AOR CODE: AOR04086

Premium

Bone Basics

Superior Bone and Joint Health Formula

- Increases calcium absorption
- Stimulates bone growth
- Effective sources of nutrients in research-based doses and forms

Gluten Free  Non-GMO  Bone Health

AOR Code  Variant
AOR04086 120 CAPSULES
AOR04085 240 CAPSULES
AOR04231 360 CAPSULES

Details
Bone Basics is more than just a calcium supplement for bone health. It is a complete bone-building formulation that includes nutrients which are fundamental for maintaining mineral balance in the bone matrix and for supporting healthy joints. Bone Basics is unique because it serves not only to reduce bone loss but to maintain or even increase bone growth.

Label Info

Discussion
Bone Basics™ is a multi-nutrient combination designed to support bone health, helps in the development and maintenance of teeth, cartilage and gums and helps in connective tissue formation, production and repair, and also helps in the maintenance of proper muscle function. It features a hydroxyapatite complex (MCHA), an extract of bovine bone derived from New Zealand pasture-fed, free-range livestock not subjected to routine antibiotics or rBGH. Calcium intake, when combined with sufficient vitamin D, a healthy diet, and regular exercise, may reduce the risk of developing osteoporosis.

Product Variation

Product Code  Size
AOR04086  120 CAPSULES
Supplements Facts

Serving Size: 6 Capsules

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
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<tr>
<td>Calcium (from bone meal, MCHA)</td>
<td>900 mg</td>
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<tr>
<td>Phosphorus (from bone meal, MCHA)</td>
<td>312 mg</td>
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<tr>
<td>Boron (Citrate)</td>
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<tr>
<td>Copper (Citrate)</td>
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<td>Magnesium (Ascorbate, Citrate, Glycinate)</td>
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<td>Manganese (Bisglycinate)</td>
<td>5 mg</td>
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<td>Zinc (Citrate)</td>
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<td>Vitamin C (Ascorbic Acid, Magnesium Ascorbate)</td>
<td>100 mg</td>
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<tr>
<td>Vitamin K2 (MK-7/MK-4)</td>
<td>120 mcg</td>
</tr>
<tr>
<td>Vitamin D3 (Cholecalciferol)</td>
<td>1000 IU (25 mcg)</td>
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†Ossein microcrystalline hydroxyapatite complex (MCHC) is lyophilized bone meal guaranteed free of bovine spongiform encephalopathy.

Non-medical ingredients:

Non-medicinal ingredients: sodium stearyl fumarate, hydroxypropycellulose and microcrystalline cellulose Capsule: hypromellose.

Guarantees

AOR™ guarantees that all ingredients have been declared on the label. Contains no wheat, gluten, nuts, peanuts, sesame seeds, sulphites, mustard, dairy or eggs.

Adult Dosage

Take up to 6 capsules daily with meals, or as directed by a qualified health care practitioner. Take a few hours before or after taking other medications.

Cautions

Consult a health care practitioner prior to use if you are pregnant or breastfeeding or taking blood thinners.

Source

Calcium & phosphorus – MCHC, a lyophilized, defatted bone tissue from free-range, pasture-fed New Zealand bovine livestock not subjected to routine antibiotics or rBGH.

Guaranteed free of bovine spongiform encephalopathy

Vitamin D3 - Lanolin from sheep wool
Glucosamine - New vegetarian source

MK-7 - Soy

**Main Application**
Excellent source of calcium and other nutrients

Bone health

Joint health

**Disclaimer**
The information and product descriptions appearing on this website are for information purposes only, and are not intended to provide or replace medical advice to individuals from a qualified health care professional. Consult with your physician if you have any health concerns, and before initiating any new diet, exercise, supplement, or other lifestyle changes.

