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BONE HEALTH
(by Bryan Jick, MD, FACOG, MSCP)

As we age, the health of our bones assumes greater importance. Osteoporosis is a disease where bones become brittle and can break (fracture) easily. A common serious break is a hip fracture. Osteoporosis can be treated but even better it can be prevented, however, prevention has to start many years BEFORE the disease develops.

If you've been diagnosed with osteoporosis, or osteopenia (low bone mass), or if you want to know more and do more to help your bone health, please read this article.

BONE MASS

Human bone is an organ. It's alive! Every moment of our lives we have cells that make new bone (osteoblasts) and cells that digest/destroy/recycle old bone (osteoclasts). Many microscopic biological processes take place to maintain bone strength and to heal damaged or broken bone, a process that slows down as we age but never stops. Bone mass is referred to as BMD (Bone Mineral Density). Bone is a complex mixture of calcium, protein, collagen and many other substances and minerals.

As we grow from childhood, bones grow in size, strength, and mass. This growth reaches a peak or maximum at about age 30. That's the most bone mass you'll ever have, so we need this amount to be as high as possible. After age 30 there is a slow reduction of total body bone mass. The lower your mass at age 30, the higher the chance you'll get osteoporosis years later. This means we need to educate females under age 30 to do everything possible to build bone mass and bone strength. Raising peak bone mass now will help prevent fractures 40-50 years later!

MENOPAUSE

The majority of people with osteoporosis are female. After menopause, the female hormone estrogen level decreases to near zero. Menopause changes many things in the female body and one unfortunate change is accelerated loss of bone mass (decrease in BMD). The normal rate of BMD loss is about half a percent per year. But starting a year or so before menopause and for the first few years after, there might be as much as a 10% loss of bone mass. Then the loss slows down to 1% a year for a few more years and by age 60 or so it slows down again to the normal half-percent loss per year. These numbers are based on normal healthy females. Many diseases, conditions, and medications can cause more bone loss than this. More on this later.

OTHER CAUSES and RISK FACTORS

Men can get osteoporosis and so can younger people. There are dozens of medical conditions that increase the risk of developing osteoporosis (called secondary osteoporosis). There are medications that cause bone loss (steroids for example). Being underweight, sometimes due to an eating disorder, increases the risk. Family history is a factor. Smoking, high alcohol intake, sedentary lifestyle, poor diet, and vitamin or mineral deficiencies are also risk factors for developing osteoporosis. The most common cause of osteoporosis is female post-menopausal primary osteoporosis.

DEXA – measure BMD

DEXA stands for Dual Energy X-Ray Absorptiometry. This is an X-Ray used to diagnose low bone mass (osteopenia) or osteoporosis. The report shows a T-score and this number, if low, is how these disorders are diagnosed. You can read more online about DEXA.

STATISTICS

Most people with osteoporosis don't know they have it. Osteoporosis is usually silent. Joint pain and back pain are usually not osteoporosis, but low back pain due to vertebral compression fractures might be due to osteoporosis. The main way osteoporosis is diagnosed is either by a DEXA scan, or after a "non-traumatic" bone fracture. Not all bone fractures are due to osteoporosis, but an unexpected fracture that wasn't after a major fall or accident could be.

Here are some statistics to help understand how serious and also how widespread osteoporosis is:

- Osteoporosis affects 10 million people in the U.S. About 8 million women and 2 million men. Most of these people don't know they have it.
- 8.4% of adults (1 in 12) ages 50–64 and 17.7% (1 in 6) adults ages 65 and older have osteoporosis (but most of them do not know they have it).
- More than 2 million fractures related to osteoporosis occur each year in the U.S.
- There are 300,000 hip fractures per year in the U.S., which is the same as the number of new breast cancer cases diagnosed yearly.
- 1 in 8 women will one day develop breast cancer, but 1 in 6 will one day have a hip fracture.
- 95% of hip fractures occur after a fall, usually in the home. The average age is about 80.
- About 1 in 3 women who fracture a hip will not be alive 1 year later and for survivors, about half the time their mobility will be permanently limited.

Hip fractures can be very serious, so to help prevent them,
bone health must also be taken seriously.

MYTHS AND TRUTHS

1. Exercise is good for bone health. NOT CORRECT. Studies show that weight-lifting, high intensity exercise, and high impact exercise, are better for bone health. Walking and swimming do not reduce future risk of fracture (but they are still good forms of exercise). For bones to get stronger, they need to be stressed. No pain, no gain applies. Newer studies have shown benefits from some bone health devices often found at special gyms like OsteoStrong.
2. Calcium prevents hip fractures. NOT CORRECT. Unless someone is severely calcium deficient, taking excess or large amounts of calcium does not prevent fractures and it might increase the risk of kidney stones.
3. Vitamin D prevents fractures. MAYBE CORRECT. Vitamin D blood levels need to be above 30. Higher numbers than this do not further lower the risk of fracture. 1,000 units daily is a reasonable amount.
4. The first DEXA should be at age 65. NOT CORRECT. Industry and government guidelines are overdue for change. By age 65 one in four women already have osteopenia or osteoporosis. There might be 10-15 lost years of opportunity to treat or prevent bone loss due to this terrible policy. Ideally, the first DEXA should be within a year of starting menopause. Some experts advocate for routine DEXA at age 40.

