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HEALTHY BONE

JOINTS & MUSCLES

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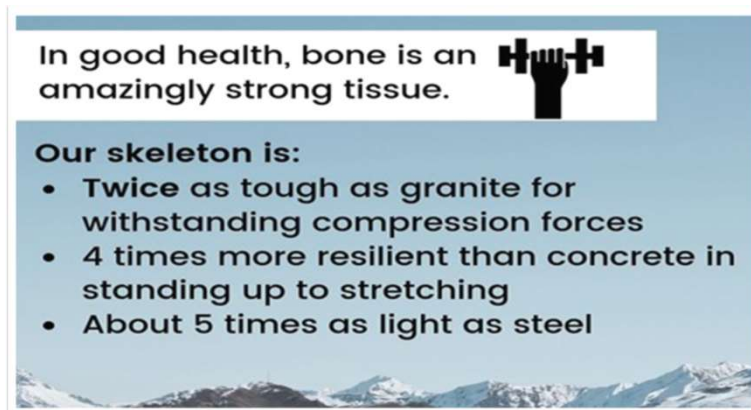


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THE NATURE OF BONE



- Tsiaras A, Werth B. *The Architecture and Design of Man and Woman: The Marvel of the Human Body, Revealed*, Doubleday Books, Oct 19th 2004.

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BONE IS STRONG AND ABUNDANT

- By its very architecture, bone tissue is so well built that osteoporotic vertebrae with only 50% of their normal amount of bone are still strong enough to withstand **five times** the strain load **they would normally be given. They're trying!**
- Bone weakness is largely due to accumulations of micro-damage and suboptimal self-repair.
- With repair deficits (inflammation) comes depletion of collagen and minerals such as magnesium and calcium.



- H. Frost, *The Pathomechanics of Osteoporosis*. *Clin Orthop* 200 (1985): 198-255.

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BONE IS ADAPTING AND SELF-REPAIRING

- Entire skeleton is replaced every 10 years
- Bone adapts to the loads put upon it; we must bear weight!
- Every moment >2 million small pieces of weakened bone are dissolved, recycled, and new bone laid down
- Ongoing activity of bone breakdown cells (osteoclasts) and our bone build-up cells (osteoblasts) repairs bones and allows remodeling to adjust its size and form to the stresses / force / weight put upon it



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BONE SERVES A MULTITUDE OF FUNCTIONS

- Form, rigidity and locomotion allowed
- Leverage for muscles to work
- Protection of delicate organs
- Makes red blood, immune cells & platelets
- Protective milieu for immune cells
- Reservoir of alkalinizing minerals (Mg, Zn, Ca...)
- Adequate bone mineral content counteracts effect of toxic metals
- Guardian to maintain blood acid-base homeostasis (balance)
- Makes progenitor stem cells
- Hormone synthesis (some)
- Glucose homeostasis and energy metabolism



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BONE IS INTELLIGENT TISSUE

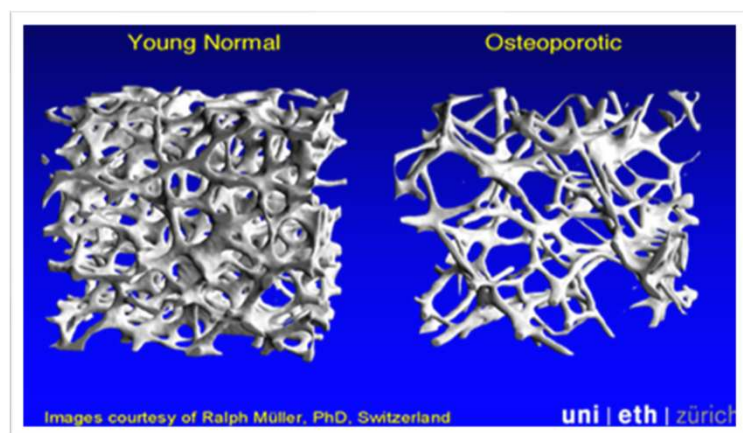
- The study of which enlivens our awareness of the order and intelligence of the entire body.
- Fenestrated, canaliculi, elegant, dynamic.

Bone is *intelligent tissue*.



NATURE OF OSTEOPOROSIS

*How much collagen,
calcium & magnesium
binding
dicarboxyglutamate and
connective tissue*



DEFINING OSTEOPOROSIS

- Over the last 28 years, we have been told that osteoporosis is defined as a DEXA test T-score of -2.5 or greater. The test takes two years for comparisons to be made. The same equipment needs be used both times because different machines measure differently.
- Today, we know this not totally accurate.
- Body type matters.



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ORIGINAL, LOW-TECH DEFINITION OF OSTEOPOROSIS

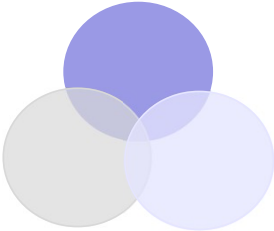
- Originally “osteoporosis” referred to bones that were so weak that they would break without substantial trauma.
- A bone break that occurred from a fall in a standing position was classically defined as an “osteoporosis fracture.”
- Diagnosis depends on who is diagnosing.



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OSTEOPOROSIS, SKELETAL DISORDER CHARACTERIZED BY WHO, 1993

Micro-architectural deterioration of bone tissue



Low Bone Mineral Density

Increase in Bone Fragility and Susceptibility to Fracture

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- American Journal of Medicine 1993; 94: 646-50.

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1994 REDEFINITION OF OSTEOPOROSIS

Diagnostic Classification

Classification	T-Score
Normal	-1 or greater
Osteopenia	Between -1 and -2.5
Osteoporosis	-2.5 or less
Severe/Established Osteoporosis	-2.5 or less & fragility fracture

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- Reference: World Health Organization. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. Technical report series 843. Geneva; World Health Organization, 1994.

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THE LIMITATIONS OF DEFINING OSTEOPOROSIS BY DEXA BONE DENSITY

- Osteoporosis occurs because of damage to the architectural structure of bone.
- Bone mineral density testing cannot assess the microarchitectural structure or the quality of bone.
- DEXA ignores why bone is lost.
- DEXA overstates in some; understates in others.



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BONE MINERAL TESTING LIMITATIONS

- “DEXA generates 2-dimensional images of complex 3-dimensional structures, bone density is the quotient of the bone area.
- Larger bone will convey superior strength, but may, in fact, have the same bone density as a smaller bone.”
- Small-boned individuals, people under five feet, or thin people, are likely to have the DEXA measurements underreport their bone strength.



- <https://pubmed.ncbi.nlm.nih.gov/29862042/> The challenges of diagnosing osteoporosis and the limitations of currently available tools

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LIMITATIONS OF DEXA, CONT'D

- Bone density testing has low precision and repeatability. Studying sequential bone density readings, noted osteoporosis authority by Dr. Susan Ott suggests **that even same-day repeat measurements on the same machine might show up to a 7% ! difference between tests.**
- Bone mineral density testing machines are **not standardized**. Therefore different commercial machines produce different bone density test results. For example, a person's bone density would be about **6% higher on a Lunar machine** versus Hologic machine according to Dr. Susan Ott.

