

Osteoporosis

Prevention & Management

by

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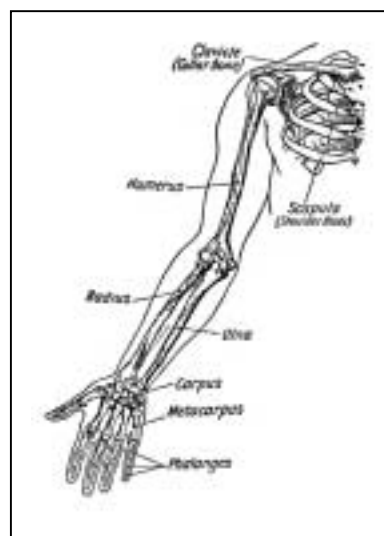
SCOPE OF THE DISEASE

Put simply, osteoporosis is a reduction in bone density usually attributed to a loss of calcium and other minerals. This mineral loss causes the bones to become porous and brittle and renders them susceptible to fractures. An estimated **20 to 25 million Americans are affected by osteoporosis, primarily postmenopausal women (80%).**¹

Because there are **few early warning signs of osteoporosis**, most people who have the disease are not aware of it until they suffer a fracture. Osteoporosis is associated with 1.5 million fractures per year.² Hip fractures are the most common fracture type in women. Rib or wrist fractures are the most common in men. Osteoporosis is also associated with most common spinal fractures.^{3,4,5,6}

The National Osteoporosis Foundation estimates **osteoporosis leads to 300,000 hip fractures, 200,000 broken wrists, over a half million vertebral fractures and 300,000 fractures of other bones annually.**⁷ In fact, one out of two women over the age of 50 will experience an osteoporosis-related fracture at some point in her life.⁷

One-fifth to one-third of all hip fractures and one-half of vertebral fractures are estimated to occur in men.⁷ Because of the complications inherent in the condition, osteoporosis-related injuries are now the **12th leading cause of death in the U.S., contributing to approximately 50,000 deaths annually.** It is estimated that **24% of hip fracture patients die within a year following their fracture.**⁷



The most common fatal complication of osteoporotic fractures is pulmonary embolism. Pulmonary embolism occurs when a blood clot becomes lodged within a pulmonary (lung) artery, resulting in severe respiratory dysfunction. Symptoms include shortness of breath, chest pain (worse with breathing) and rapid heart rate.

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Other consequences of osteoporosis include curvature of the spine, loss of height, limited mobility and inability to participate in everyday activities.

As the population ages, the costs of medical treatment for fractures secondary to osteoporosis will place a significant financial burden on the economy. Currently, the annual cost of osteoporosis-related injuries is estimated at 6 billion dollars.⁸ Statistics reveal 50% of all people over the age of

75 are affected by osteoporosis. The number of Americans over the age of 50 is expected to increase **50% by the year 2020**. The number of men over age 70 is expected to double by the year 2050. If these estimates are accurate, the annual cost of osteoporosis-related diseases will be driven to **\$60 billion**.⁷

Osteoporosis is not limited to the U.S. It is a global problem, contributing to considerable morbidity and mortality worldwide (with huge financial implications). This disease is predicted to increasingly affect healthcare budgets of all nations, particularly as the world population grows and ages.^{9,10} The National Institutes of Health estimates that by 2050, **6.3 million hip fractures** will occur worldwide, with approximately 50% of them occurring in Asia.⁷ Projections like these make it absolutely crucial for all nations, not just the U.S., to identify risk factors, provide early detection, apply appropriate treatment and develop preventive health models for the disease.

Common sense dictates as the baby boomer generation ages in this country, demand will increase for a prevention-oriented healthcare model. The National Osteoporosis Foundation estimates the **average physician currently sees eleven patients weekly who have osteoporosis, but only diagnoses one of them with the disease**. Over 75% of women between the ages of 45 and 75 report they have never discussed osteoporosis with their doctor. **77% of all postmenopausal women have undiagnosed osteoporosis** and therefore go untreated for the disease.¹¹

Today, the primary prevention tool in the conventional medical model is early detection. This does not prevent the disease, although it can help prevent its complications.

The following factors are keys to the prevention model for osteoporosis:

- ❖ Understanding of bone remodeling process
- ❖ Knowledge of risk factors
- ❖ Awareness of effects of metabolic and physiological activities
- ❖ Recognizing lifestyle factors that influence bone metabolism negatively or positively
- ❖ Developing a preventative program for nutritional support



BONE METABOLISM

Bone tissue is made up of collagen, protein and minerals. Bone is constantly being renewed or repaired; it is a metabolically active, living tissue. This process of bone metabolism or turnover is also referred to as **bone remodeling**.

Bone metabolism occurs by means of two activities: The first is resorption, or the breaking down or removal of old bone by specialized cells in the bone called osteoclasts.¹² During bone resorption, osteoclasts remove collagen fibers, which are then released into the body.

The second activity is the formation of new bone, which is accomplished by cells known as osteoblasts. The osteoblasts produce new collagen to fill in the spaces left by the osteoclasts. Thus, total **bone mass is determined by the balance between resorption and formation**. Risk of osteoporosis occurs when bone resorption exceeds bone formation or bone formation does not completely repair the spaces left by the osteoclasts, or both.

Peak bone mass, the maximum amount of bone mass achieved during skeletal growth, is generally reached during the first two decades of life. Up to **60% of total bone mass is achieved during adolescence** and skeletal growth is nearly complete by age 18.¹² Some minor accumulations in bone density occur until approximately age 30, and minimal changes occur in women between age 30 and menopause.



RISK FACTORS FOR OSTEOPOROSIS

There are many recognized physiological, medical and lifestyle risk factors related to the potential for developing osteoporosis.

Most common physiological risk factors:

- ❖ Northern European heritage
- ❖ Small and slender frame
- ❖ Blue eyes
- ❖ Fair complexion
- ❖ Light hair
- ❖ Men over 50 and women over 40.

Medical risk factors:

- ❖ Family history of osteoporosis
- ❖ Women who have had total hysterectomies
- ❖ Recently pregnant women and nursing mothers
- ❖ Menopausal women
- ❖ Individuals with lactose intolerance and/or dairy allergies
- ❖ Heavy metal exposure
- ❖ Vitamin D deficiency
- ❖ Repeated antibiotic use
- ❖ Use of certain medications including NSAIDS, steroids, and phenytoin
- ❖ Some disease processes such as hyperthyroidism, hypogonadism (in men)

Lifestyle risk factors:

- ❖ Heavy alcohol consumption
- ❖ Heavy soft drink consumption
- ❖ Heavy caffeine consumption
- ❖ Heavy exercise
- ❖ Sedentary occupations and/or lifestyles
- ❖ Smoking

Ethnicity/Race

Historically, Caucasian females were seen at greater risk than other races for osteoporosis. However, this perception is changing, possibly because minority groups have never been studied as thoroughly as the Caucasian group. Traditionally the **racial groups at highest risk are those with Caucasian and Asian ancestry, but African American and Hispanic women are also at significant risk.**⁷

Asian women consume about half the amount of calcium as women in Western populations. Latino and Caucasian females tend to consume less calcium in all age groups than other races. Many of the diseases prevalent among the African-American population increase their risk of osteoporosis and it is the cause of the majority of hip fractures in African-American women over age 64.⁷ African-American women are also more likely to die from complications of a hip fracture than Caucasian women.⁷

Small slender frame

Women with small frames are at greater risk for osteoporotic fracture than women with heavier frames or obese women. Caucasian and Asian-American women are at particular risk because they tend to have smaller frames than women of other races. Caucasian and Asian women also tend to achieve lower levels of bone mass and density than African American women.⁷

Men over the age of 50

As men reach age 65 to 70, calcium absorption continues to decrease and bone loss occurs at the same rate as in women. Caucasian males in this age group tend to be at highest risk. A 1996 Gallup survey funded by the National Osteoporosis Foundation revealed most men think of osteoporosis as a woman's disease and therefore do not believe they are at risk. An American man over the age of 50 has a higher risk for an osteoporotic fracture than for developing prostate cancer. **One-third of those men who suffer a fracture will die** within a year due to complications. Leading researchers estimate that **1.5 million men have osteoporosis and another 3.5 million are at high risk** for developing osteoporosis.^{7,13} Those at greatest risk smoke, drink alcohol moderately, have sedentary lifestyles, consume calcium-deficient diets and/or have a family history of fractures.^{7,13}

Most men are unaware of their risk. Of the small percentage of men who are aware osteoporosis is preventable, one in five has not discussed it with his physician.⁷ Three out of ten men say they would not see their physicians if they had a loss of height, which is one of the most common symptoms of osteoporosis.⁷ The Gallup study also indicated **fewer than one in four men take a daily calcium supplement.**

There have been no research trials evaluating therapies for men with osteoporosis, so there are **no approved therapies for men.**⁷ However, most physicians are prescribing some of the same medications for men as for women, such as calcitonin or alendronate. Testosterone deficiencies can also contribute to osteoporosis in men.

