activity which builds bone seen especially during periods of rapid growth such as during early childhood and more notably in adolescence.

Bone health is influenced by many factors such as hormones, medications, lifestyle choices – diet, physical activity, smoking and alcohol consumption. As a general prevention and optimizing bone health strategy it is important to focus of how to build and maintain bone mineral density in all spans of life. Lifestyle choices such as a balanced diet and regular exercise have positive effects in promoting healthy bones. Research suggests that 20-40% of adult peak bone mass is influenced by lifestyle choices.

There is a vast amount of research supporting different types of exercises to help build strong bones and other activities which help prevent bone loss. Considerable amount of research suggests that incorporating exercises that promote bone density before the adolescent growth spurt has a greater effect on building bone density. Load bearing exercises also known as strength building, or resistance training exercises have shown to increase bone density. Exercises like these put stress on the skeletal system stimulating osteoblastic activity to regenerate and build more dense bones. Peak bone density is typically reached by age 30. Once peak bone density is reached, bone mineral density slowly starts to decline with age.

A sedentary lifestyle leads to loss of muscle and bone mass; therefore, any physical activity is helpful in reducing the rate at which bone density is lost. To optimize bone health, we need to understand the type of movement that the skeletal system sees as a stimulus for maintaining bone mass and strength. The skeletal system responds to activities that are kinetic and have variation. Exercises like walking, jogging, playing tennis, and jumping all provide the mechanical strain to the skeleton which allow for remodeling of bones to help maintain the strength and integrity of the skeleton.

Emphasis on bone health is more often presented to the public at the later stages of life when we start seeing the decline in bone density and the rise in conditions such as osteopenia and osteoporosis. The risk of fracture in the elderly is much higher and can have more of debilitating outcomes for an individual. To help maintain bone health and prevent falls current guidelines from Osteoporosis Canada recommends four types of exercises especially for those with osteoporosis.

1. Strength Exercises: As we age, we lose muscle mass and strength. Muscles not only provide strength but also provide protection to our bones. Weight or resistance training two times a week, will help maintain and build stronger muscles and bones.
2. Postural Exercises: Promote better posture and stability. Choosing exercises that work out the flexors and extensors of the back and core is the aim in these types of exercises. These exercises will reduce the risk of injuries and improve muscle awareness.
3. Balance Exercises: Promote stability and help prevent falls by strengthening postural muscles that keep us upright and stable. Training these muscles will help with balance and coordination, by improving proprioception and spatial awareness. Examples include yoga, pilates, tai chi and using a bosu ball.
4. Aerobic Physical Activity: Helps promote strength and integrity of the bones. Aim for at least 150 mins a week.

Exercise is not only important for maintaining a healthy skeletal system, it also helps improve balance, coordination, increase muscle strength and not to mention the great benefits it can have on mood and the metabolic system.