- <http://courses.washington.edu/bonephys/opBMDp.html>; Wainwright, S. A., et al. (2005). "Hip fracture in women without osteoporosis." *J Clin Endocrinol Metab* 90(5): 2787-2793.
- Stone, K. L. e. a. (2003). "BMD at Multiple Sites and Risk of Fracture of Multiple Types: Long-Term Results From the Study of Osteoporotic Fractures." *Journal of Bone and Mineral Research* 18(11).
- Siris, E.S. et al. 2001. Identification and fracture outcomes of undiagnosed low bone mineral density in postmenopausal women: results from the National Osteoporosis Risk Assessment. *JAMA*, 286(22):2815-2822.
- Garg, M.K., Kharb, S. 2013. Dual energy X-ray absorptiometry: Pitfalls in measurement and interpretation of bone mineral density. *Indian Journal of Endocrinol Metabolism*. 17(2):203-210.
- Jarvinen, T. L., et al. (2015). "Overdiagnosis of bone fragility in the quest to prevent hip fracture." *BMJ* 350: h2088.; Cardona Corrochano, E., et al. (2018). "Overdiagnosis in women's health: The case of osteoporosis." *Aten Primaria* 50 Suppl 2: 30-38.



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THE LIMITATIONS OF DEFINING OSTEOPOROSIS BY DEXA BONE DENSITY

- Having a DEXA T score of -2.5T or less is not a reliable predictor of fracture. Sigh
- In fact, up to 86% of all fractures occur in individuals that have a bone density **within** the osteopenia or even **normal range**.

- <https://pubmed.ncbi.nlm.nih.gov/29018567/> Do we need bone mineral density to estimate osteoporotic fracture risk? A 10-year prospective multicentre validation study
- <https://academic.oup.com/jcem/article/104/8/3514/5427152> Two-Thirds of All Fractures Are Not Attributable to Osteoporosis and Advancing Age: Implications for Fracture Preventio
- <https://pubmed.ncbi.nlm.nih.gov/28161747/> Low-trauma fractures without osteoporosis



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A NEW WAY OF DEFINING AND DIAGNOSIS OSTEOPOROSIS IS NEEDED

- The current definition and diagnosis of osteoporosis will *likely* soon be revised once again.
- A new and even better way of defining and diagnosing osteoporosis must await the development of new non-invasive, safe, and accurate ways to measure bone strength.
- In the meantime, you can build healthy bone with weight bearing, walking, laughing, and eating well.



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ECHOLIGHT ULTRASOUND



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DEXA VS. ECHOLIGHT

Age 65, 118 lbs. female

	<u>DEXA</u>	<u>Echolight</u>
Spine BMD	-4.6	-2.6
Hip BMD	-2.5	-2.5

Fragility Index on Echolight was low at 22.1 out of 100

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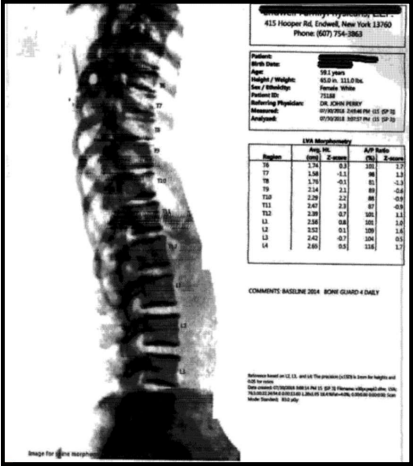
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VERTEBRAL DEFORMITY ASSESSMENT

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IF DEXA BONE DENSITY TESTING DOES NOT PREDICT FRACTURE, WHAT DOES?

The Importance of Multiple Risk Factors

Calcaneal Bone Density	No. of Risk Factors	Rate of Hip Fracture (per 1000 women-years)
Lowest Third	0-2	2.6
Middle Third	0-2	4.0
Highest Third	0-2	1.1
Lowest Third	3-4	6.6
Middle Third	3-4	1.1
Highest Third	3-4	1.9
Lowest Third	≥5	27.3
Middle Third	≥5	14.7
Highest Third	≥5	9.4

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- Cummings et al., *N Engl J Med* 1995; 332:767-773.

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CAN WE PREDICT FRACTURE

In a classic study of older women, Dr. Cummings found that hip fracture risk was 17 times greater among the 15% of women who had five or more risk factors (exclusive DEXA bone density) than that of the 47% of women with two or fewer risk factors.

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- Cummings et al., *N Engl J Med* 1995; 332:767-773

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MACRO LEVEL COMPONENTS OF TOTAL LOAD

- Gender
- Age
- Activity: bone loading exercise
- Nutrient inadequacies
- Stress and Toxic load
- Lifestyle choices
- Medications





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STEROIDS

About 4 million cases of osteoporosis in the United States, or 20% of the total number, are attributable to corticosteroid medication use.





- Am. College of Rheumatology Task Force on Osteoporosis Guidelines 1996

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MOLECULAR BONE CONTROL FACTORS

- Chronic **Metabolic Acidosis**
- **Oxidative stress**, unmet antioxidant needs
- **Neurohormonal Imbalance**
- **Hormones and neurochemicals of Distress**



- Jaffe, R, Brown, S.E. Natural Bone, Joint, Muscle Health: A Practitioners Guide, 2022.

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SUBOPTIMAL BONE DENSITY (U.S.)

In the U.S., over **10 million** have osteoporosis, and another 43 million have osteopenia.



This equals 1/2 of all adults aged 50+!
In which half are you?



- Healthy People 2030, Office of Disease Prevention and Health Promotion US Dept of Health and Human Services, 2022.

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LOW TRAUMA FRACTURE EACH YEAR (USA)



2 million fractures per year.



1 in 2 women & 1 in 4-5 men will fracture.

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- Bone Health and Osteoporosis Foundation, 2022.
<http://www.bonehealthandosteoporosis.org/wp-content/uploads/2015/12/Osteoporosis-Fast-Facts.pdf>

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ACID-ALKALINE BALANCE & BONE HEALTH

The body is an acid-producing machine.

-Albert Szent-Gyorgi

01234567891011121314



acidicneutralalkaline

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BODY PRODUCES AND BUFFERS ACIDS

- Arterial blood pH **must** be maintained within the **precise** range of 7.35 and 7.45 to be healthy.
- Through daily metabolism the body produces a **gigantic** amount of **acid**; this acid must be excreted or neutralized by minerals etc. for continued survival.
- Even a **slight acidic tilt** towards the 7.35 low pH range creates dramatic shifts in cell functioning.
- Fortunately, through nature's design, most of the acids produced by the body are either buffered within the body itself or excreted when we are healthy and have little distress and toxin exposure.



- Brown, SE and Jaffe, R Acid-alkaline balance and its effect on bone health. - International Journal of Integrative Medicine, vol 2, #6, 2000.

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BONE: KEY GUARDIAN OF PH BALANCE

Our skeleton serves as a gigantic reserve of alkaline mineral compounds (magnesium and calcium, zinc, manganese, molybdenum etc.) ready for transfer into the blood for maintenance of an obligatory, precise pH level.