Women over the age of 40

The onset of menopause has been associated with an increased risk of osteoporosis. In the past, women generally experienced menopause in their 40's. However, while some women may experience hormonal changes during the early to mid 40's, most women today do not experience menopause until their late 40's to early 50's. Because of hormonal changes associated with menopause (primarily estrogen reduction), significant bone resorption occurs during the first four postmenopausal months. Bone loss continues during the next few years. The increase in risk slows over the next five to seven years, but can persist throughout the menopausal years.

Lactose intolerance/dairy allergies

Dairy is actually a poor source of calcium, but many individuals find it difficult to obtain their daily calcium requirements without supplementation if they are unable or unwilling to consume dairy foods. Dairy increases mucus production, and an excessive amount of mucus in the GI tract can interfere with nutrient absorption. Milk in particular is poorly tolerated by many individuals. It is a common food allergen, causing bloating and other digestive disturbances in many people. Humans are the only mammals that consume milk derived from another species (and who continue to consume milk past infancy).

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) estimates that **30 to 50 million Americans are lactose intolerant.**⁷ Those of Asian, African and Native American ancestry are particularly susceptible. Studies on lactose intolerance and increased risk for osteoporosis are inconclusive. Some indicate a connection while others do not.⁷

Dietary Considerations

Alternative dietary sources of calcium include broccoli, kale, turnip greens, dandelion greens, black strap molasses, corn tortillas, buckwheat, whole-wheat products, flounder, salmon, sardines, oats, nuts and seeds, tofu and most vegetables. Individuals who consume a varied diet rich in these foods should have little problem meeting minimum calcium requirements. It is important to note **this type of diet is not typical of today's average American.**

...most men think of osteoporosis as a woman's disease and therefore do not believe they are at risk.

Another dietary factor to consider is the depletion of nutrients from America's food supply as a result of modern cultivation methods. In the past 3 decades, advances have been made in fertilizers, genetically engineered plants and shipping capabilities. Forty to fifty years ago, fruits and vegetables were shipped fresh picked from local sources. Today the same fruits and vegetables are genetically altered to be larger, more disease resistant and more storage friendly. Because produce can be shipped anywhere in the world, much of our produce is picked before it is ripe and allowed to age ripen in a shipping crate. Some crops are artificially ripened (such as tomatoes). Fertilizers allow the same land to be farmed year after year, producing well-grown yet nutritionally stunted food. As a result, even the freshest modern foods contain only a fraction of the nutrition they did only a few decades ago.^{14,15}

Pregnancy and Lactation

There is no strong evidence pregnancy-associated osteoporosis is a serious problem. However, occurrences have been noted mostly **during the third trimester or post-partum period**. Symptoms include back pain, loss of height, vertebral fractures and, less commonly, hip pain and fracture. It is theorized pregnancy-associated osteoporosis occurs because of **increased urinary calcium excretion** and the stress placed on maternal calcium stores.⁷ However, intestinal absorption of calcium increases during pregnancy and 1,25-dihydroxyvitamin D levels increase in response to increased fetal calcium demands. It is interesting to note the majority of women diagnosed with pregnancy-associated osteoporosis are breastfeeding at the time of diagnosis.⁷

Other physiological changes occur during pregnancy that may actually protect bone, especially during the third trimester. These include a surge in estrogen levels and the obvious weight gain that increases pressure on the bones.

Smoking

More than 20 years ago, cigarette smoking was identified as a risk factor for osteoporosis and bone fracture. Since then, studies have shown a **direct relationship between tobacco use and reduced bone density**. The New England Journal of Medicine reports women who smoke 1 pack of cigarettes a day during adulthood have **5 to 10 percent less bone mass** at the age of menopause than do non-smokers.¹⁶ Men who smoke a pack a day over 16 years have **twice the bone loss and average 5.8 percent less bone mineral density** than non-smokers. In fact, **smokers as a whole have double the risk for osteoporotic bone fractures as non-smokers**.^{17,18} Smoking also hinders bone self-repair and slows the healing process.¹⁹

It is difficult to determine the direct results of tobacco smoke on bone loss and repair, as other factors associated with smoking also affect bone density. For instance, smoking can lead to lower bone density in adolescence and young adulthood, as smokers are usually thinner than nonsmokers, more sedentary, tend to consume more alcohol and tend to have more nutritional deficiencies. Female smokers tend to have lower estrogen levels and experience menopause at an earlier age than nonsmokers. One study (Framingham; Kiel and associates) concluded **protective effects of estrogen are eliminated in women who smoke**. Reports from researchers, including Kiel, support the theory that **cigarette smoking has an anti-estrogenic effect**. Smokers have also demonstrated **impaired calcium absorption**.⁷

Alcohol consumption

Light alcohol consumption supplies extra (empty) calories. Moderate to heavy alcohol consumption interferes with nutritional intake, digestion and absorption; particularly the bone-building nutrients such as calcium, magnesium, vitamin C, copper and zinc.²⁰ Typically, **the heavier the alcohol use, the greater the risk for osteoporosis and fractures**. In addition, alcoholics have been noted to have high cortisol levels, which can directly induce bone loss.

Recent studies suggest heavy alcohol consumers may not be the only ones at risk for alcohol-induced bone loss. In one study of social drinkers, men who drank alcoholic beverages ran nearly **2 1/2 times the risk of osteoporosis as non-drinkers**.²¹ In another study, women who drank in moderation, consuming just under 1 ounce of alcohol a day, had over **twice the risk of a hip fracture** compared to women who did not drink.²² It is of interest to note **beer drinkers had a higher risk of hip fracture than those who drank other alcoholic beverages**.²³

Heavy metal exposure

Cadmium, lead and aluminum are among the most common toxic metals found in the United States. These metals **interfere with calcium metabolism.**

❖ Lead

North Americans have the greatest lead exposure risks in the world. Lead is found in paints, gasoline and various industrial processes.^{11,24,25} It is the most widely spread heavy metal contaminant worldwide. Current environmental levels of lead have been shown to be 500 times greater than in prehistoric times due to today's product-manufacturing techniques. Analysis shows that skeletons of the recently deceased contain **500-1000 times more lead than older skeletons.**^{11,25,26}

Twenty percent of American homes contain lead in their drinking water due to old plumbing and the new dripless faucets that are made with metal alloys containing lead.²⁴

Lead interferes with normal functions of **calcium, magnesium, zinc, B vitamins and vitamin C.** In addition to displacing calcium, it **interferes with progesterone utilization,** a hormone imperative to proper bone remodeling.^{11,25} When entering the body, lead travels to the spleen, liver and kidneys. Within a few days it moves to the bones where it is bound and stored in a phosphate matrix.²⁴ This matrix **displaces normal matrix structures in the bone, leaving weak spots.** A blood lead level above 10 micrograms per 100 milliliters of serum is considered dangerous for anyone, especially children. However, lead is a toxic metal and thus is not safe at any level in the human body.²⁴

❖ Aluminum

The average American will ingest about 30 to 50 milligrams of aluminum daily. Modern sources of aluminum include antacids (more than forty antacids contain aluminum), some over-the-counter pain relievers, antiperspirants, hairspray, vaginal douches, beverage cans, cookware, foil wraps, baking soda, baking powder, cake mixes, frozen dough, self-rising flour, processed cheese, pickling salts, nondairy creamers, pizza, toothpaste, cosmetics and food additives. Aluminum has also been identified in soymilk, cow's milk, infant formulas and some teas.²⁴