**Research**

**Background**

**Are you in balance?**

Calcium is critical to the body for more than bone health, in fact it is essential for many vital functions such as normal nerve transmission, blood clotting and muscle contraction. Every cell in the human body uses calcium for basic functions and for this reason, the amount of calcium circulating in the blood (the calcium balance) is tightly controlled within a very narrow range. It follows that disturbances in the sensitive calcium balance are serious. Therefore, the body has developed efficient mechanisms to deal with acute alterations in circulating calcium levels. However, when the body needs to continually deal with either excessive (hypercalcaemia), or inadequate (hypocalcaemia) blood calcium, this can come at the expense of long term health. Indeed excessive calcium levels in the blood can result in a myriad of negative outcomes. At its extremes Hypercalcaemia is linked with kidney stones, bone pain, nausea, depression and insomnia. By contrast a shortage of circulating calcium will see the body strip the necessary calcium from the skeleton (the body’s natural reservoir). Over time this comes at a significant cost to overall bone health and can lead to osteopenia and, ultimately, osteoporosis which carries with it a much higher risk of bone fracture. The correct balance is maintained by the parathyroid gland, mediated by Parathyroid Hormone (PTH), which, through a complex series of functions is able to manipulate blood calcium levels for optimal function.

**Multis Just Don’t Cut It**

Traditional methods of maintaining bone health correlate with the efforts of health conscious individuals who supplement with a daily multi-vitamin/multi-mineral. Users of such an essential supplement (combined with a sensible diet) often assume that it covers something as elemental as bone health. The fact of the matter is that people in the high-risk demographic for developing osteopenia likely have a higher need for certain specific essential nutrients, especially minerals. Of these, calcium is certainly one of the most familiar. Most recommended daily allowances for calcium
stand at around 1,000 milligrams, although 1,500 milligrams are recommended for those in the osteopenia high risk group. Even with the effects of processing taken into account, calcium is still prevalent to such a degree in common dairy foods such as milk and cheese that deficiencies are not as widespread as that of other minerals. Nevertheless, deficiencies do occur, and it is noteworthy to remember that even the finest multi-vitamin/multi-mineral one-a-days rarely contain more than 300 milligrams of calcium.

**Bone Basics** is a full-spectrum bone health formula that contains various nutrients at balanced doses in their most effective forms known to promote healthy bone formation and joints. Due to the type of calcium provided by Bone Basics, this formula not only slows bone loss but may even promote both growth. Bone Basics now contains both MK-4 and MK-7 as sources of Vitamin K2.

**Calcium from MCHC**
MCHC is a freeze-dried extract of bovine bone, and this process of lyophilization is important in retaining the intact microcrystalline structure of whole bone. This is a significant differentiation from regular bonemeal, which uses a heat-treated process called “ashing”. Many of the unique bone-building factors of MCHC are heat-sensitive and simply do not survive this process, and this has been demonstrated in clinical studies comparing MCHC directly to bonemeal. MCHC is, in effect, a full-spectrum multiple nutrient source in its own right. However, it is particularly rich in calcium, and the type of calcium in MCHC has been clinically proven in over 30 years of randomized, double-blind, controlled clinical trials to be the best calcium source for bone building and maintenance. Other calcium sources such as calcium gluconate, calcium citrate, calcium carbonate, calcium citrate-malate and even coral calcium (which in fact is simply calcium carbonate with a sprinkling of trace minerals) may be capable of slowing down the rate of bone loss. MCHC, in contrast, has actually been proven to halt and even reverse bone loss attributable to osteoporosis.

**Glucosamine**
Glucosamine is an aminomonosaccharide, meaning that it is the product of a synthesis between glucose and an amino acid – in this case, glutamine. Glucosamine sulfate is produced naturally in the body by chondrocytes in cartilage to help maintain and build healthy joint tissue. The main basic purpose of glucosamine is to create long chains of modified disaccharides called glycosaminoglycans (GAGs), which the joints and cartilage require for repair. The GAGs are the main component of proteoglycans (PGs), which along with chondrocytes and collagen, make up cartilage. Glucosamine is also converted in the body to N-acetyl-glucosamine, which in turn is critical to the formation of hyaluronic acid. Hyaluronic acid is the central component of synovial fluid which acts as a lubricant in the joints. Since the cartilage in the joints protects the bone ends, preserving the health of both is essential for good bone health. Bone Basics’ glucosamine source is now a vegetarian glucosamine sulfate, making it safe for those who avoid shellfish.

**Vitamin D3**
Bone Basics contains 1000 IU of vitamin D3 (cholecalciferol) per daily dose. Vitamin D is the single most important factor in the absorption of calcium. A superior form of vitamin D is vitamin D3 (also known as cholecalciferol), a colorless crystalline compound found in fish-liver oils. Research has shown that cholecalciferol is the preferred, active form of vitamin D in the body. Although humans are fully capable of endogenous vitamin D production, this is dependent upon adequate exposure to the UVB rays in sunlight, making a constant, steady intake of this vitamin difficult for high-risk demographics who are often confined indoors. This is compounded by the lack of sunlight in the
winter months and in more extreme latitudes, further underlining the importance of supplementation.