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MINERALS STORED IN BONE

Bone and the hydration shell periosteum around it contain:

- 99% of the body's calcium
- 35% of the body's sodium
- 53-80% of the body's magnesium
- 0.1-0.2% of the body's potassium
- 80% of the body's carbonate
- 80% of the body's citrate, malate, succinate



- **Brown, SE and Jaffe, R Acid-alkaline balance and its effect on bone health. *International Journal of Integrative Medicine*, vol 2, #6, 2000**

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THE GREAT GIVER

If we do not maintain adequate alkaline-mineral reserves from our diet, our skeleton willingly sacrifices itself for the survival of the whole.

Bone renewal depends on having enough nutrients and not too many anti-nutrients; on stretching and bearing weight; on gratitude for having bones, joints, and muscles.



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CHRONIC METABOLIC ACIDOSIS

- The body has consistently taken on an acidic tilt.
- The blood pH, for example, will remain within the life-supporting level heading towards the acidic end. While small, this acidic tilt has vast implications for cellular functioning.
- Even a small amount of accumulated acid limits our health potential.
- The average Western diet produces an excess of 50 to 100 mEq of acid a day.
- The standard Western diet consumed by adults generates 2-4 times the amount of fixed metabolic acids that the body can easily buffer.



- L A Frassetto, K M Todd, R C Morris, Jr, A Sebastian, Estimation of net endogenous noncarbonic acid production in humans from diet potassium and protein contents, *The American Journal of Clinical Nutrition*, Volume 68, Issue 3, September 1998, Pages 576–583, <https://doi.org/10.1093/ajcn/68.3.576>

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CHRONIC METABOLIC ACIDOSIS, CONT'D

- 50-100 mEq of acid a day carries with it significant long-term health impacts.
- Over 20 years, it is calculated that this would equate to depletion of **one-half of the average female's skeletal calcium and 1/3 of the male's skeletal calcium.**



- Uriel S. Barzel, Linda K. Massey, Excess Dietary Protein Can Adversely Affect Bone, *The Journal of Nutrition*, Volume 128, Issue 6, June 1998, Pages 1051–1053, <https://doi.org/10.1093/jn/128.6.1051>
- T Remer, F Manz, Estimation of the renal net acid excretion by adults consuming diets containing variable amounts of protein, *The American Journal of Clinical Nutrition*, Volume 59, Issue 6, June 1994, Pages 1356–1361, <https://doi.org/10.1093/ajcn/59.6.1356>.

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WHY WE ARE SO ACID TODAY

- We have strayed from the alkalizing, high mineral balanced diet our ancestors enjoyed.
- Dietary changes over the last 2 centuries have resulted in a mismatch between genetically determined nutritional requirements and actual nutrient intake.
- This has resulted in chronic metabolic acidosis being the norm rather than the exception:
 - Deficiency of potassium, magnesium, and other essential minerals from alkaline-forming foods (i.e., Lack of vegetables, fruits, nuts, seeds, and spices)
 - Excess dietary intake of acid-forming foods (flesh foods, sugar, grains, processed foods, alcohol)
 - Excess sodium chloride (table salt) and too little intake of trace minerals.

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COST OF CHRONIC METABOLIC ACIDOSIS

- Increased bone breakdown, decreased bone formation
- Decreased efficiency of cellular ATP energy production
- Urinary loss of calcium
- Loss of magnesium, potassium, sodium, phosphorus
- Increased risk of kidney stones
- Growth hormone & insulin-like growth factor reduction
- Nitrogen and muscle losses (sarcopenia)
- Decreased exercise performance
- Kidney function decline
- Increase in parathyroid hormone
- Depressed protein synthesis
- Impaired liver detoxification

- Reduced enzyme functioning
- Lessening of immune competence
- Reduction of elective, protective biochemicals
- Accelerated aging
- Loss and weakening of connective tissue
- Disrupted balance of intestinal flora
- Reduced size of cerebral brain energy pools
- Imbalanced oral bacteria lead to increased dental decay and periodontal disease
- Development of low blood phosphate
- High uric acid and gout
- Hypertension
- Type 2 diabetes and insulin resistance

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- Frassetto L, Sebastian A. Age and systemic acid-base equilibrium: analysis of published data. *J Gerontol A Biol Sci Med Sci.* 1996 Jan;51(1):B91-9. doi: 10.1093/gerona/51a.1.b91. PMID: 8548506.
- Green J, Kleeman CR. Role of bone in regulation of systemic acid-base balance. *Kidney Int.* 1991 Jan;39(1):9-26. doi: 10.1038/ki.1991.2. PMID: 1706001.
- DiNicolantonio JJ, O'Keefe J. Low-grade metabolic acidosis as a driver of chronic disease: a 21st century public health crisis. *Open Heart.* 2021 Oct;8(2):e001730. doi: 10.1136/openhrt-2021-001730. PMID: 34702776; PMCID: PMC8549658.

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CORRECTING METABOLIC ACIDOSIS

Frassetto and colleagues at the University of California SF used 60-120mmol of potassium bicarbonate (a base) in a research study to neutralize the dietary acid load of the participants. After essentially removing the **acid load** of the Standard American Diet, the study subjects saw:

- Decreased blood acidity
- Decreased kidney calcium excretion
- Regained positive balance of calcium and phosphorus



- Frassetto, L., Morris, Jr., R., Sellmeyer, D. et al. Diet, evolution and aging. *Eur J Nutr* 40, 200–213 (2001). <https://doi.org/10.1007/s394-001-8347-4>

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CORRECTING METABOLIC ACIDOSIS, CONT'D

- Decreased **urinary nitrogen wasting** (enough to both prevent continued muscle loss (sarcopenia) and **restore** previously accrued deficits)
- Good news for bones: Decreased bone resorption and Increased bone formation
- Bone loss halted in a sustained fashion (over 5-year study)



- Sebastian A, Harris ST, Ottaway JH, Todd KM, Morris RC Jr. Improved mineral balance and skeletal metabolism in postmenopausal women treated with potassium bicarbonate. *N Engl J Med*. 1994 Jun 23;330(25):1776-81. doi: 10.1056/NEJM199406233302502. PMID: 8190153.
- Frassetto L, Morris RC Jr, Sebastian A. Potassium bicarbonate reduces urinary nitrogen excretion in postmenopausal women. *J Clin Endocrinol Metab*. 1997 Jan;82(1):254-9. doi: 10.1210/jcem.82.1.3663. PMID: 8989270.

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CORRECTING METABOLIC ACIDOSIS, CONT'D

Potassium Citrate Increases Bone Mass in Post-Menopausal Women

A randomized, double-blind controlled one-year trial (N=161) of post-menopausal women with osteopenia or osteoporosis:

- Subjects were given either potassium chloride or potassium citrate in equivalent doses (30 mEq per day).
- Those given 3.1 g of potassium citrate/day experienced a 1.9% increase in spinal BMD, a 1.4% increase in femoral neck, and 2% increase in total hip **over** those given potassium chloride.