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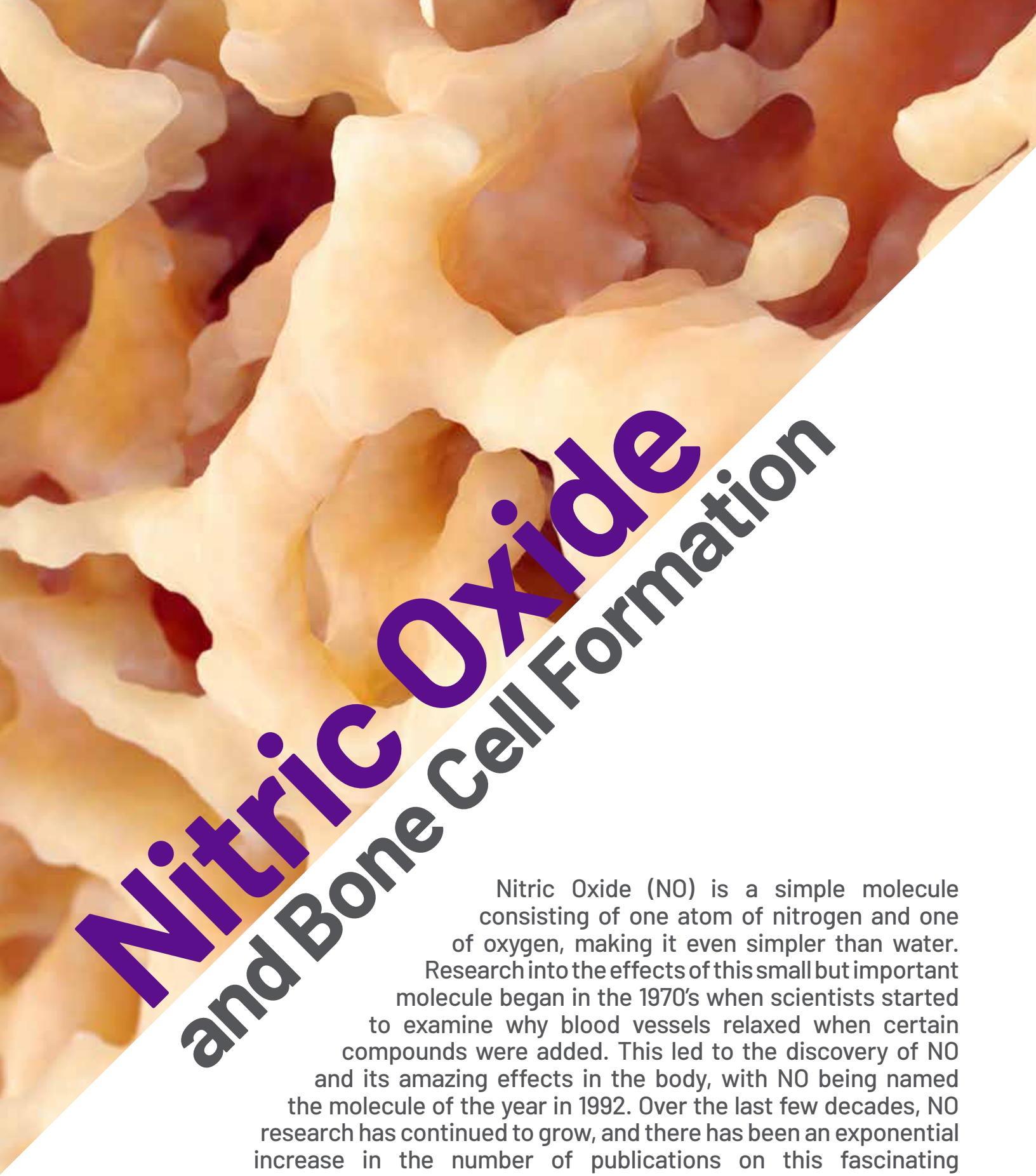
NOx Boost

Enhance your physical performance and improve your nitric oxide levels



Nitric Oxide and Bone Cell Formation

Nitric Oxide (NO) is a simple molecule consisting of one atom of nitrogen and one of oxygen, making it even simpler than water. Research into the effects of this small but important molecule began in the 1970's when scientists started to examine why blood vessels relaxed when certain compounds were added. This led to the discovery of NO and its amazing effects in the body, with NO being named the molecule of the year in 1992. Over the last few decades, NO research has continued to grow, and there has been an exponential increase in the number of publications on this fascinating molecule. Some health promoting effects of nitric oxide include increased circulation, lowered blood pressure, enhanced digestion, enhanced libido, improved immune system and stronger bones.

How NO is Produced in the Body?

The conventional method of NO synthesis is from the amino acid L-Arginine which is oxidized via a series of steps involving a family of enzymes called nitric oxide synthases (NOS). Normal oxygen conditions as well as a neutral to high (alkaline) pH level are required for the generation of NO in different tissues like the nerves or blood vessels. When these conditions are met the NOS-dependent conversion of L-Arginine occurs efficiently. Production of NO is the primary reason for the dietary intake of L-Arginine. However, under low oxygen conditions the conversion of L-Arginine to NO is severely limited. Low oxygen conditions can occur for a variety of reasons. For example, partial or complete blockage of a blood vessel, conditions of extreme physical exercise or high altitudes can all result in reduced blood flow and thus reduced oxygen delivery to the body's tissues and cells.