Aluminum negatively affects bone remodeling by increasing resorption, modifying collagen production and decreasing new bone formation. It binds with **phosphorus in the GI tract and increases urinary excretion of calcium.**²⁷ In fact, insufficient concentrations of phosphorus and/or zinc can increase the risk of aluminum toxicity.²⁴

Aluminum can be absorbed not only through ingestion, but also through the skin and by inhalation. The main problem is that it can be found everywhere and anywhere. Osteoporosis is just one of the diseases associated with aluminum exposure.²⁸

❖ Cadmium

Cadmium is found primarily in cigarette smoke, cheese, paint, colored plastics, fertilizers, batteries, polluted air around cities, industrialized areas and in several manufacturing processes. Cadmium may be a factor in the link between osteoporosis and cigarette smoking. In addition, cadmium **inhibits enzyme formation and nutrient activity, including calcium metabolism.**²⁴ High cadmium levels may be a factor in increased urinary calcium excretion and excessive calcium stone kidney formation.^{24,28}

Heavy soft drink/caffeine consumption

Caffeine functions as a stimulant and diuretic, but also **increases urinary calcium excretion.** Excessive phosphorus (from canned soft drinks) may alter calcium/phosphorus ratios and inhibit calcium absorption.

Diseases

Diseases contributing to increased risk for osteoporosis include:

- ❖ Rheumatoid arthritis
- ❖ Liver or thyroid disease
- ❖ COPD
- ❖ Asthma
- ❖ Depression
- ❖ Metabolic acidosis
- ❖ Diabetes mellitus
- ❖ Chronic diarrhea
- ❖ G.I. disorders

These diseases create various situations within the body affecting calcium excretion and secretion, nutrient absorption and nutrient depletion. In addition, many of these conditions require **medications that deplete nutrients related to bone mineralization**, including calcium.^{7,13}

Medications

Medications that increase the risk of osteoporosis include:

- ❖ **Corticosteroids/Glucocorticoids**
Inhibit calcium absorption in the GI tract, increase urinary excretion of calcium, alter regulation of hormones involved in bone remodeling processes (creating impairment in bone remodeling) and inhibit formation of osteoblasts.⁷
- ❖ **Thyroid hormones**
Increase osteoclastic activity.
- ❖ **Heparin**
Increases osteoclastic activity and decreases osteoblastic activity.
- ❖ **Methotrexate**
Increases urinary calcium excretion and interferes with osteoblastic activity.
- ❖ **Anticonvulsants**
Decrease calcium absorption and interfere with vitamin D activity.
- ❖ **Antacids (containing aluminum)**
Decrease calcium and phosphorus absorption, increase urinary calcium excretion.
- ❖ **Diuretics**
Increase urinary calcium excretion.
- ❖ **Antibiotics**
Alter gastrointestinal flora impacting nutrient absorption, B vitamin production, and vitamin K production. Tetracycline directly inhibits calcium absorption.

Another risk factor found with medications in regard to osteoporotic fractures is the increased risk of falling. Medications such as tranquilizers, sedatives, antidepressants, blood pressure medications and others are attributed to causing 32,000 hip fractures each year due to excessive sedation or imbalance.²⁹

Age

Osteoporosis has been associated with aging. While the disease can occur in adolescents, it is rare and usually secondary to another disease process or to the medications prescribed to treat such diseases. However, due to today's lifestyle and dietary habits, more and more children are at potential risk for osteoporosis. Since the majority of bone mass is accumulated during the first two decades of life, a preventive model requires the healthcare community to focus greater effort on children and teens.

Nutritional Status

According to surveys by the USDA, it is likely that as many as **25% of adolescent females will receive less than the recommended levels of calcium.** This indicates most females are not achieving maximum bone density when they are in their teens. Such deficiencies during youth can account for as much as a 5-10% difference in peak bone mass, significantly increasing the risk for osteoporosis and hip fracture later in life.^{30,31}

Males tend to have greater bone mass than females; this appears to occur after puberty. Until puberty, males and females generally acquire bone mass at an equal rate.³¹ In today's society, so much emphasis is placed on thinness that many adolescent females are simply not getting the basic nutrition they need, let alone the nutritional demands for calcium and bone growth.

Exercise

Physical activity, particularly weight bearing activity, increases peak bone mass. The areas of the skeleton most affected are those under mechanical loads.³² Since more and more of today's youth are decreasing physical activity and engaging in sedentary lifestyle activities, their attainment of peak bone mass during this critical time of growth could potentially be impaired. A minimum of 100mg of calcium is needed daily to positively affect bone mass.³⁰

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bone mass.***

Seasonality

Studies are also being done on **seasonal variations in bone remodeling**. These variations could be factors to consider when interpreting bone metabolism measurement results. The European Vertebral Osteoporosis Study (EVOS) showed **significant elevations in bone formation and resorption markers in men and women during the winter months**. These variations may be due to a vitamin D deficiency as a result of lack of sunlight exposure or to diminished mobility. Studies suggest vitamin D supplementation during the winter months should be considered in all areas of studies of bone metabolism.^{33,34,35,36,37} Vitamin D supplementation (400-800IU/d) alone has improved bone density.



WARNING SIGNS

Warning signs of calcium metabolism problems and potential osteoporosis include:

- ❖ Bone pain
- ❖ Broken bones
- ❖ Loss of height/bone deformities
- ❖ Brittle/soft fingernails
- ❖ Nocturnal leg/foot cramps
- ❖ Restless legs
- ❖ Low back pain/curvature of the lower spine
- ❖ Periodontal disease
- ❖ Receding gums
- ❖ Thin, transparent skin
- ❖ Teeth discoloration, easily chip or crack
- ❖ Decreasing muscle mass
- ❖ Irregular heartbeat
- ❖ Premature graying of hair (up to 50% gray by age 40);
- ❖ Loss of hair

These signs may also be indicators of other mineral deficiencies or imbalances, such as magnesium, manganese, zinc, potassium, or sodium.^{38,39,40,41}



PREVENTION

Nutrition

Consuming the appropriate amounts and types of nutrients is one of the most important measures that can be taken to prevent osteoporosis. Yet, it is critical to understand good nutrition means not only eating the right kinds of foods, but avoiding the wrong kinds of foods as well. In addition, an alkalizing diet will encourage anabolism (building up), but an acidifying diet will contribute to catabolism (breaking down). **pH balance is directly related to osteoporosis. If the pH of the body is acidic, the body will move minerals from bone tissue into the blood in an attempt to alkalize the body.** An acidic pH also increases susceptibility to illness and infection.^{38,39,40,41}

Foods that encourage alkaline pH (thumbs up) include:

<u>Most Alkaline</u>	<u>More Alkaline</u>	<u>Low Alkaline</u>	<u>Lowest Alkaline</u>
❖ Lentils	❖ Broccoli	❖ Almonds	❖ Apricots
❖ Limes	❖ Cantaloupe	❖ Apples	❖ Bananas
❖ Nectarines	❖ Endive	❖ Avocado	❖ Beets
❖ Onions	❖ Garlic	❖ Bell pepper	❖ Blueberries
❖ Pumpkin seeds	❖ Grapefruit	❖ Cauliflower	❖ Brussels sprouts
❖ Raspberries	❖ Kale	❖ Cherries	❖ Flaxseed oil
❖ Sweet potatoes	❖ Kohlrabi	❖ Collard greens	❖ Grapes
❖ Tangerines	❖ Mangoes	❖ Eggplant	❖ Lettuce
❖ Watermelon	❖ Molasses	❖ Lemons	❖ Oats
	❖ Mustard greens	❖ Mushrooms	❖ Okra
	❖ Olives	❖ Peaches	❖ Olive oil
	❖ Parsnips	❖ Pears	❖ Oranges
	❖ Soy sauce	❖ Pineapple	❖ Squash
		❖ Potato	❖ Strawberries
		❖ Pumpkin	❖ Wild rice
		❖ Rice syrup	

Foods that encourage acid pH (thumbs down) include:

<u>Lowest Acid</u>	<u>Low Acid</u>	<u>More Acid</u>	<u>Most Acid</u>
❖ Brown rice	❖ Alcohol	❖ Carrots	❖ Barley
❖ Canola oil	❖ Chard	❖ Chick peas	❖ Beef
❖ Cream	❖ Cheese, aged	❖ Chicken	❖ Beer
❖ Eggs	❖ Cow's milk	❖ Coffee	❖ Brazil nuts
❖ Fish	❖ Lamb	❖ Corn	❖ Carob
❖ Gelatin	❖ Lima beans	❖ Cranberries	❖ Cocoa
❖ Kidney beans	❖ Pinto beans	❖ Green peas	❖ Fried foods
❖ Maple syrup	❖ Plums	❖ Lobster	❖ Hazelnuts
❖ Rhubarb	❖ Prunes	❖ Peanuts	❖ Ice cream
❖ Spinach	❖ Safflower oil	❖ Pecans	❖ Jams/jellies
❖ String beans	❖ Semolina	❖ Pork	❖ Processed cheese
❖ Sunflower oil	❖ Shellfish	❖ Rye	❖ Soy beans
❖ Venison	❖ Tofu	❖ Snow peas	❖ Sugar
❖ Yogurt	❖ Tomatoes	❖ Veal	❖ Table salt
	❖ Turkey		❖ Walnuts
	❖ Wheat		
	❖ White rice		

(Ref. Serammune Physicians Lab, Reston, Virginia, 1995). Table prepared by Dr. Russell Jaffe.

When working with a pH-based diet, test the pH of the urine to determine whether it is alkaline or acidic. This can easily be done with pH hydrion paper. The most important time of day to check is first thing in the morning. The body's pH works in a cycle. Optimal results should yield: (3 a.m. – 3 p.m.) anabolic metabolism, (3 p.m. – 3 a.m.) catabolic metabolism. If a person's first morning urine is less than a pH of 6.5, the pH of the body is acidic, meaning catabolism rather than anabolism is occurring during the night. This is an indicator of strong potential for osteoporosis. Optimally, the urine pH should be between 7.0 and 7.5. Having a patient test their own pH often improves compliance.^{38,39,40,41}

Supplementation

Another key element in nutrition is obtaining the ideal dose of nutrients and minerals. As discussed earlier, **it is difficult to obtain the optimal nutrient dosing in diet alone; supplements can make up the difference.**

Calcium is not the only mineral essential to bone health. Most minerals work synergistically with other minerals and/or proteins.

The following is a list of minerals and other nutrients that play key roles in bone metabolism along with a brief description of each. These nutrients are also important in many other functions of the body, but for the purpose of this article, those functions relevant to bone remodeling are discussed.

<u>Magnesium</u>	<p>Although magnesium actually competes with calcium for receptor sites, it also assists in calcium uptake. Studies indicate that it <u>plays a major role in trabecular bone mass and aids in reversing bone loss.</u> Magnesium is vital to many other activities within the body, including enzyme activity. It also assists in potassium uptake and plays a role in regulating PTH (parathyroid hormone) secretion, which is important in urinary calcium excretion.</p> <p>A huge number of Americans are deficient in this vital mineral, often by as much as 100 mg. per day. For men, it is best taken in a 1:2 magnesium/calcium ratio. For women, it is now thought that a 1:1 ratio is usually optimal. Although dosing recommendations vary widely in the literature, a reliable average can be found between 500 to 1000 mg. daily in men and 500 mg. to 2000 mg. in women. Dosing should be adjusted up or down depending on risk factors. The greater the risk factors, the higher the dose. Magnesium salts vary widely in their solubility and absorbability. Preferred salts would be citrates, malates or chlorides.^{42,43,44,45}</p>
<u>Boron</u>	<p>Trace amounts of this mineral are needed to <u>optimize calcium uptake and metabolism.</u> Since many elderly people have problems with calcium absorption, most can benefit from 1-3 mg. of daily Boron supplementation.^{42,43,44,45} The USDA conducted a study of postmenopausal women who supplemented their diets with 3 mg. of boron daily. The study showed <u>significant reductions in urinary excretion of calcium, magnesium and phosphorus.</u>^{46,47,48,49,50}</p>
<u>Copper</u>	<p>Copper is another trace mineral <u>essential in collagen formation.</u> Collagen makes up the connective tissue of bone matrix. Copper is easily excreted in a poor diet high in sugar and refined foods and is among the minerals most often deficient in the American diet. Recommended daily intake for copper is between 1.5 – 3 mg.^{47,48,49,50}</p>
<u>Manganese</u>	<p>Manganese is <u>essential for proper bone turnover.</u> A deficiency will decrease bone calcification and increase bone resorption. Manganese plays a role in the <u>creation of enzymes responsible for developing the matrix allowing mineralization to occur.</u> Manganese is vital to maintaining spinal disc health and inner ear health (bones). All cartilage & bone tissue synthesis is dependent on manganese.⁵¹</p> <p>Manganese intake recommendations vary from 2mg-15mg. The adequate dose varies depending on each individual's diet. The more refined the diet, the poorer the absorption of manganese.^{52,53,54,55,56,57,58,59}</p>
<u>Phosphorus</u>	<p>Phosphorus is the second most abundant mineral in the body; <u>one fourth of all mineral material is phosphorus.</u> Phosphorus is <u>essential for cell growth and repair, energy production, heart contraction, nerve and muscle activity, calcium, glucose, fat and starch metabolism and pH buffering.</u> Phosphorus combines with calcium to form a mineral salt <u>giving strength and framework to our bones and teeth.</u> While phosphorus is required in adequate supply to help prevent osteoporosis, an overabundance can actually facilitate bone wasting. If our intake of phosphorus is too</p>

<p><u>Phosphorus (cont'd)</u></p>	<p>great, calcium is removed from bone to create a balance if blood levels of calcium are low. Phosphorus <u>must be balanced with calcium and magnesium</u> for all three to properly function. The perfect ratio of calcium to phosphorus intake should be 1:1. In the typical American diet, this ratio can be closer to 1:3 or even 1:4.</p> <p>Phosphorus is readily found in meat, soft drinks and processed foods. While the RDA for this mineral is between 800 mg and 1200 mg., the ratio of 1:1 is most important. Supplementation is rarely needed.^{60,61,62}</p>
<p><u>Silica</u></p>	<p>Silica is Earth's most abundant mineral. Silica is concentrated in the high strength tissues of the body such as arteries, tendons, skin, teeth, hair and collagen. Studies have shown silica appears to <u>increase bone mineralization and strength even in the absence of adequate calcium levels.</u> Its activity appears to assist in strengthening the connective tissue matrix by crosslinking collagen strands. Although there is no established RDA for silica, dosing ranges vary from 30 mg. to 1000 mg. Silica is found in many unprocessed high fiber foods including grains, fruits, vegetables, seeds and grasses such as horsetail.^{63,64,65,66,67}</p>
<p><u>Vanadium</u></p>	<p>Important to bone tissue formation. Vanadium is a trace mineral involved in cellular metabolism and formation of bones and teeth. Vanadium appears to have a close relationship with other trace minerals in the human body. Dosing recommendations range from 5 to 20 mg. <u>Vanadium uptake is decreased in patients who smoke tobacco.</u>^{68,69}</p>
<p><u>Zinc</u></p>	<p>The role of zinc in osteoporosis prevention is multifold. It is needed to <u>produce the matrix of collagen protein threads</u> upon which is deposited the bone forming calcium–phosphorus compound. Zinc is also <u>required for proper calcium absorption.</u> It has <u>an enhancing effect on the activity of vitamin D and has been positively linked to bone repair functions.</u> In the United States, studies have shown only 32% of Americans receive the RDA of 15 mg. of zinc daily. The group with the lowest intake was teenage females – the same group that must have adequate zinc intake to avoid a predisposition to osteoporosis.^{48,70,71,72,73,74,75} Zinc is also involved in over 200 enzyme activities.</p>
<p><u>Vitamin K</u></p>	<p>Vitamin K plays a major role in bone health and formation. Dr. Alan Gaby, a leading researcher in osteoporosis treatments, states that it is <u>as important as calcium in bone formation.</u>²⁸ Vitamin K is <u>required for synthesis of osteocalcin</u> – the bone protein matrix upon which calcium crystallizes. Without osteocalcin, bone would be fragile and easily broken.</p> <p>Supplementation of vitamin K in osteoporotic females has shown a <u>decrease in calcium loss of up to 50%!</u> Vitamin K supplementation is absolutely essential in fracture repair. Studies have shown vitamin K migrates to the fracture site and the rest of the body will be depleted if adequate stores are not available.^{28,76,77} Recommended intake of vitamin K ranges from 70 mg. to studies using 1 mg. daily. Daily requirements should be based on individual needs of the patient. Caution should be taken in those patients who are taking blood thinning drugs such as warfarin and heparin.^{28,76,77,78}</p>
<p><u>Vitamin D</u></p>	<p>Vitamin D is <u>essential for calcium and phosphorus transport into the blood stream.</u> As we age, vitamin D plays a greater role in bone maintenance. Studies now document that as many as <u>80% of all hip fractures are related to vitamin D deficiency.</u>^{79,80,81,82} Although the RDA recommendation for Vitamin D ranges from 200 IU per day to 400 IU, the elderly are at greater risk for depletion due to decreased absorption.^{83,84,85} Doses of 400 IU to 1000 IU have been shown to reduce hip fracture rates among postmenopausal women in northern climates.^{83,84,85} Toxicities have occurred in dosage levels of 2000 IU per day, so staying below 1000 IU per day is recommended.^{86,87}</p>