• Partial Neutralization of the Acidogenic Western Diet with Potassium Citrate Increases Bone Mass in Postmenopausal Women with Osteopenia Sigrid Jehle, Antonella Zanetti, Jürgen Muser, Henry N. Hulter, Reto Krapf *JASN* Nov 2006, 17 (11) 3213-3222; DOI: 10.1681/ASN.2006030233

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NATURAL SOLUTIONS FOR OSTEOPOROSIS AND OSTEOPENIA



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U.S. SURGEON GENERAL'S
OSTEOPOROSIS TREATMENT
PYRAMID

Pharmacotherapy
(Antiresorptives and
Anabolics)

Address Secondary Factors
(Drugs and Diseases)

Lifestyle Changes
(Nutrition, Physical Activity, and Fall Prevention)

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USDHHS 2004

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STEP 1 - CASE ASSESSMENT

Assessment

Adult Osteoporosis
RISK ASSESSMENT

Far from being a simple disorder, many factors contribute to the development of weak and fragile bones. The following questionnaire is designed to help you assess your risk of experiencing an osteoporosis fracture.

	YES	NO
1. I am 65 years of age or older.....	☐	☐
2. I have little muscular development.....	☐	☐
3. I currently smoke.....	☐	☐
4. During my life, I have gone through three or more cycles of losing and regaining 30 pounds or more.....	☐	☐
5. I eat meat, fish, or other fresh foods more than once a day.....	☐	☐
6. I tend to worry a lot and/or am more often unhappy than happy.....	☐	☐
7. I exercise less than 20 minutes three times a week.....	☐	☐
8. I have three or more significant health problems, (do not even include.....)	☐	☐
9. I spend less than 30 minutes three times a week outside in the sunshine.....	☐	☐
10. On a daily basis, I generally consume less than two servings of dairy or green leafy vegetables or calcium fortified food (such as fortified OJ or fortified soy milk).....	☐	☐
11. I have had three or more major surgeries in my life involving general anesthesia.....	☐	☐
12. I am underweight.....	☐	☐
13. I regularly use, or have used over long periods of time, glucocorticoids ("steroid" drugs) such as Prednisone or steroid inhalers or high dose steroid medication.....	☐	☐
14. One or both of my parents fractured a hip.....	☐	☐
15. I have lost more or less five inches of height.....	☐	☐
16. I am 80 years of age or older.....	☐	☐
17. I generally consume less than four servings of vegetables a day.....	☐	☐
18. I drink more than two cups of coffee or two sodas or two servings of alcohol a day.....	☐	☐
19. I have experienced a bone fracture not due to severe trauma.....	☐	☐
20. If a woman asked: During my nonbearing years, there were times when my period stopped for many months (not including pregnancy, lactation or menopause).....	☐	☐

Questionnaire Scoring:

4 or less YES answers, indicates a low level of risk for osteoporosis.
5 to 8 YES answers, indicates a questionable risk for osteoporosis.
9 or more YES answers, suggests likely risk for osteoporosis.

Questionnaire Note:

If you are 20 years old or younger and have 4 or more YES answers, then your long-term risk for suffering an osteoporosis fracture still might be significant.
If you are a senior, you are likely to have more risk factors. Aging by its very nature, tends to increase ones risk for osteoporosis. Do not be discouraged, rather, establish an action program to reduce the risk factors under your control. Get diet, exercise and lifestyle healthy.

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CASE ASSESSMENT : BONE DENSITY CHARTING

[illegible]

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MEDICAL WORK-UP FOR OSTEOPOROSIS

THE MEDICAL WORK-UP FOR OSTEOPOROSIS

One of the basic principles of the Better Bones Program is that all osteoporosis, all excessive bone loss, or all real increased risk of low-trauma fracture has a cause. There are a number of medical problems that can cause, or contribute to, bone loss. To better understand any undetected causes of bone loss, it is important to obtain a medical work-up for osteoporosis. A medical osteoporosis work-up can be ordered by your physician. At the Center for Better Bones, in addition to the standard DEXA bone density test, we like to see the following tests included in an osteoporosis work-

Vitamin D 25(OH)D blood test

This test determines your blood level of vitamin D. The results of this test allow us to know the amount of vitamin D supplementation needed to reach a therapeutic blood level of vitamin D, which is important for adequate calcium absorption and bone mass support. You can read more about the importance of vitamin D to bone on my website at <http://www.bonnethealth.com/2009/04/01/vitamin-d-for-bone-health.aspx>.

Ionized calcium test

This is a single blood test to measure the level of free calcium – that is, the metabolically active portion of calcium not bound to proteins in the blood. This test is not meant to assess the appropriateness of your calcium intake as much as it's meant as an indirect test of parathyroid functioning. It can also indirectly tell us some things about vitamin D status.

Intact parathyroid hormone blood test (iPTH)

This is a simple blood test to measure the level of free calcium—that is, the metabolically active portion of calcium not bound to proteins in the blood. This test is not meant to assess the appropriateness of your calcium intake as much as it is meant as an indirect test of parathyroid functioning. It can also indirectly tell us some things about vitamin D status.

24-hour urine calcium excretion test

This test looks at how much calcium is being excreted in the urine. For this test, you collect all your urine over 24 hours in a large container for laboratory analysis to measure the amount of calcium in the total volume of urine. Excessive urinary calcium excretion is a common cause of bone loss and osteoporosis.

Thyroid hormone function test (TSH)

This is a measure of thyroid function, which can screen for under- or overactive thyroid conditions. Thyroid hormone levels that are too high or too low can contribute to osteoporosis, as can a dose of thyroid medication that is too high.

Vertebral deformity assessment

Just as the bone density test, this is another x-ray for bone. This test, however, images each vertebral body of the spine and looks to see if there are deformities or fractures. The Vertebral Deformity Assessment can be done on newer bone density testing machines, with special software that takes a "lateral" view of the spine. This new spine x-ray can also be done and interpreted by knowledgeable radiologists using other x-ray technology.

Free cortisol test (blood or saliva)

Cortisol is a corticosteroid hormone produced by the adrenal cortex, which is part of the adrenal glands. It is usually referred to as a "stress hormone" as it's involved in response to anxiety and stress. Abnormally high cortisol levels are damaging to bone and in such represent a major risk factor for osteoporosis and low-trauma fractures.

DHEA test (blood or saliva)

Dehydroepiandrosterone (DHEA) is a hormone produced by both the adrenal glands and the ovaries. DHEA helps neutralize the effects of cortisol. DHEA helps to protect and increase bone density. Stress reduction activities like yoga and meditation can help maintain youthful DHEA levels as we age. Low levels of DHEA are a risk factor for osteoporosis.

C-reactive protein test (high sensitivity if possible)

Dehydroepiandrosterone (DHEA) is a hormone produced by both the adrenal glands and the ovaries. DHEA helps to modulate the effects of cortisol. DHEA helps to protect and increase bone density. Stress reduction activities like yoga and meditation can help maintain youthful DHEA levels as we age. Low levels of DHEA are a risk factor for osteoporosis.

Homocysteine test (plasma or serum)

Homocysteine is a non-essential amino acid, a product of the metabolism of a dietary amino acid, methionine. In the absence of adequate B vitamins, homocysteine can accumulate in the body. High levels of this substance damage collagen and represent powerful risk factors for both cardiovascular disease and for osteoporotic fractures.