**Vitamin K2**
Similarly to Vitamin D, Vitamin K2 is essential to absorbing and properly utilizing the calcium you ingest. Vitamin K2 helps shunt the calcium from the bloodstream into the bones. In fact, taking a lot of calcium without adequate vitamins D & K can be dangerous. Bone Basics contains vitamin K2 in the forms of MK-4 & MK-7, the most effective forms of these vitamins.

**Vitamin C**
Although Vitamin C has not been shown to prevent osteoporosis, women who consume higher levels of vitamin C tend to have higher bone density levels. Vitamin C helps produce collagen, which is one of the main proteins in bone, and it helps heal fractures.

**Magnesium**
Magnesium is another mineral commonly associated with the maintenance of bone health, which is very easy to fathom when one considers that two-thirds of the body’s magnesium stores are located in our bone structure. Much of the magnesium within this bone structure is part of the bone’s crystal lattice (which can metaphorically be referred to as the “bone scaffolding”) where it binds together with the minerals phosphorus and calcium. Magnesium on its own has been shown to slow the rate of bone turnover, which is when the growth of new bone is outpaced by the degeneration of old. Magnesium shortages result in the reduced assimilation of vitamin D as well as the inhibition of parathyroid hormone, leading to low blood calcium levels. Magnesium also seems to work synergistically with MCHC (see below) by helping to form smaller, denser, microcrystalline hydroxyapatite crystals, providing yet another avenue for strong bone development. The amount of magnesium in even the highest quality multi-vitamin/multi-mineral supplements is still well below levels which researchers believe are needed for prevention in high risk demographics.

**Trace Minerals: Zinc, Copper, Manganese & Boron**
Several other minerals have also been identified as co-factors for enzymes involved in bone metabolism – notably zinc, copper, and manganese. The latter is essential for the proper function of the osteoblast cells that are responsible for building new bone. Manganese also increases the activity of the enzyme alkaline phosphatase and as well as growth factors such as estrogen and IGF-1 in a manner that is directly pertinent to these osteoblast cells. Copper is essential for producing an enzyme called lysyl oxidase which cross-links (strengthens) collagen. Zinc, in turn, is essential for the operation of copper, since unbalanced zinc intake can reduce copper absorption.

Another ingredient included in Bone Basics is boron, a mineral that at long last is in the process of being officially recognized as ‘essential’. Boron’s role regarding bone health appears to be mediated by its ability to reduce the urinary excretion of calcium and magnesium, thus enhancing vitamin D as well (which is directly interdependent with calcium). Boron’s mechanism of action takes place in the kidney.

**Research**

**Calcium**
MCHC is, in effect, a full-spectrum multiple nutrient source in its own right. However, it is particularly rich in calcium, and the type of calcium in MCHC has been clinically proven in over 30 years of
randomized, double-blind, controlled clinical trials to be the best calcium source for bone building and maintenance.

Current “official” recommendations suggest an intake of 1000 milligrams of calcium for younger adults, and 1200 milligrams for people over the age of 50. Some evidence suggests that a still higher intake (1300-1600 milligrams) of calcium is more effective for lowering fracture risk in the elderly. But remember that these numbers are your total calcium need. The more calcium you get in your diet, the less you need from supplements.

A review published in 2012 cited that the most prevalent factors associated with both osteoporosis were low calcium intake, deficiencies in vitamins D & K, and high sodium intake. Clinical trials show that calcium supplementation provides better results when combined with vitamin D at doses greater than 300 IU per day.

A double-blind, controlled clinical trial on post-menopausal women examined the effects of a plain dairy product versus a dairy product enriched with 800 mg of calcium, 10 mcg of vitamin D and 100 mcg of either vitamin K1 or K2. While total bone mass density increased for all the dairy groups, lumbar spine bone mineral density increased significantly only in the two groups receiving the treatments enriched with calcium and vitamins D & K.