<u>Vitamin C</u>	Vitamin C's usefulness in the body is almost without limitations. In regard to bone structure, vitamin C is required for the proper formation of collagen – forming the foundation for proper mineralization. This collagen matrix comprises about 30% of healthy bone tissue. Vitamin C also appears to stimulate function of the bone-building osteoblast cells. Recommended dosages vary from the very minimal 60 mg. (as proposed by the RDA) to at least 2000 mg. (by the late Nobel laureate, Dr. Linus Pauling). ^{88,89,90,91}														
<u>B Vitamins</u>	The vitamin B family is essential for our overall good health and proper metabolism. The effects of each B vitamin on bone formation can be narrowed down to three in particular. Vitamin B ₆ (also called P5P) is involved in over 50 enzyme systems and is a co-factor in the crosslinking of collagen strands. B ₆ is also necessary for proper acid production in the stomach that is responsible for liberating minerals from our foods. Vitamin B ₁₂ is necessary in proper function of osteoblasts. The combination of B ₆ , B ₁₂ and folic acid is essential for the proper metabolism of homocysteine. Homocysteine, a major factor in determining heart disease risk, interferes with collagen crosslinking thus leading to a defective bone matrix and osteoporosis. Dosages vary for all of these B vitamins, from product to product. A healthy recommendation for patients is to take a high quality multiple vitamin along with a quality calcium/multi-mineral supplement. ^{43,92,93,94,95}														
<u>Biotin</u>	Biotin aids in cell growth, fatty acid production and utilization of B complex vitamins. ⁶⁹ In one noted animal study, biotin deficiency in chicks resulted in leg deformities. ⁹⁷ Biotin has also shown excellent results in improving brittle fingernails (91% improvement in one study). ^{98,99}														
<u>Vitamin A</u>	Vitamin A is involved in osteoblastic activity in bone matrix formation . Without vitamin A, osteoblasts do not mature and thus do not function properly. Deficiency of vitamin A has also been linked to calcium metabolism problems. Dosing for vitamin A is generally in the 4000 IU to 10,000 IU range. Much of our intake is in the form of beta carotene. ^{90,96}														
<u>Calcium</u>	<p>The value of calcium in the body cannot be overstated. Ninety-nine percent of the body's calcium is found in the bones. The other 1% is found in extracellular fluid, structures and membranes. The body contains about 1200 g. of calcium on average. In addition to its role in bone metabolism, calcium is instrumental in the following processes:¹⁰⁰</p> <table border="0" data-bbox="386 1150 1425 1459"> <tr> <td>❖ Protein and fat digestion</td> <td>❖ Activating enzyme channel for some of the proteolytic enzymes</td> </tr> <tr> <td>❖ Energy production</td> <td>❖ Muscle contraction and relaxation</td> </tr> <tr> <td>❖ Nerve impulse transmission</td> <td>❖ Acetylcholine synthesis</td> </tr> <tr> <td>❖ Neuromuscular activity</td> <td>❖ Involved in blood clotting</td> </tr> <tr> <td>❖ Assisting in absorption of other nutrients</td> <td>❖ Absorption of B12</td> </tr> <tr> <td>❖ Activating enzyme channel ADP → ATP</td> <td>❖ Facilitates secretion of certain hormones and hormone releasing factors</td> </tr> <tr> <td>❖ Activating enzyme channel pancreatic lipase</td> <td>❖ Cell membrane permeability</td> </tr> </table> <p>Calcium supplementation plays a vital role in maintaining overall health. As noted above, calcium is essential to many everyday functions. This necessity combined with the following deficiency statistics proves the value of daily calcium supplementation.^{48,101,102}</p> <ul style="list-style-type: none"> ❖ 42% of the U.S. population consumed less than 70% of the RDA for calcium (a recommendation considered too low by many high ranking nutritional leaders) ❖ 95% of females age 11–18 did not consume the RDA ❖ 79% of males age 11–18 did not consume the RDA ❖ 66% of U.S. women age 18–34 did not consume the RDA ❖ Average postmenopausal female consumes 511 mg. calcium–(barely 1/3 of the RDA minimum) ❖ 25% of women consume less than 300 mg. calcium/day 	❖ Protein and fat digestion	❖ Activating enzyme channel for some of the proteolytic enzymes	❖ Energy production	❖ Muscle contraction and relaxation	❖ Nerve impulse transmission	❖ Acetylcholine synthesis	❖ Neuromuscular activity	❖ Involved in blood clotting	❖ Assisting in absorption of other nutrients	❖ Absorption of B12	❖ Activating enzyme channel ADP → ATP	❖ Facilitates secretion of certain hormones and hormone releasing factors	❖ Activating enzyme channel pancreatic lipase	❖ Cell membrane permeability
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Calcium Supplementation

Not all calcium supplements are created equal. Different forms of calcium exhibit different levels of bioavailability. Calcium ion availability is influenced by many factors. Stomach pH is an initial concern as some calcium products rely on adequate stomach acid to properly dissolve and activate. One study indicates as much as 33% of the population over age 60 is achlorhydric (almost no stomach acid production whatsoever).¹⁰³ In addition, some calcium products work as an antacid (causing an achlorhydric condition), thus defeating their own purpose. Antacids work to lower acid thus making individuals who are achlorhydric worse. Following is a list of the most common calcium sources and their positives and negatives with respect to osteoporosis.

- ❖ **Calcium carbonate and salts** require an acidic stomach for ionization. As mentioned previously, this form of calcium is impacted negatively by its own ability to neutralize stomach acid. Calcium carbonates also **carry a risk of kidney stones and can cause gas, bloating and constipation** in some individuals. While these are the most common forms of calcium (and the least expensive) on the market, they have some of the **poorest absorption rates**.¹⁰⁴ Many of the inexpensive, commercially available products containing calcium carbonate do not contain the other vitamins and minerals necessary for proper mineralization of bone. Many OTC brands, such as **Tums**, fall into the carbonate category.
- ❖ **Calcium citrate** offers a decreased risk of kidney stone formation and is **well absorbed, even in a low stomach acid environment**.¹⁰⁴ The citrate salt also does not interfere with iron absorption. Calcium citrate is often combined with other calcium salts such as maleate to form a more complete calcium product. Calcium citrate is modestly priced and well-tolerated, but still must be combined with other bone building components.
- ❖ **Calcium Malate** salts are also well absorbed. Both malate and citrate are made up of fairly large molecules, and the majority of the compound is comprised of the salt. Thus, a fairly large tablet is necessary to deliver adequate calcium dosing. Malate is almost always combined with another form of calcium.¹⁰⁵
- ❖ **MCHC, microcrystalline hydroxyapatite calcium**, is a whole bone extract from bovine sources. MCHC contains all the necessary ingredients that comprise bone, including calcium, magnesium, phosphorus, protein, mucopolysaccharides, and trace minerals. MCHC is the only form of calcium that has been **clinically proven to reverse osteoporosis**.¹⁰⁶ MCHC actively deposits the bone-forming matrix in both trabecular and cortical bone, thus increasing bone mass through the entire cross-section of bone. MCHC tends to be the most expensive and highest quality calcium supplement. Most MCHC supplements are combined with other essential nutrients for optimal bone mineralization. MCHC has been used extensively in Europe where osteoporosis awareness and education has been in place for decades.^{106,107,108,109,110}

Weight-bearing Exercise

Exercising for at least 45 minutes three times a week and supplementing with a high-quality calcium product has been shown to **increase bone mass by as much as 5.2%**.¹¹¹ If the other nutrients important to bone remodeling are included, bone density should increase more significantly.