Celiac's disease and gluten sensitivity tests

Full-blown celiac disease, or even just a sensitivity to gluten, can lead to inflammation of the gut. This inflammation is related to a complex inflammatory cascade which can expunge bone loss. Also, those with Celiac's disease suffer from weak digestion and malabsorption of many nutrients including vitamins A, K, and D. These deficiencies in turn damage bone. If there is any suggestion of gluten sensitivity or Celiac's disease, appropriate testing should be considered. For a detailed update on gluten sensitivity as a cause of bone loss see, *The Whole-Body Approach to Osteoporosis* by R. Keith McCormick, New Harbinger Publications, 2008.

Sex hormone tests

Postmenopausal females: progesterone, estrogen. Female sex hormones drop naturally at menopause among all women, thus at the Center for Better Bones we do not generally suggest testing of these hormones. Those interested in this type of hormone testing, or those taking hormone replacement medications, can be tested for

The menopausal female's reproductive axis (hypothalamic-pituitary-ovarian, estrogen, progesterone) for women from their teens to menopause, proper levels of sex hormones are very important to bone health. Low levels of both estrogen and progesterone can limit development of optimum peak bone mass. Irregular, or frequently missed, periods should be studied by a knowledgeable physician. According to noted reproductive researcher, endocrinologist Dr. Jerilyn Prior, some 25% of young women in the US and Canada fail to develop optimum peak bone mass due to undetected ovulatory disturbances which result in low progesterone levels. Testing estrogen and progesterone can be helpful.

Midlife testosterone and, at times, estrogen. A common cause of osteoporosis in men is low testosterone; thus a needle work-up for osteoporosis in men almost always includes a test for testosterone. Interestingly enough, estrogen also plays a role in male bone health and at times the physicians will test for estrogen in men with osteoporosis.

Bone breakdown tests

Bone breakdown tests (called bone resorption tests) measure the degradation products of bone collagen in the urine or blood. As more bone is broken down, more of these collagen bone protein fragments show up in the urine and blood. Here at the Center for Better Bones we suggest the use of either the urine NTx test or the serum CTx test as markers of bone breakdown.

The urine NTx test for bone breakdown: This simple urine test looks at the amount of cross-linked N-telopeptides of bone type-1 collagen (NTx) in the urine. As there can be a great deal of day-to-day variation in urine bone breakdown markers, at the Center for Better Bones we have developed a two-day collection procedure for greater accuracy. Instructions for this collection method can be found on my website at http://www.betterbones.com/bonehealth/urine_tests.asp. For further details on bone resorption testing, see my article on assessing bone breakdown and loss on my website at <http://www.betterbones.com/bonehealth/bonebreakdownandloss.asp>.

The serum CTX bone breakdown test: The CTX tests for the C-terminal telopeptide of type-1 collagen, which is a peptide fragment derived from the carboxy-terminal end of the bone protein matrix. CTX is a blood test used to monitor the rate of bone breakdown and effectiveness of anti-resorptive natural or drug bone therapies. The serum CTX test should be done first thing in the morning before eating anything (in a fasting state). Twelve hours before this blood test, do not take multivitamins or dietary supplements containing biotin or vitamin B7 that are commonly found in hair, skin, and nail supplements and multivitamins.

Bone formation tests:

Bone formation tests assess the rate of the development of new collagen and new bone. The two most common test are the P1NP test and the Osteocalcin test.

The P1NP test for bone formation: The P1NP is the preferred marker of bone formation test. P1NP (pro-collagen type-1 N terminal propeptide) is formed by the bone-building cells and reflects the rate of collagen and bone formation. P1NP is the most sensitive marker of bone formation and particularly useful for monitoring bone formation therapies. It is recommended that this test be performed at baseline before starting a natural or pharmacologic osteoporosis therapy and again 3 to 6 months later. Serum or plasma blood sample is acceptable. The test should be done first thing in the morning before eating anything. (Testing site).

The osteocalcin test: Osteocalcin is the most important non-collagen protein in bone matrix. Osteocalcin is produced by the osteoblasts and is widely accepted as a marker of bone osteoblastic activity. Osteocalcin, incorporated into the bone matrix, is released into circulation from the matrix during bone resorption; hence is considered a marker of bone turnover rather than the specific marker of bone formation. The osteocalcin test is a blood test that should be done first thing in the morning in a fasting state. Twelve hours before this blood test, do not take multivitamins or dietary supplements containing biotin or vitamin B7 that are commonly found in hair, skin, and nail supplements and multivitamins.

<https://www.betterbones.com/osteoporosis/whats-the-cause-of-your-osteoporosis>

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YOUR BONE DEFENSE: NATURE'S ALKALINE WAY DIET



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WHAT IS NATURE'S ALKALINE WAY DIET?

Nature's alkaline way diet is high in vegetables, fruits, berries, nuts, seeds, pulses, fungi, sea vegetables, sprouts, edible flowers and spices with an adequate amount of protein. Organic or biodynamic better!



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ALKALINE EATING FOOD GUIDELINES

[illegible]

NATURE'S ALKALINE WAY FOOD EFFECTS CHART

[illegible]

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DIETARY NUTRIENT INADEQUACIES

Percent of US Population Obtaining LESS THAN EAR or AI from food

Nutrient	Percent of US Population
Potassium	100
Vitamin D	95
Choline	90
Vitamin E	85
Vitamin K	65
Magnesium	50
Calcium	40
Vitamin A	40
Vitamin C	35
Zinc	10

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- Linus Pauling Inst., Micronutrient inadequacies in the US Population: An Overview from N-Hanes 200-2010

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BETTER BONES SOLUTION

20 KEY BONE NUTRIENTS

THE 20 KEY BONE BUILDING NUTRIENTS

© Susan Brown, PhD, Center for Better Bones, East Syracuse, NY, 1-888-206-7119

Nutrient	Adult RDA or AI	Therapeutic Range for Bone Health ⁶	Dietary Considerations
Calcium	800–1,200 mg	800–1,200 mg	Typical diet is inadequate, averages 500–600 mg. ^{1,2}
Phosphorus	700 mg	800–1,200 mg	Inadequate intake is rare except in elderly and malnourished; excessive intake common with use of processed foods and soft drinks.
Magnesium	420 mg men 320 mg women	500–1,000 mg	Intake generally inadequate: All ages, sexes, classes, except children less than 5, fail to consume this RDA. 40% of population, 50% of adolescents consume less than 2/3 the RDA. ²⁻⁵
Chromium	30–35 mcg men 20–25 mcg women	200–1,000 mcg	Common intake in the US is 50 mcg/day or lower. ⁶
Silica	No RDA established	10 mg and up	Intake significantly higher in men (30–33 mg/day) than in women (~25 mg/day), yet generally suboptimal. Silica is the first element to go in food processing.
Zinc	11 mg men 8 mg women	12–30 mg	Average intake is 46 to 63% the RDA. ⁴ Marginal zinc deficiency is common, especially among children. ⁵
Manganese	2.3 mg men 1.8 mg women	2–10 mg	Intake generally inadequate, 1.76 mg adolescent girls, 2.05 mg women, and 2.5 men. ⁷

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- <https://www.betterbones.com/bone-nutrition/20-key-bone-nutrients/>

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PLANT PHYTONUTRIENTS, POLYPHENOLICS

- **Best is quercetin dihydrate and soluble OPC.**
- Among the best-studied phytonutrients are quercetin Epigallocatechin Gallate (EGCG) as in green tea, curcumin from turmeric, and resveratrol.
- These compounds provide a high level of bone-protecting antioxidants and anti-inflammatory activity.
- Each one is well documented to favor the development of strong bones.