MCHC

A recent study compared the bone turnover effects of MCHC with conventional bone supplements and concluded the following:

**MCHC is clinically proven to deliver calcium without causing undesirable spikes in blood calcium levels.**

Peak blood calcium levels after ingestion of MCHC by study participants were 45%-49% lower than peak blood calcium levels after ingestion of the same amount of calcium from either calcium carbonate or calcium citrate.

After ingestion of MCHC, average increase in blood calcium levels compared to the control group over an 8 hour period did not reach statistical significance. By contrast after ingestion of the same amount of calcium as either calcium carbonate or calcium citrate, average increase in blood calcium levels were statistically significantly different to control.

(Area under the curve data shows that) The total amount of calcium delivered to the blood over an 8 hour period after ingestion of MCHC did not differ significantly from the total amount of calcium delivered to the blood over the same time period after ingestion of either calcium citrate or calcium carbonate.

**MCHC is clinically proven to deliver the same levels of efficacy as both calcium carbonate and calcium citrate as measured by the ability to supress key markers of bone turnover (bone resorption).**

After 90 days of continuous supplementation, MCHC supressed CTX and P1NP, two key makers of bone turnover, by an identical amount to calcium carbonate and calcium citrate.

**MCHC is not artificially modified calcium, it does not rely on chemical coatings and additives**
which delay release but not the rate of release.

MCHC has been designed, developed and clinically proven to deliver calcium in a 100% natural protein complex which the body is able to digest, as it would a food, releasing the calcium slowly and steadily into the body without the undesirable spikes.

**MCHC has demonstrated ability to promote bone matrix deposition and mineralisation (bone formation).**

Proteins extracted from MCHC demonstrated osteo inductivity, the ability to stimulate bone formation, as measured by osteoblast (bone cell) differentiation and mineralisation in vitro.

**Independent testing has verified the presence of critically important bone stimulating growth factors and bone matrix proteins in MCHC.**

Unlike conventional calcium supplements, such as calcium citrate and calcium carbonate, MCHC contains protein (25% on average) rich in essential bone matrix components, including Type I collagen and Osteocalcin, and bone stimulating growth factors. Specifically, testing has verified the presence of the osteo inductive growth factors IGF I and 2, and TGFb 1 and 2.

**Vitamin D: 800 IU**

From what we now know, the old RDA of 400 IU will not protect you from vitamin D insufficiency except in the sunniest of climates. Even in sunny Spain, researchers have found that 80% of children have inadequate vitamin D levels in March and October. In fact, in one remarkable recent study, researchers at Creighton University were able to document that even North Americans who spend nearly all day in the sun during the summer (such as landscapers and agricultural workers) were still at a 58% risk of being too low in vitamin D to support optimal calcium metabolism by the end of the winter! Studies show that a 400 IU vitamin D supplement is just not enough to keep serum levels of the active vitamin above the cutoff for insufficiency, and the use of 400 IU supplements have not been shown to reduce fracture rates. Even 600 IU has little effect on BMD. Instead, controlled studies show that vitamin D, together with calcium, helps to reduce the risk of fracture at a dose of at least 800 IU per day and recent trials suggest much higher dosages are needed to maintain optimal blood levels.

**Vitamin K2**

Recent studies have suggested that vitamin K2 is better absorbed and persists longer in the plasma than vitamin K1. Studies have also shown that it also has greater benefits to the skeletal and vascular systems than vitamin K1. Vitamin K is important for bone health as it is able to regulate calcium through the amino acid gamma-carboxyglutamic acid (Gla), and in particular the protein osteocalcin, which helps maintain calcium in bone, but at the same time keeps it out of soft tissue.

**The advantages of taking both MK-4 and MK-7**

More recently, Vitamin K2 in the forms of MK-4 and MK-7 has emerged as bone-building superstars. MK-4 is a specific form of vitamin K2 produced in the body from phylloquinone (vitamin K1) or even the bacterial menaquinones (which are also forms of vitamin K2). It is thought that other forms of vitamin K are converted to MK-4 in order to be absorbed by cells. Multiple clinical trials show that megadose MK-4 supplements reduce fracture rates in osteoporotic women as much as Fosamax®-
type drugs by improving the quality of the bone itself, measured by bone mineral content and width. Another study found that MK-4 combined with 1500 mg of calcium carbonate significantly increased bone density in the lumbar spine and decreased the amount of undercarboxylated osteocalcin compared to just the 1500 mg of calcium alone.