BONE HEALTH

There are many ways to make and keep your bones healthy and strong. This does not mean you can always prevent osteoporosis. You still need to have the testing done at some point. But the sooner you prioritize bone health, the better will be your chance of avoiding a serious fracture.

DIET

- Always try to get nutrients from real food. Protein powders and supplements are processed, expensive, and often missing critical micronutrients that are naturally found in real food.
- Humans are omnivores. We can eat many different types of food (animal, fish, dairy, eggs, vegetable, fruit, some grains). Some food items should be kept to a minimum due to their inflammatory and anti-nutrient properties (wheat, beans, corn, nuts, legumes). Seed oils (corn, canola, safflower, sunflower, grapeseed) should be eliminated. Healthy fats and oils include avocado, olive and coconut oils. Saturated fats found in meat and dairy are now recognized as NOT AS BAD for us as we've been taught. Moderation is important and avoid burning food that is cooked (grilling, broiling, barbecuing can create carcinogens).
- Adequate protein is important, bone is part collagen (a protein) and part calcium (a mineral) plus many other substances. Protein should be "complete" which means it contains all the essential amino acids (these are ones we cannot make in our bodies and must get from food). The easiest complete protein to digest comes from animal sources (meat, fish, poultry, dairy, eggs). Soy, if not processed, is a complete protein. Many plant proteins are NOT complete. Goal is 0.6 to 0.8 grams of "complete" protein per pound of ideal body weight per day, divided into 2 or 3 meals. A 130 pound ideal weight female should eat 80 to 100 grams of high quality protein per day for optimal bone health.
- Calcium daily intake – ideally calcium is from food. Dairy products are a good source, or for vegan/vegetarians, plant milks with calcium added are a good source (soy, oat, almond, etc.). The goal is 1,000 mg total per day. Supplements ideally no more than 500 mg a day. If milk intolerant, A2 milk might be worth trying. Also, whole-fat Greek yogurt tends to be low lactose and a great source of protein and calcium, and the fat is a "healthy" fat.
- Vitamin D3 – you can make enough with direct sun exposure, twice a week, 15-minutes over most of the body, without sunscreen or lotions. Most of us do not get this much sun. In that case 1,000 units of Vitamin D3 daily is advised. Blood levels above 30 are fine. Higher is NOT better.
- Alkaline diet – Here is where I disagree with some online experts. Nothing in the normal diet, whether it's acidic or alkaline, will significantly affect your blood pH. Our bodies have complex and efficient systems for keeping blood pH in a tight normal range, this is called homeostasis. [This is why urine pH can vary so much. The body will conserve or excrete acid to preserve normal blood pH.] Only severe medical issues (such as drug OD, poisoning, diabetic keto-acidosis, severe persistent vomiting and/or diarrhea, chronic respiratory failure, etc.), can alter your blood pH. Alkaline water or alkaline foods do not have any special properties. Eating acidic foods or alkaline foods does NOT change your body's homeostatic pH which is nearly always 7.35 to 7.45 (slightly alkaline).
- Vegan/Vegetarian diets are NOT inherently beneficial for bone health. Depending on levels of protein, calcium, vitamins and supplements, people on these diets can have higher rates of fracture than omnivores, or similar, or lower. Some studies show that vegans/vegetarians have higher rates of fracture and lower BMD, probably from nutrient deficiencies. Reference: https://pubmed.ncbi.nlm.nih.gov/36129610/

EXERCISE

There is extensive research in the past 10 years regarding how much and what types of exercise are best for making bones stronger and healthier. This has led to controversies and disagreements among the experts. The older advice says that any exercise is good for bone health. Undoubtedly, any exercise at all is better than none and exercise has many other health benefits, but this article is about bone health.

There are many different types of exercise. Low intensity aerobic (walking, swimming, cycling), high intensity aerobic (sprinting, brisk walking, cycling hills), flexibility (yoga), core strengthening (pilates), weight training (high reps with low weights and low reps with high weights), high impact (jumping, gymnastics, dance) and low impact.

More recent research has identified specific exercises that seem to be better for improving bone health (strength, density and quality). There are far fewer published studies on the long-term benefits of exercise for bone health compared to medication studies. It's easy to understand this. One drug study could take 10 years and cost many millions of dollars. But if the drug is proven safe and effective the company gets a patent and stands to earn millions or even billions of dollars of profit.