- **Nicolin V, De Tommasi N, Nori SL, Costantinides F, Berton F and Di Lenarda R (2019) Modulatory Effects of Plant Polyphenols on Bone Remodeling: A Prospective View From the Bench to Bedside. *Front. Endocrinol.* 10:494. doi: 10.3389/fendo.2019.00494**

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STEP 4- ENHANCE DIGESTION AND DETOXIFICATION

- Clinically, osteoporosis is often associated with **weak digestion**.
- **Food allergies, delayed immune lymphocyte responses** and food intolerances are more the rule than the exception.
- Elimination diet for detecting **immediate** response is recommended.
- Use of the **LRA by ELISA/ACT®** tests to reveal inflammatory repair deficit delayed hidden immune responses.



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HIDDEN LIFE WITHIN AMAZING MICROBIOME

There are more microbes in the human body — a number estimated to be in the trillions — than there are stars in the Milky Way.



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ACID BLOCKERS: INCREASE FRACTURE RISK

British study of 13,556 individuals 50 and older:

- Those using PPIs (proton pump inhibitors) in high doses **for more than a year were 2.6 times more likely to fracture a hip than non-users.**
- Modest doses of PPIs used regularly for 1 – 4 years increased risk 1.2 to 1.6 times.



- Yang YX, Lewis JD, Epstein S, Metz DC. Long-term proton pump inhibitor therapy and risk of hip fracture. *JAMA*. 2006 Dec 27; 296(24):2947-53. doi: 10.1001/jama.296.24.2947. PMID: 17190895.



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YOUR BONE DEFENSE: EXERCISING INTO BONE STRENGTH



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WOFF'S LAW

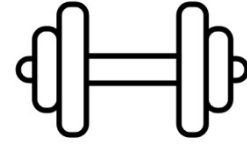
“Strong muscles usually do make strong bones, and chronically weak muscles usually do make weak bones.”

Harold Frost 2001



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STRENGTH TRAINING BUILD BONE DENSITY



German study with women 56-59; 14 months training 4x week (2 in group; 2 at home):

- **Isometric strength increased 11 to 39% in exercise group** and decreased -1.1 to -3.9% in controls
- BMD increased in lumbar spine 1.3% in exercise group
- BMD decreased in controls 1.2%
- Hip loss less in exercise group



- Kemmler W, Engelke K, Weineck J, Hensen J, Kalender WA. The Erlangen Fitness Osteoporosis Prevention Study: a controlled exercise trial in early postmenopausal women with low bone density-first-year results. *Arch Phys Med Rehabil.* 2003 May;84(5):673-82. doi: 10.1016/s0003-9993(02)04908-0. PMID: 12736880.

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OSTEOGENIC EXERCISES

- For a physical exercise to be called “osteogenic” it must produce an environment of work loads which differs from the habitual.
- Bone formation will only happen when a critical threshold of activity is achieved; multiples of body weight.



- Lirani-Galvao and Lazaretti-Castro Arquivos Brasileiros de Endocrinologia & Metabologia, Vol 564, No.2, San Paolo, March 2010.

60

HOPPING & JUMPING BUILD BONE

A study of 34 men aged 65+:

- Hopped on one leg in all 4 directions
- 2 mins a day for 1 year
- Results were compared between exercise and non-exercise groups...



- Allison, Sarah. High impact exercise increased femoral neck bone mineral density in older men: A randomized unilateral intervention. *Bone*, 53 (2013):321-328.



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HOPPING & JUMPING BUILD BONE

Results:

- Bone mass increased in the exercise group by 7% in parts of the hip's outer shell.
- Increased density of spongy bone under cortex.
- These effects also seen in the thinnest area of hipbone which is usually the most likely to break.
- Clear differences between exercise and non-exercise groups.



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ONE-LEGGED HOPPING BUILDS BONE IN POST-MENOPAUSAL WOMEN

6 Month Study Hopping in all four directions on one leg; women worked up to 50 one-legged hops per day.

Results: hoping leg compared to control leg

- Bone strength increased 3.18% in the hopping leg, while bone strength decreased in the control leg.
- Hip-neck bone density increased in the exercised leg while it decreased in the control leg.
- The bone mineral content also increased in the hopping leg but decreased in the control leg.

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- Bassey, E.J., Ramsdale, S.J. Increase in femoral bone density in young women following high-impact exercise. *Osteoporosis Int* 4, 72–75 (1994). <https://doi.org/10.1007/BF01623226>
- <https://www.betterbones.com/exercise/hopping-osteoporosis/>

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NEW FRONTIER:
HIGH-INTENSITY RESISTANCE
AND IMPACT TRAINING



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AUSTRALIAN BONE CLINIC

It's all about high-intensity weightlifting

Clinical Trial Study Basics:

- 101 Postmenopausal women with a T score less than -1
- Supervised 30-minute sessions of high intensity resistance training (5 sets of 5 reps at 80-85% of their 1 rep max)
- 2x a week, for 8 months
- Deadlift, overhead press, back squat
- Jumping chin ups with drop landings for impact loading



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AMAZING AUSTRALIAN BONE CLINIC

It's all about high-intensity weightlifting

Results:

- The high intensity group gained **2.9% BMD** in the lumbar spine while the control group lost 1.2%.
- The high intensity group gained **0.3% BMD** in the femoral neck, while the control group lost 1.9%.
- The high intensity group gained **13.6% BMD** femoral neck cortical thickness while the control group lost 6.3%.



- Watson SL, Weeks BK, Weis LJ, Harding AT, Horan SA, Beck BR. 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. *J Bone Miner Res*. 2018 Feb;33(2):211-220. doi: 10.1002/jbmr.3284. Epub 2017 Oct 4. Erratum in: *J Bone Miner Res*. 2019 Mar;34(3):572. PMID: 28975661.

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AMAZING AUSTRALIAN BONE CLINIC



It's all about high-intensity weightlifting

Alison J., a 59-year-old woman gained:

- 10.5+ bone density in the hip (femoral neck)
- 8.8% in the spine
- Also increased functional reach by 11.63%
- Improved mobility by 21.57%



www.theboneclinic.com.au

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MORE AMAZING CENTER FOR BETTER BONES

Our 67-year-old client Cindy undertook a high intensity technical weightlifting program working supervised by trainers while doing all the steps of our Better Bones Program and she broke all records.

Over one and a half years she gained:

- **+21%** in the neck of the hip
- **+10%** in the total hip
- **+5.6%** in the spine



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AUSTRALIAN BONE CLINIC 5 YEAR DATA ON THE REDUCTION OF FALLS AND FRACTURES

- 71% reduction in falls
- 51% reduction in fractures

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• Dr. Belinda Beck, personal communication, May 2021.