In a recent study comparing MK-4 against MK-7, one of the first actually comparing the two head-to-head, it was found that when subjects took a single dose administration of 420 ?g of MK-4 or MK-7, the MK-7 was well absorbed and reached maximal serum level at 6 h after intake and was detected up to 48 h after intake. MK-4 was not detectable in the serum of all subjects at any time point. It is not yet clear whether this is because MK-4 was metabolized very quickly (some nutrients actually benefit from a short half-life) or because it was not absorbed. Consecutive administration of MK-7 at 60 ?g for 7 days demonstrated that MK-7 increased serum MK-7 levels significantly in all subjects and activated osteocalcin at this dose. Further research is warranted on the benefits of both forms of vitamin K2, as MK-4 has shown many beneficial effects in humans that have not yet been studied with MK-7, and there appears to be a cellular receptor specific to MK-4 in humans. Therefore, AOR has chosen to provide both MK-4 and MK-7 in Ortho•Bone to maximize the potential benefits of each.

**Absorbable Magnesium**

Take a magnesium you can absorb. Magnesium citrate is absorbed at 29.64%, but much better absorption is available from other forms – especially fully-reacted magnesium aspartate, with a remarkable 41.7% bioavailability.

In a two-year, open, controlled trial, 71% of women receiving magnesium supplements experienced increased bone mineral density whereas the women not receiving supplements suffered bone loss. The amount of magnesium in even the highest quality multi-vitamin/multi-mineral supplements is still well below levels which researchers believe are needed for prevention in high risk demographics.

**Boron**

In a clinical study among 12 post-menopausal women not on estrogen replacement therapy, boron was not only shown to significantly diminish urinary losses of calcium and magnesium, but it also raised levels of plasma ionized calcium, beta-estradiol, and testosterone.

**Market Trends**

**Problems with conventional Calcium supplementation**

Multivitamins do provide an array of nutrients necessary for good health. Unfortunately, they just don’t provide enough of most nutrients for people with specific needs. For those at risk of bone disorders, certain vitamins and minerals are more important.

Calcium supplements and Vitamin D are number one sellers among post-menopausal women and seniors, yet osteoporotic fracture incidences continue to rise at an alarming rate. What else is missing?
Vitamin K has recently joined the bone health bandwagon. Vitamin K2 is as important for good bone health as vitamin D, since Vitamins D & K help the body to absorb and utilize calcium effectively. But is there still more?

Calcium has recently gotten a bad reputation for contributing to heart disease. Of course too much of a good thing is never a good thing. Excessive calcium consumption without sufficient amounts of vitamins D & K can cause a build-up of calcium in the bloodstream, without actually being taken up into bone tissue. It is imperative that adequate calcium, vitamin D and vitamin K be taken together in order for them to support bone health. In addition, fast-release calcium salts (such as calcium citrate) pose more of a threat to arterial health than food sourced calcium such as in MCHC due to the amount of calcium being dumped into the bloodstream at once.

Given the importance of the calcium balance it has been somewhat surprising that some of the most popular and widely accepted calcium supplements on the market have been promoted on the basis of rapid absorption and, or, efficient “once daily” dosing.

**AOR Advantage**

Bone Basics provides the ideal source of MCHC which is pasture-fed, free-range livestock not subjected to routine antibiotics or recombinant bovine growth hormone (rBGH). This not only ensures that the widest possible range of micronutrients within the whole bone extract survive the manufacturing process, but it would also provide assurances against bovine spongiform encephalopathy, commonly referred to as mad cow disease. The most reputable sources of such livestock appear to be from Australian, New Zealand and Argentine pastures, where local legislation and/or custom either prohibits, limits or discourages routine antibiotics and recombinant bovine growth hormone (rBGH).

MCHC provides all the nutrients found in bones as well as proteins, which function as growth factors, actually stimulating bone development rather than just reducing calcium loss.

Vitamin K2 as MK-4 and MK-7 are two forms of vitamin K used by the human body.

Vitamin D3 is the most absorbable form of vitamin D.

Provides other minerals known to contribute to bone health.

Provides a vegetarian glucosamine sulfate to support the joints, since the joints are usually affected when bone health declines.