Only weight-bearing exercise impacts bone density. Strength training with light weights, walking, jogging, racquet sports, aerobics and dancing are all excellent ways to help prevent osteoporosis. In fact, recent studies on overall osteoporosis treatments relative to exercise programs and bone mineral density provide evidence that **osteoporosis can be prevented and even reversed in both premenopausal and postmenopausal women who exercise regularly**.¹¹²

Homeopathy

Homeopathics can be used in several ways to assist in the management and prevention of osteoporosis. Unlike other natural products, homeopathy is approved and legally regulated by the Food and Drug Administration. Thus, specific treatment claims can be tested, approved and stated in regard to their efficacy.

As mentioned previously, heavy metals can play a part in fooling the body to implant toxic substances into the bone matrix and other soft tissues. **Homeopathic xenobiotic detoxifiers** can be used safely, gently, and effectively to assist in the removal of these biotoxins. Xenobiotics should be a part of any detoxification program for anyone who has been exposed to osteoporotic risk factors such as heavy metals, chemicals, industrial pollutants, dental fillings and adhesives, pesticides, fertilizers, strong electrical fields, high levels of toxic cosmetics, or environmental toxins.

Homeopathics can also be used to **encourage healing of osteoporotic fractures**. From a clinician's standpoint, the best approach is to enroll in a homeopathic education program or enlist the assistance of a practitioner trained in homeopathy to get optimal results with this very powerful yet safe complimentary approach.

The following homeopathics have been shown to be involved in calcium absorption, according to the *Materia Medica*. Furthermore, a combination product that includes all or many of the remedies listed below will generally prove more efficacious than taking just a few single remedies. In addition, potencies in 30x or 30c (high potency) can force the issue in a poor healing patient and are therefore highly recommended by many practitioners of homeopathy. The following ingredients have different pathways of healing for osteoporotic patients.

- ❖ **Arsenicum Album** – Sciatica, burning pain and chronic aches and pain; degenerative changes.
- ❖ **Aurum Metallicum** – Paralytic, tearing pain in joints.
- ❖ **Calcarea Carbonica** – Weakness of extremities; swelling in joints, especially the knee.
- ❖ **Calcarea Fluorica** – Malnutrition of bones; osseous tumors; aggravated on beginning to move and ameliorated on continued motion.
- ❖ **Calcarea Phosphorica** – Non-union of fractured bones; stiffness and pains in joints and bones.
- ❖ **Fluoric Acid** – Inflammation of joints and fingers; necrosis of the bones.
- ❖ **Fluoricum Acidum** – Inflammation of joints. Caries and necrosis of bones.
- ❖ **Hekla Lava** – Osteitis, osteosarcoma, periostitis and bone necrosis.
- ❖ **Silicea** – Weak spine. Pains through hips, legs and feet.
- ❖ **Silicea Terra** – Diseases of bones; caries and necrosis; sciatica; pains through hips, legs and feet.
- ❖ **Staphysagria** – Extremities feel beaten and painful.
- ❖ **Symphytum Officinale** – Irritable bones at point of fracture and stump after amputation; injuries to sinews, tendons and periosteum.
- ❖ **Rhus Toxicodendron** – Soreness of condyles of bones; reduces pain and stiffness; affects fibrous tissue – joints, tendons, sheaths; aponeurosis.

Herbs

Herbs may also play a valuable role in osteoporosis treatment and prevention. Again, combination formulas are available that have been customized to be osteoporosis-specific. To achieve optimal efficacy, these combination remedies should contain all or most of the following herbs:

- ❖ **Alfalfa** – (*Medicago Sativa*) Rich in trace minerals, calcium, vitamins A, D, E, K, carotene and digestive enzymes.
- ❖ **Angelica** – (*Angelica ArchAngelica*) Effective at reducing pain, including arthritis.
- ❖ **Arnica** – (*Arnica Montana*) Its action is a stimulant and a diuretic; pain relief.
- ❖ **Calendula** – (*Calendula Officinalis*) Beneficial for reducing inflammation; wound healing; antiseptic
- ❖ **Cayenne** – (*Capsicum Frutescens*) Used for stomach problems, cramping pains and diseases of the circulatory system; bringing nutrients to the bones.
- ❖ **Horsetail** – (*Equisetum Arvense*) Rich in minerals and silica; supports bone structure.
- ❖ **Hydrangea** – (*Hydrangea Arborescens*) Used for urinary tract disorders. May have positive influence on reabsorption of minerals through the kidneys.
- ❖ **Meadowsweet** – (*Filipendula Ulmaria*) Contains salicin, a pain-reducing compound.
- ❖ **Pleurisy Root** – (*Asclepias Tuberosa*) Asthma, bronchial congestion, colds, fever, flu. Has documentation showing relief of rheumatic pain and digestive difficulties.
- ❖ **St. John's Wort** – (*Hypericum Perforatum*) Excellent for treating open wounds, sores and depression. Shows strong relief for neuralgic pain, sciatica, and rheumatic pain.
- ❖ **Bromelain** – Instrumental in protein breakdown to amino acids. For mineral transport into the circulatory system from the GI tract. Helps to reduce inflammation.

Phytoestrogens

Phytoestrogens can play a strong role in the prevention and support of osteoporosis. These natural healers fall somewhere between nutritional and hormonal approaches.

Phytoestrogens are **plant compounds exhibiting estrogen-like activity**. They are comprised of three main classes: soy isoflavones, lignans and coumestans. In humans, lignans and isoflavones are converted into compounds that are structurally similar to endogenous estrogens. The major isoflavones—and the ones most heavily researched—are **genistein and daidzen**. These metabolized phytoestrogens exhibit weaker activity than human estrogens and do not stimulate abnormal breast or tissue growth. They compete with other estrogens for the same receptor sites, and prevent xenoestrogens from binding to those sites. Xenoestrogens are chemicals that are non-estrogenic and have either no effect or a negative effect in the body.

It is thought that while conferring the benefits of estrogen without the side effects, phytoestrogens also antagonize estrogen in type II estrogen receptors in the breast. This means the **risk of breast cancer associated with estrogen is decreased**. In-vitro studies have shown **phytoestrogens inhibit cancerous cell growth in the presence of estradiol**.¹¹³

*Studies indicate the existence of **bone-building benefits derived from soy**.*

Studies indicate the existence of **bone building benefits derived from soy**. One study completed at the University of Illinois at Champaign-Urbana found postmenopausal women who consumed high concentrations of soy had healthier, stronger bones. Study results indicate **significant increases in bone mineral content as well as greater bone density of the lumbar spine**.¹¹⁴ Another study completed at the University of Illinois at Chicago found **soy protein not only improved bone density, but improved bone quality as well**. The same study found soy prevented the ovarian-hormone-deficiency-associated increase in serum cholesterol.^{114,115}

In December 1997, *Archives of Internal Medicine* published a two-year, double blind study completed at the University of California–San Francisco, involving 406 menopausal women.¹¹⁴ In addition to phytoestrogens, these women consumed 1000 mg. of calcium daily. Results showed **increases in bone mineral density at the spine, hip and other skeletal areas**, while women receiving placebo continued to lose bone mass. Simultaneously, estrogen-associated side effects were not present or were minimal. There were **no increases in vaginal bleeding or endometrial hyperplasia**. **Symptoms such as breast**

tenderness, headaches and nausea were minimal in comparison to standard hormone therapies. Phytoestrogen dosing in the study was equivalent to two servings of soy daily.