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TAI CHI CAN INCREASE BONE DENSITY

5 of 9 clinical trials show Tai Chi produced significant
improvements in BMD

REVIEW ARTICLE

The effect of Chinese martial arts Tai Chi Chuan on prevention of osteoporosis: A systematic review

Tsz Ho Chow*, Bo Yee Lee, Adrian Bing Fung Ang,
Veronica Yi Ki Cheung, Michelle Man Ching Ho, Saori Takemura

*Department of Orthopaedics and Traumatology, Faculty of Medicine, The Chinese University of Hong
Kong, Hong Kong Special Administrative Region*

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Available online 26 June 2017

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Original Article

Effects of Yogasanas on osteoporosis in postmenopausal women

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Department of Musculoskeletal Physiotherapy, Sancheti Healthcare Academy, Sancheti Institute College of Physiotherapy, 12, Thube Park, Shivaji Nagar, Pune - 411 005, Maharashtra, India.

ABSTRACT

Background: Osteoporosis is commonly encountered by postmenopausal women. There is an increased need for a low cost and efficient treatment alternative to address this population.

Aims: To study the effects of integrated yoga on bone mineral density (BMD) in postmenopausal women with osteoporosis.

Settings and Designs: Experimental pre-post study conducted in a community setting.

Materials and Methods: 30 females in the age group of 45–62 years suffering from postmenopausal osteoporosis with a dual-energy X-ray absorptiometry (DEXA) score of ≤ -2.5 underwent a 6 months fully supervised yoga session. All the participants completed the study. Pretraining and posttraining BMD was calculated. Outcome measure: DEXA score at the lumbar spine.

Statistical Analysis: The study was statistically analyzed using paired *t*-test to see the significance of pretraining and posttraining effects of a yoga session.

Results: Improvement in T-score of DEXA scan of -2.55 ± 0.25 at posttraining as compared to a pretraining score of -2.69 ± 0.17 .

Conclusions: Integrated yoga is a safe mode of physical activity which includes weight bearing as well as not weight bearing asanas, Pranayama, and suryanamaskar, all of which helps induce improvement in BMD in postmenopausal osteoporotic females.

Key words: Dual-energy X-ray absorptiometry-scan; menopause; osteoporosis; yogasanas.

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Dx. Osteoporosis, 4 x/wk. 6 months

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MACHINE BASED ISOMETRIC
AXIAL COMPRESSION

Multiple of Bodyweight Bone Loading
(10x Body Weight)



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BIODENSITY OSTEOSTRONG PROGRAM

- Significant clinical trial was done with older men by the Australian Bone Clinic, 8 month trial
- Compared Biodensity machine-based isometric exercise to their high-intensity resistance: HIRIT and impact and training and controls
- **HIRIT improved bone, function, and fracture risk more than machine-based isometric program**



• Harding, AT, et al., JBMR, Vol 00, No.00, Month 2020, p 1-11.

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STEP 6: REDUCING STRESS AND CREATING RESILIENCE



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" **NOTHING** holds more power over the body than the *thoughts* held in the mind."

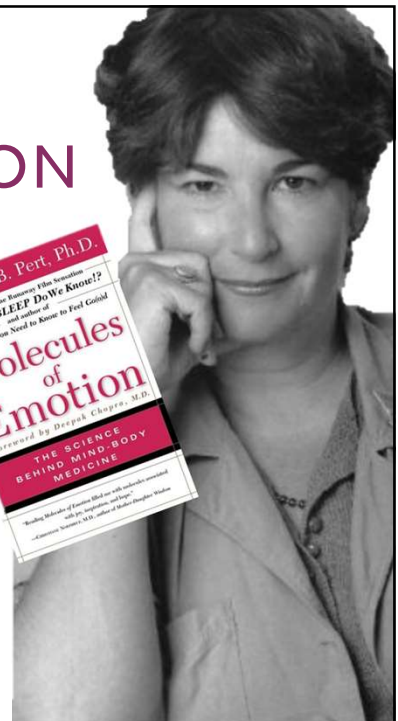
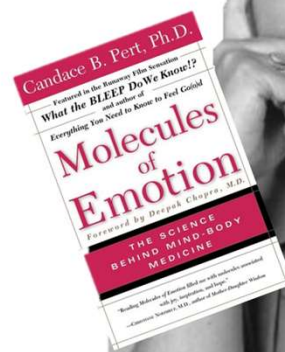
– Deepak Chopra

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CANDACE PERT MOLECULES OF EMOTION

"A feeling sparked in your mind will translate as a peptide being released somewhere. Peptides regulate every aspect of your body, from whether you're going to digest your food properly to whether you're going to destroy a tumor cell."

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DEPRESSION ANXIETY & FRACTURE RISK

- A meta-analysis of 23 studies reported that depression was associated with a **26% increase in fracture risk**.
- Anxiety — Large Taiwanese study found patients with anxiety disorder were nearly **2x as likely** to develop osteoporosis.



- Wu Q, Liu B, Tonmoy S. Depression and risk of fracture and bone loss: an updated meta-analysis of prospective studies. *Osteoporos Int*. 2018 Jun;29(6):1303-1312. doi: 10.1007/s00198-018-4420-1. Epub 2018 Mar 12. PMID: 29532130.
- Hong-Jhe C, The incidence and risk of osteoporosis in patients with anxiety disorder: A Population-based retrospective cohort study. *Medicine (Baltimore)*. 2016 Sep;95(38):e4912. doi: 10.1097/MD.0000000000004912. PMID:

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WHAT I HAVE LEARNED SO FAR:

- There are many physiological mechanisms by which chronic stress depletes bone and contributes to osteoporosis.
- Fear and its child worry are particularly damaging to bone.
- With awareness, we can move towards a state of internal balance and ease.



- Stress and Alterations in Bones: An Interdisciplinary Perspective <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5410657/>
- Impacts of Psychological Stress on Osteoporosis: Clinical Implications and Treatment Interactions <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6465575>

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CORTISOL STRESS RESPONSE: EXOGENEOUS AND ENDOGENOUS

- Cortisol triggers bone mineral resorption (removal) to free amino acids for use as a backup energy source through gluconeogenesis.
- Cortisol indirectly acts on bone by blocking calcium absorption which decreases bone cell growth. The disruption to serum calcium homeostasis increases bone resorption and ultimately reduces BMD.



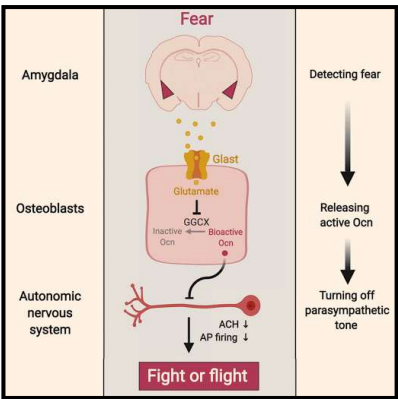
• Jaffe, R, Brown, SE, 2022. *Natural Bone Health: A Practitioner's Guide*, HSC Press, Ashburn, VA .

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HOW BONE RESPONDS TO DANGER

Our skeleton, along with our adrenals, serves to guarantee a robust flight or flight survival response.

This response to danger occurs before the adrenal hormones have time to kick in and it will occur even if the adrenals are removed or non-functional.