How Bone Remodeling Occurs

Bone is a complex tissue composed of several cell types which is continuously undergoing a process of renewal and repair termed 'bone remodeling'. The two major cell types responsible for bone remodeling are osteoclasts ("bone eaters"), which breakdown bone, and osteoblasts ("bone builders"), which form new bone. During the bone remodeling cycle, old or damaged bone is removed by osteoclasts, which secrete acid and enzymes that digest the bone onto the bone surface. Subsequently the osteoclasts migrate away from the area of bone undergoing resorption and die. They are replaced by osteoblasts, which lay down new bone matrix.

During bone formation, some osteoblasts become embedded within the bone matrix, and become osteocytes, a third cell type unique to bone. Osteocytes interconnect with one another and with cells on the bone surface via channels in the bone matrix. It is thought that osteocytes act as sensors of mechanical stress in the skeleton, by detecting and responding to changes in fluid flow which run through canaliculi in the bone. Bone remodeling is regulated by several systemic hormones, such as parathyroid hormone, vitamin D, sex hormones like estrogen, as well as by local factors including NO, lipids, growth factors and proteins.

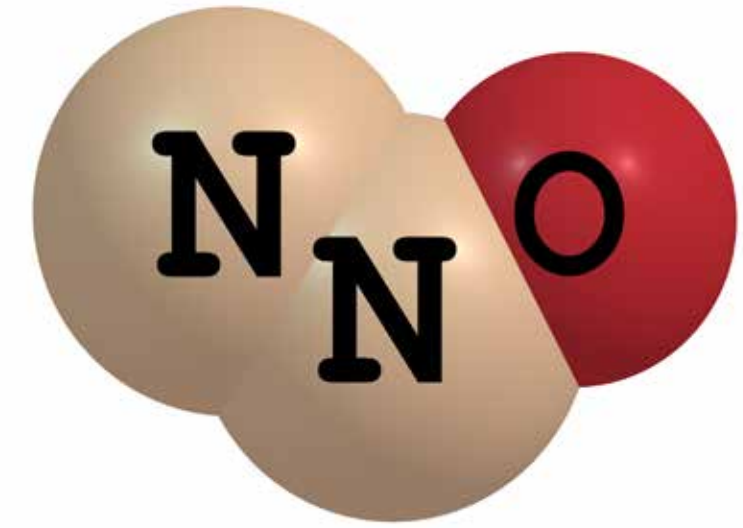
How is Nitric Oxide (NO) Involved in Bone Health?

Nitric oxide appears to have a two-fold effect on osteoblast activity. Studies have indicated that the small amounts of NO which are produced by osteoblasts may stimulate their own growth as well as the production of immune modulating proteins. Whilst some investigators have shown that slow-release NO donors stimulate osteoblast growth and differentiation, other reports show that NO donors and NOS (Nitric Oxide Synthase) inhibitors had little effect on osteoblast growth or differentiation, except at high concentrations where osteoblast growth seemed inhibited.

The most compelling evidence supporting a role for NO in osteoblast function comes from animal studies. Two groups of researchers have reported major defects in bone formation and osteoblast activity and a reduced growth response to administered estrogen in NO deficient animals. The molecular mechanisms responsible for this remain to be defined but indicate the existence of an important interaction between NO and the molecular pathways involved in osteoblast differentiation and function. In addition, a possible cause for the inhibition of osteoclast activity by NO is the modification of cathepsin K (a bone regulating enzyme). Cathepsin K is highly expressed in osteoclasts and plays a key role in the bone resorption mechanism, since it degrades bone collagen. NO has been shown to inhibit the activity of this enzyme.