Sources of phytoestrogens include anything in the legume family – soybeans, peas, red clover and most beans. They are also found in alfalfa and black cohosh.

Hormones

Hormonal excesses or deficits can create metabolic disturbances negatively affecting bone remodeling. These hormones include progesterone, testosterone, thyroid, parathyroid, DHEA, estrogen and cortisol. **Progesterone has been shown to stimulate bone formation. Testosterone builds bone density. Thyroid hormones increase osteoclastic activity. Parathyroid hormones affect urinary excretion of calcium.** DHEA and cortisol are steroid hormones secreted by the adrenal glands. Elevated cortisol levels will lead to bone demineralization. DHEA is a precursor for androgen hormones, including estrogen. As such, it **may stimulate calcium absorption and bone mass retention through regulation of osteoclastic activity.**^{116,117,118,119}

It is important to note the adrenal gland produces small amounts of estrogen. Considering all the effects of the adrenal glands and hormones in the body, it stands to reason that **supporting healthy adrenal function will promote overall health and bone metabolism.** Laboratory tests are available to accurately assess cortisol and DHEA levels, mapping out the functionality of the adrenals. (See section on Laboratory Tests).



MENOPAUSE AND HORMONE REPLACEMENT THERAPY

Hormone replacement therapy and menopause are two very broad, interlinked and controversial subjects. Their interplay with osteoporosis is vital, complex and worthy of days of discussion. Therefore, a brief but direct discussion of HRT and menopause is necessary to complete this article. Future issues of *Natural Choices/Informed Decisions* will describe these topics in detail.

Menopause has a profound effect on bone density. Plummeting bone density has been associated with decreased hormone production as a woman enters menopause. These hormones mainly consist of progesterone, estradiol, estriol, estrone, and testosterone. A great controversy exists regarding which hormone or hormones cause the decrease in bone density. When HRT started in the 1960's, estrogen supplementation was the primary treatment used. It is difficult to ascertain whether these therapies were helpful or harmful. The estrogens used were derived from horses, which are not the same as human estrogens but do exhibit estrogenic action in the body. While these therapies may have shown decreased rates in bone fractures, the benefits were offset by **increases in endometrial and breast cancer, gall bladder disease, fibrocystic breast disease, abnormal bleeding, and fluid retention.**^{111,120}

To remedy some of the imbalances created by this therapy, in the late 1970's progesterone was added (in the form of progestins) to the regimen. Progestins are not identical to human progesterone, but rates of endometrial cancer declined as a result of this new form of HRT.

In the late 1980's an HRT revolution began with the more widespread use of "natural" hormones. These "natural" hormones were synthetic yet exacting to the hormones present in the human body. **One study involving the old versus the new HRT protocols showed up to a 50% decrease in osteoporotic fractures.**¹¹¹

HRT may prove to be an excellent approach to osteoporosis, but many long-term risks must still be exposed. HRT therapy in the current medical model involves considerable guesswork even though accurate laboratory testing is available. Other factors such as adrenal function and production of hormones from other cells in the body should be taken into consideration. For HRT to be a useful and safe approach in osteoporosis, **each individual must be tested and thoroughly evaluated** to insure that, first and foremost, no harm is done to the patient! Most menopausal women who start on HRT discontinue its use within one year because of side effects. Much safer and proven alternatives with fewer side effects exist in the battle against osteoporosis. In these authors' opinions, HRT should not be the primary nor the only approach in treating a menopausal female at risk for osteoporosis.



ADRENAL GLANDS AND BONE LOSS

The adrenals, though small in size, play a very large part in total body function. The adrenals are the primary source of cortisol. As mentioned, **corticosteroids in excess can cause significant bone loss**. The adrenal glands help deal with stress, both physical and emotional.

The adrenals affect and are affected by all other hormonal systems in the body, including the ovaries or testes, thyroid, parathyroid, pituitary, pancreas, and others. All of these hormonal systems influence the production of healthy bone. Therefore, it is obvious the adrenal glands are powerful influences on overall health in addition to osteoporosis. They must be considered when preparing an osteoporosis regimen for an ill patient. To evaluate adrenal function, an ASI (Adrenal Stress Index) laboratory test should be performed.^{121,122,123,124}



LABORATORY TESTS FOR MEASURING OSTEOPOROSIS RISK

Non-invasive home laboratory tests can be a useful tool for healthcare professionals to accurately evaluate and assess patients for osteoporosis risk factors. The following labs are simple, accurate and utilize the latest technology available. Laboratory testing validates assessment risks and can be used to monitor response and progress to a regimen.

Adrenal Stress Index (ASI) – A proper Adrenal Stress test measures:

- ❖ **24-hour cortisol production** at selected time frames corresponding to the body's natural biorhythm. Cortisol has a major affect on our energy maintenance, immune function, hormones and feedback to other organ systems.
- ❖ **DHEA levels** (the building block for other hormones in the body)
- ❖ **SlgA levels** (a measure of proper gut function and determinant of leaky gut syndrome)
- ❖ **Antigliadin** (an indicator of gluten sensitivity). A person with a significant sensitivity to gluten proteins will never feel better until these proteins are removed from the diet because gluten sensitivity can negatively affect all GI absorptive abilities.

Approximately 90% of all patients will generate abnormal results in at least one of these categories. This is the test of choice in most cases because **poor adrenal health will contribute to poor overall health**.

UMM – Urine Mineral Metals – This article has outlined the need for the presence of many minerals to allow healthy bone growth and reformation. A UMM test can measure these essential elements. The test also **determines toxic exposure** to heavy metals and potentially toxic substances that can impair proper bone maintenance. The UMM is a 24-hour urinary catch allowing for accurate daily averaging to assess elemental levels. These levels can assist the practitioner in individualizing patient care.

Dpd- Bone Resorption Test - The Dpd test measures deoxyypyridinoline crosslinks, a **specific biochemical marker for bone resorption**, which is composed of bone and type 1 collagen. Deoxyypyridinoline is almost exclusively specific to bone tissue. It is the molecule responsible for the integrity and strength of bone. Additionally, it forms the “net,” or matrix, in which calcium and other minerals that make up healthy bone precipitate. These indicators are excreted in the urine during bone loss. Therefore, one simple, non-invasive home specimen taken from the first or second morning void (before 10 AM) is all that is required to detect the rate of current bone loss.

- ❖ In women, if the Dpd results are higher than **7.4 nM/mM**, the result is considered abnormal.
- ❖ For men, anything above **5.4 nM/mM** is abnormal.

Although elevated Dpd levels usually return to normal soon after aggressive bone adsorption therapy is initiated, they may rise if this therapy is discontinued. It is recommended that **3 to 6 months after beginning therapy, the patient be tested again** to measure their response to therapy. The patient should be re-tested approximately every 6 months for tracking purposes, adherence to protocol and continued success in the current regimen.

STP – Short Thyroid Panel – Abnormal thyroid function can be indicative of metabolic and/or hormonal irregularities that can affect a patient's overall health. This can translate into **improper uptake and usage of minerals necessary to prevent osteoporosis**. The STP uses a single first morning saliva sample to directly measure 4 important factors in thyroid function. By measuring free unbound T₄ (levothyroxine), free unbound T₃ (triiodothyronine), TSH (thyroid stimulating hormone) and TPO (an anti-thyroperoxidase antibody), osteoporosis risk factors can be determined based on thyroid function. Thyroid disease is the second most common endocrine disorder behind diabetes.

Food Allergy Testing – Food allergies affect mineral absorption by stimulating negative immune reactions such as IgG and IgE. These reactions can cause excessive mucus production, inflammation of the GI lining, and **decreased absorption of minerals** necessary to help prevent or reverse osteoporosis. Even severe food allergies can go on for years without proper diagnosis. Food allergies can be immediate reactions (RAST test) or delayed (ELISA test). The ELISA test tends to pick up many hidden allergies that most individuals do not realize they have.