• Berger, J.M., P. Singh, L. Krimian, D.A. Morgan, S. Chowdhury, E. Arteaga-Solis, T.L. Horvath, A.I. Domingos, A.L. Marsland, V.K. Yadav, K. Rahmoni, X.B. Gao, and G. Karsenty. 2019. Mediation of the acute stress response by the skeleton. *Cell Metabolism* 30 (5):890-902.e8.

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SPECIAL INSIGHTS FOR TEENS: PEAK BONE MASS

- From early adolescence to late teens some 50% of peak bone mass is laid down.
- Epidemiological studies indicated that a **10 % increase in PBM can reduce bone fracture in postmenopausal women by 50%.**



<https://pubmed.ncbi.nlm.nih.gov/18296321/>

<https://www.sciencedirect.com/science/article/abs/pii/S0140673693925558>, Cummings *et al.*, 1993.

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SPECIAL INSIGHTS FOR TEENS: BONE-BUILDING NUTRIENTS

- Micronutrient deficiency is common
- Studies suggest over half of the children are vitamin D deficient

Roh, Y. E., Kim, B. R., Choi, W. B., Kim, Y. M., Cho, M. J., Kim, H. Y., Park, K. H., Kim, K. H., Chun, P., Kim, S. Y., & Kwak, M. J. (2016). Vitamin D deficiency in children aged 6 to 12 years: single center's experience in Busan. *Annals of Pediatric Endocrinology & Metabolism*, 21(3), 149–154. <https://doi.org/10.6065/apem.2016.21.3.149>

- 49% of children 4-18 consume less than the EAR for calcium

<https://ods.od.nih.gov/factsheets/Calcium-HealthProfessional/>



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SPECIAL INSIGHTS FOR TEENS: EXERCISE

- Several studies document the beneficial impact of exercise on building peak bone mass.
- Dr. Belinda Beck and colleagues used 10 minutes of jumping exercises in adolescence.
- In an 8-month trial the adolescent girls gained 13.9% in femoral and 5.2% in the spine more than the controls doing regular physical education.

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- Weeks BK, Young CM, Beck BR. Eight months of regular in-school jumping improves indices of bone strength in adolescent boys and Girls: the POWER PE study. *J Bone Miner Res.* 2008 Jul;23(7):1002-11. doi: 10.1359/jbmr.080226. PMID: 18302501.

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SPECIAL INSIGHTS FOR MENOPAUSE

Menopausal Bone Loss

Years before last period

1

1

2

Years after last period

Trans Menopause

Greatest menopausal bone loss occurs in trans menopause: one year before, two years after a woman's last period.

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- Greendale GA, Sowers M, Han W, Huang MH, Finkelstein JS, Crandall CJ, Lee JS, Karlamangla AS. Bone mineral density loss in relation to the final menstrual period in a multiethnic cohort: results from the Study of Women's Health Across the Nation (SWAN). *J Bone Miner Res.* 2012 Jan;27(1):111-8. doi: 10.1002/jbmr.534. PMID: 21976317; PMCID: PMC3378821.

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SPECIAL INSIGHTS FOR MENOPAUSE: TRANSMENOPAUSE BONE LOSS

10-year observation from 5 years before to 5 years after the last period.

SWAN study:

- Cumulative loss in spine 10.6%
- Femoral neck loss of 9.1%
- Greatest loss in trans menopause period.



- Greendale GA, Sowers M, Han W, Huang MH, Finkelstein JS, Crandall CJ, Lee JS, Karlamangla AS. Bone mineral density loss in relation to the final menstrual period in a multiethnic cohort: results from the Study of Women's Health Across the Nation (SWAN). *J Bone Miner Res.* 2012 Jan;27(1):111-8. doi: 10.1002/jbmr.534. PMID: 21976317; PMCID: PMC3378821.

85

SPECIAL INSIGHTS FOR MENOPAUSE

- It is becoming increasingly recognized that antioxidant deficit is a causal factor for osteoporosis.
- Some researchers suggest a paradigm shift from an estrogen-centric focus to an oxidative stress focus.



- Jaffe, R, Brown, SE, 2022. *Natural Bone Health: A Practitioner's Guide*, HSC Press, Ashburn, VA
- Kimball, Jeff S. MD1; Johnson, Joey P. MD1; Carlson, DuWayne A. MD1 Oxidative Stress and Osteoporosis, *The Journal of Bone and Joint Surgery*: August 4, 2021 - Volume 103 - Issue 15 - p 1451-1461 doi: 10.2106/JBJS.20.00989
- Stavros C. Manolagas, From *Estrogen-Centric to Aging and Oxidative Stress: A Revised Perspective of the Pathogenesis of Osteoporosis*, *Endocrine Reviews*, Volume 31, Issue 3, 1 June 2010, Pages 266–300, <https://doi.org/10.1210/er.2009-0024>

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SPECIAL INSIGHTS FOR MENOPAUSE

Clinically I have seen that:

- Implementing each of the 6 Better Bones Program components can reduce the rate of menopausal bone loss.
- Monitoring the rate of bone breakdown can be helpful in high turnover cases.
- Low-turnover osteoporosis is common, especially in thin and worried women.
- Small boned and underweight women tend to lose more BMD than normal-weight women.
- It is unusual to see a higher rate of transmenopause bone loss in the hip than in the spine. If so, check PTH.



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CASE STUDIES

Halting Menopausal Bone Loss

- Joanne had menopause at age 54, and lost bone between ages 52 and 57 (the years just before and just after menopause).
- Lost 13% in the spine, and 11% in the hip.
- Began working with the Better Bones Program.
- Halted bone loss, stabilized in the hip, and gained 1.3% density in spine bone mineral density.



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CASE STUDIES CONT'D

Increase Bone Mass Well Beyond Menopause

- Nancy was diagnosed with osteoporosis at age 55.
- For five years, beginning in 1999, she began to lose bone.
- Working with us, she gained 6.9% in spine; 10.6% in hip.
- 16 months after beginning the program, she gained lost bone and more (including 3.2% more in the spine).



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CASE STUDIES CONT'D

Going Off Fosamax and Gaining Bone

- Lily was 60 years old when she began with us in 2001.
- She had high bone breakdown (even on Fosamax, which gave her diarrhea).
- After dropping Fosamax and beginning our nutritional program, her bone resorption gradually went down and between 2004 and 2006, her BMD went up (6.5% in the hip, 4.1% in the spine).



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CASE STUDIES CONT'D

Postmenopausal Recovery from Osteoporosis

- Caucasian female came to us at age 64 with osteoporosis of spine and hip.
- Full hysterectomy at age 54, went off ERT four years ago at age 61.
- **She did the total Better Bones® Program and the first year with us increased bone density 1.7% in the spine, 6.2% in the hip, and moved out of having osteoporosis.**



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CASE STUDIES CONT'D

Going Off HRT

- Lynne, early 60s, was on HRT for several years and gained quite a bit in the spine and hip.
- Went off HRT and developed high bone breakdown (NTx was 58).
- Began our program, went through menopause, and was able to reduce NTx to 30.
- No more recent bone density tests have been conducted yet.



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HEALTHY BONE
JOINTS & MUSCLES

DR. SUSAN E. BROWN, PH.D.