What You Need to Know

Bone health is a key component to healthy aging. As a large sector of the population is now entering or into its senior years, it is imperative that we look at our options, both novel and conventional, when it comes to keeping our bones strong. The nitric oxide molecule plays a role in keeping the bone remodeling process robust over time. Our bones are very much alive and it is vital that our system keeps removing the old bone and laying down new bone in its place. Consuming foods rich in nitric oxide in combination with other key bone building nutrients such as calcium, magnesium, vitamins D, C and K is a potent recipe for maintaining bone integrity for years to come.



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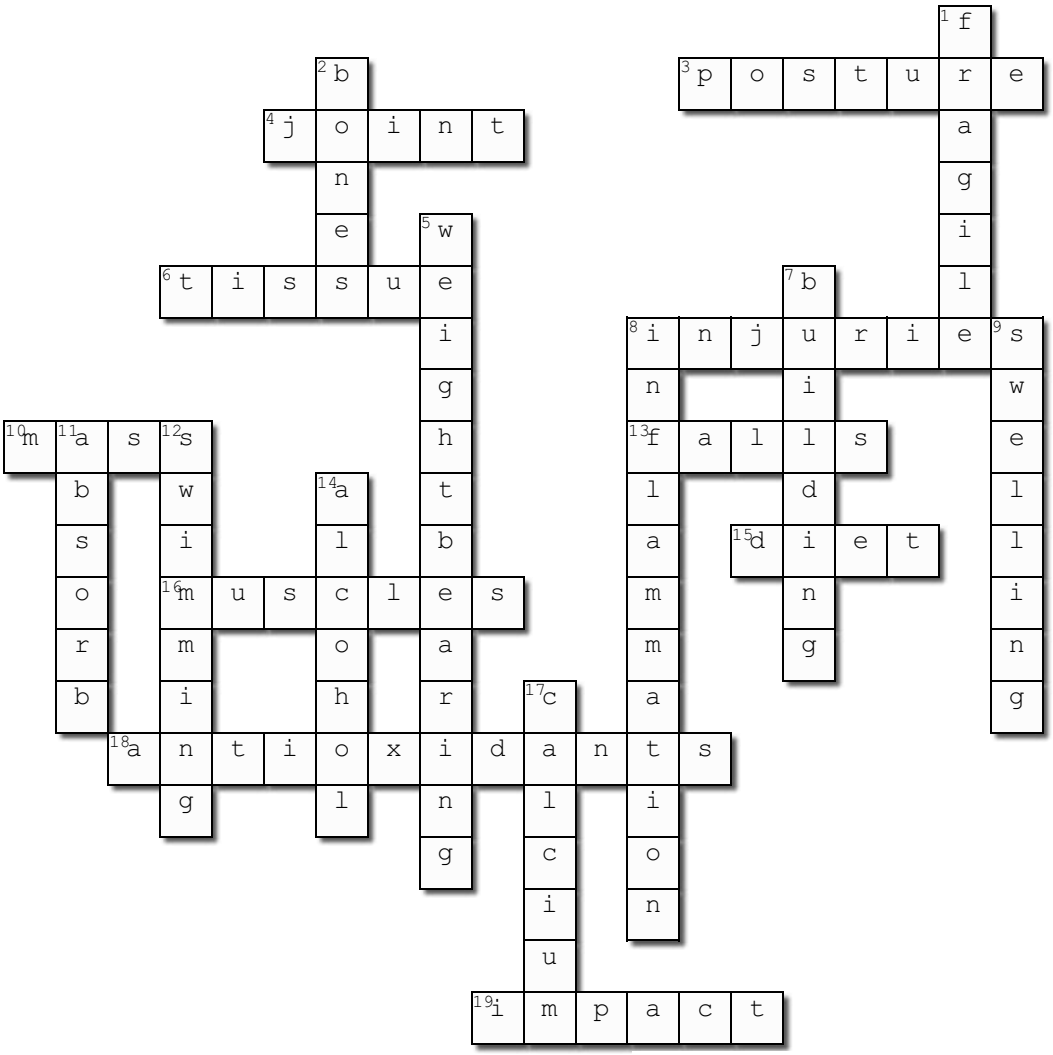
Crossword Puzzle Answer Key

Check your answers to the crossword puzzle on page 18 to see how many you got right.



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