Bone Density Screening - The Sahara Clinical Bone Sonometer is the diagnostic screening machine of choice. It performs a **quantitative ultrasound measurement of the calcaneus** (heel bone), the results of which can be used in conjunction with other clinical risk factors as an aid in the identifying osteoporosis and medical conditions leading to reduced bone density, and ultimately in the determination of fracture risk. Sahara measures the speed of sound (SOS, in m/s) and broadband ultrasonic attenuation (BUA, in dB/MHz) of an ultrasound beam passed through the heel, and combines these results to obtain the Quantitative Ultrasound Index (QUI). This output is used to calculate an estimate of the Bone Mineral Density (BMC, in g/cm²) of the heel.

Sahara is the only ultrasound bone densitometer that **estimates BMD and determines T-scores**. Sahara results can be used to derive Z-scores, which are important for predicting fracture risk.

Questionnaires – Questionnaires can take the guesswork out of identifying individuals at risk. In other words, even if your body type and ethnicity do not make you a prime candidate for osteoporosis, other risk factors may. A quality questionnaire needs to take many factors into account in order to be accurate. The many facets of osteoporosis need to be addressed, such as magnesium and calcium intake, vitamin D intake, individual risk factors of diet and/or lifestyle, stress, toxicity exposures, etc.

First, patients should complete a **calcium intake questionnaire**. This questionnaire lists common foods, broken down by calcium content, in order to get an idea of the patient's daily dietary calcium consumption. 75% of all patients will generate a failing score on this questionnaire, reinforcing the need for high-quality supplementation.

Magnesium and Vitamin D deficiency questionnaires are also available. These can help practitioners customize protocols of care based on the severity of the patient's deficiency.

Based on the results of these quick forms, the practitioner can determine if it is necessary for the patient to fill out the entire **Osteoporosis questionnaire**. This is a longer, more in-depth form which, in most cases, will help to pinpoint the specific dietary and lifestyle issues that are placing the patient at

risk. In many cases, toxicity risks are exposed (metals, chemicals, etc.). Adrenal dysfunction, amino acid deficiencies, nutritional deficiencies and other issues can also be uncovered with questionnaires. Changes can then be made where appropriate to reduce risks and allow patients to lead healthier lives.

Many times, Osteoporosis may be just the tip of the iceberg in regard to risks that a patient may face. A full **Health Assessment Questionnaire** can be invaluable in picking up other risk factors that may compromise the future health of each patient.



SUMMARY – PROTOCOLS

The idea of a standard protocol for all patients in regard to osteoporosis is unrealistic. Each patient should be personally assessed to identify all outstanding risks, and a program recommended based on the risks and the outcome goals. As noted, prevention is the key in the fight against osteoporosis. Prevention should take the form of **daily supplementation with a good quality calcium product** in combination with other essential minerals, vitamins, and helpful herbs.

When choosing a quality calcium supplement, a mixture of highly bioavailable calciums is a must. When choosing a product with MCHC as a base ingredient, keep in mind that MCHC has a 24-28% calcium yield. True microcrystalline structures will not yield more than this. Many nutraceutical companies make claims that boast higher yields. However, if the MCHC product yields greater than 28% elemental calcium, some other part of the structure must be compromised, creating a product that is not truly MCHC. Products listing higher yields, thus being altered, lead to a **potential for reduced bioavailability**.

National Institutes of Health Daily Calcium Intake Recommendation Chart

- Children 1-5 years: 800 mg
- Children 6-10 years: 800 to 1200 mg
- Ages 11 to 24: 1200 to 1500 mg
- Men 25-65: 1000mg
- Men 65+: 1500mg
- Women 25-50: 1000 mg
- Women 50-65 (on estrogen): 1000 mg
- Women 50-65 (no estrogen): 1000 mg
- Women 65+: 1500 mg
- Women Pregnant or Nursing: 1200 mg

Magnesium should be in a bioavailable form such as an amino acid chelate, maleate or aspartate. Other minerals should also be in equally bioavailable forms. Vitamins such as **E, C, K, and D are also necessary** for proper absorption and bone mineralization.

In advanced cases of osteoporosis, aggressive treatment is mandated. Because of the fragility of health in the advanced osteoporotic patient, a combination therapy is advised. In conjunction with the previous calcium/mineral recommendation, addition of recommended **herbals, a high potency vitamin, mineral, and amino acid supplement and a synergistic homeopathic combination should be utilized**. This combination is necessary in order to rebuild the overall health of the patient. Well-formulated nutritional products should contain:

- | | | |
|--------------------------------|--------------------------|------------------------------|
| ▪ Adrenal Enzymatic Powder | ▪ Hypothalamus Substance | ▪ Niacin (Vitamin B3) |
| ▪ Vitamin C | ▪ Potassium Citrate | ▪ Oxbile |
| ▪ Beta Carotene | ▪ Kelp Extract 4:1 | ▪ PABA |
| ▪ Betaine HCl | ▪ L-Arginine/ | ▪ Papain |
| ▪ Biotin | ▪ L-Pyroglutamate | ▪ Pituitary Enzymatic Powder |
| ▪ Boron Citrate | ▪ Phosphatidyl Complex | ▪ Pregnenolone |
| ▪ Bromelain 600 | ▪ L-Glutamine | ▪ Vitamin B6 from P5P |
| ▪ Calcium | ▪ L-Methionine | ▪ Riboflavin (Vitamin B2) |
| ▪ Pantothenic Acid | ▪ L-Ornithine | ▪ Selenium Aspartate |
| ▪ Vitamin D3 | ▪ L-Tyrosine | ▪ Soy Sprout Extract |
| ▪ Citrus Bioflavonoids Complex | ▪ Vitamin K | ▪ Thiamine (Vitamin B1) |
| ▪ Copper Aminomin | ▪ Magnesium | ▪ Vitamin E |
| ▪ Cyanocobalamin (Vitamin B12) | ▪ Phosphorus | ▪ Trace Minerals |

- Iron Fumarate
- Folic Acid
- Horsetail Extract
- Manganese Aspartate
- Molybdenum Aminomin
- NAC
- Vanadyl Sulfate Hydrate
- Zinc Aspartate
- Microcrystalline Cellulose

Well-formulated herbal products should contain all or most of the following:

- Alfalfa
- Angelica
- Arnica
- Beet Root
- Calendula
- Cayenne
- Comfrey
- Dandelion
- Echinacea
- Horsetail / Shavegrass
- Hydrangea
- Marsh Mallow
- Pleurisy Root
- Queen of the Meadow/Meadowsweet
- St. John's Wort
- Turmeric

Well-formulated homeopathics should contain all or most of the following (preferably in a 30x potency):

- ARSENICUM ALBUM
- AURUM METALLICUM
- CALCAREA CARBONICA
- CALCAREA FLUORICA
- CALCAREA PHOSPHORICA
- FLUORICUM ACIDUM
- HEKLA LAVA
- RHUS TOXICODENDRON
- SILICEA TERRA
- STAPHYSAGRIA
- SYMPHYTUM OFFICINALE

Glandulars (including adrenal, hypothalamus and pituitary) can assist in stimulation of the HPA axis to help speed healing.

As stated earlier, soy would be highly advantageous as a source of phytoestrogens. Genistein isoflavones have been closely studied and have been shown to be effective. Therefore, the soy **product used should be based on genistein**, although it may contain other forms of isoflavones as well. Osteoporosis-specific combinations containing soy are available. However, it is important to ensure the product contains high-quality forms of calcium and highly bioavailable vitamins and nutrients. Soy dosing varies based on each individual's situation and based on laboratory results. However, a range of 15-35 mg daily is a good rule of thumb.



FINAL REMARKS

In the future, the impact of osteoporosis on our healthcare system will be astronomical. Opportunities will abound for healthcare practitioners who are on the "cutting edge" in providing a preventative model including natural alternatives. Your expertise in determining and identifying risks factors in each individual will result in safe and effective recommendations. You will have the knowledge to provide an important service to your clients that will greatly benefit their health. **Osteoporosis no longer has to be a health risk associated with aging, nor does it have to be a chronic irreversible problem for those who have it today.** The information presented here should allow you to help many patients who are at risk as well as those who already have the disease.

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