There is no equivalent to this when studying exercise. This is why there are few studies about long-term reduction in fracture risk from implementing specific exercise types and programs. But there are some short-term studies showing great improvement in BMD with specific types of exercise, and this is still good science. Better BMD almost always means a lower risk of fracture.

The newer studies have shown the following:

1. To make bone stronger, you must stress or load the bone. How do you make your muscles stronger? By lifting heavy weights. The same activities that make muscles stronger also make bones stronger.
2. High impact can make bones stronger. Gymnasts have high bone density. This means some type of jumping.
3. High intensity can make bones stronger. Sprinting for example.
4. Osteogenic loading is a newer development. Specific equipment is designed to safely load weight onto specific bone groups to simulate heavy weight-lifting. Preliminary data shows increases in BMD from these exercises (see OsteoStrong).
5. Walking, jogging and swimming do not do much to help build new bone. They are still great for health but not that great for bone health.
6. Look up the LIFTMOR study. They used 4 exercises, under expert supervision, and saw BMD increases in 8 months. Dead lifts, overhead press, weight-bearing squats, and jumps.
7. Strain your muscles. Lift weights. But these activities must be done safely. Upper and lower body, especially hips, legs, low back. Higher weights and fewer reps. Resistance bands. Pilates is good for low back and core but a full body workout is better for bone health. 2 times a week ideally.
8. Whole Body Vibration (WBV) is a technology that can simulate the effects of high intensity exercise on bone. This requires specific equipment usually only available at some (not many) gyms. The data is mixed but some studies show improved BMD.

References

1. Manaye S, Cheran K, Murthy C, et al. (February 05, 2023) The Role of High-intensity and High-impact Exercises in Improving Bone Health in Postmenopausal Women: A Systematic Review. Cureus 15(2): e34644. DOI 10.7759/cureus.34644
2. Watson, Steven L., Beck, Belinda R., "High-Intensity Resistance and Impact Training Improves Bone Mineral Density and Physical Function in Postmenopausal Women With Osteopenia and Osteoporosis: The LIFTMOR Randomized Controlled Trial" Journal of Bone and Mineral Research, Vol. 33, No. 2, February 2018, pp 211–220, DOI: 10.1002/jbmr.3284.
3. Video: 5 exercises to build stronger bone. https://www.youtube.com/watch?v=1p63so9Cx-s

BONE HEALTH TO DO LIST

1. Protein intake daily – 0.6 to 0.8 grams of high-quality protein (high quality or complete proteins) per pound of body weight. Better from food than protein powders or bars.
2. Carbs - Keep sugar and carb intake as low as possible. No more than 20% of your total daily calories.
3. Fats – learn the difference between good fats and bad fats. Research this. New information is available that contradicts many long-held beliefs. Saturated fat in red meat is safe in moderation. Mono-unsaturated oils are preferred for cooking (avocado, olive coconut). These are high in Omega-3 antioxidant fatty acids. AVOID seed and plant oils such as sunflower, safflower, canola, corn, grapeseed. These are HIGH in Omega-6 pro-inflammatory fatty acids and other anti-nutrients.
4. Calcium – total of about 1,000 mg daily from diet, supplements as needed.
5. Vitamin D3 – 1,000 units daily from foods, supplements as needed.
6. Minerals and micro-nutrients – Magnesium, Potassium, Vitamin K2 – nuts, bananas, stone fruits (peaches, apricots, avocado), colored fruits (berries!) and vegetables.
7. Minimize alcohol intake. Better yet, quit altogether. Alcohol is high calories and has many negative health effects.
8. Stop Smoking.
9. Avoid colored soda. Phosphoric acid in cola is bad for bone health.
10. Exercise the right way – safe! with weight training, high intensity, and/or high impact. Research how to do this correctly or go to a special gym such as OsteoStrong.
11. Weight - Maintain normal weight. Underweight is bad for bone health. Overweight has other well-known health consequences but is less a concern for bone health.
12. Sleep - Get enough sleep – this is very important for total body health, not just bone health.
13. Check Ups - Have annual medical exams and blood work. Serum calcium is NOT an indicator of bone health but high and low calcium are both medical conditions that need to be investigated. Ask for CBC, CMP, Thyroid, Lipid, Vit D3, HBA1c. These are routine. Special tests might be needed if you have osteoporosis diagnosed.
14. Review your medications – know that long-term use of steroids is the most common form of medically-induced osteoporosis. Also, Type 2 diabetes and long term use of Prilosec, Nexxium and other PPI drugs are associated with increased risk of fracture.
15. DEXA Scan - If you are six months to one year after your last period, ask for a DEXA scan. Most doctors will say you're too young, so you need to be firm that you want to know your bone health now, not 15 years from now.
16. FRAX score. This is a quick online calculator to help you learn your 10-year risk of a vertebral or hip fracture. https://frax.shef.ac.uk/FRAX/tool.aspx?country=9