**References**


**Abstract**


Castelo-Branco C, Dávila Guardia J.

**Background and objective** The ossein-hydroxyapatite complex (OHC) is a microcrystalline form of calcium which provides a number of additional minerals (magnesium, phosphorus, potassium, zinc), and proteins (osteocalcin, type I collagen, type I insulin growth factor I and II, transforming growth factor beta) associated with bone metabolism. The objective of this review is to examine the role of OHC in preventing bone loss in different conditions.

**Material and methods** A review of clinical trials assessing the relationship between OHC and bone loss was made using the following data sources: Medline (from 1966 to December 2013), the Cochrane Controlled Clinical Trials Register, Embase (up to December 2013), contact with companies marketing the supplements studied, and reference lists.

**Results** Different randomized, clinical trials and meta-analysis suggest that OHC is more effective than calcium supplements in maintaining bone mass in postmenopausal women and in different conditions related to bone loss. In addition, OHC improves pain symptoms and accelerates fracture consolidation in patients with osteopenia or osteoporosis.

**Conclusion** The ossein-hydroxyapatite complex is significantly more effective in preventing bone loss than calcium carbonate.
Acute and 3-month effects of microcrystalline hydroxyapatite, calcium citrate and calcium carbonate on serum calcium and markers of bone turnover: a randomised controlled trial in postmenopausal women.


Ca supplements are used for bone health; however, they have been associated with increased cardiovascular risk, which may relate to their acute effects on serum Ca concentrations. Microcrystalline hydroxyapatite (MCH) could affect serum Ca concentrations less than conventional Ca supplements, but its effects on bone turnover are unclear. In the present study, we compared the acute and 3-month effects of MCH with conventional Ca supplements on concentrations of serum Ca, phosphate, parathyroid hormone and bone turnover markers. We randomised 100 women (mean age 71 years) to 1 g/d of Ca as citrate or carbonate (citrate-carbonate), one of two MCH preparations, or a placebo. Blood was sampled for 8 h after the first dose, and after 3 months of daily supplementation. To determine whether the acute effects changed over time, eight participants assigned to the citrate dose repeated 8 h of blood sampling at 3 months. There were no differences between the citrate and carbonate groups, or between the two MCH groups, so their results were pooled. The citrate-carbonate dose increased ionised and total Ca concentrations for up to 8 h, and this was not diminished after 3 months. MCH increased ionised Ca concentrations less than the citrate-carbonate dose; however, it raised the concentrations of phosphate and the Ca-phosphate product. The citrate-carbonate and MCH doses produced comparable decreases in bone resorption (measured as serum C-telopeptide (CTX)) over 8 h and bone turnover (CTX and procollagen type-I N-terminal propeptide) at 3 months. These findings suggest that Ca preparations, in general, produce repeated sustained increases in serum Ca concentrations after ingestion of each dose and that Ca supplements with smaller effects on serum Ca concentrations may have equivalent efficacy in suppressing bone turnover.

Comparison of menaquinone-4 and menaquinone-7 bioavailability in healthy women.
Sato T, Schurgers LJ, Uenishi K.

BACKGROUND: Vitamin K? contributes to bone and cardiovascular health. Therefore, two vitamin K? homologues, menaquinone-4 (MK-4) and menaquinone-7 (MK-7), have been used as nutrients by the food industry and as nutritional supplements to support bone and cardiovascular health. However, little is known about the bioavailability of nutritional MK-4. To investigate MK-4 and MK-7 bioavailability, nutritional doses were administered to healthy Japanese women.

FINDINGS: Single dose administration of MK-4 (420 ?g; 945 nmol) or MK-7 (420 ?g; 647 nmol) was given in the morning together with standardized breakfast. MK-7 was well absorbed and reached maximal serum level at 6 h after intake and was detected up to 48 h after intake. MK-4 was not detectable in the serum of all subjects at any time point. Consecutive administration of MK-4 (60 ?g; 135 nmol) or MK-7 (60 ?g; 92 nmol) for 7 days demonstrated that MK-4 supplementation did not increase serum MK-4 levels. However, consecutive administration of MK-7 increased serum MK-7 levels significantly in all subjects.

CONCLUSIONS: We conclude that MK-4 present in food does not contribute to the vitamin K status as measured by serum vitamin K levels. MK-7, however significantly increases serum MK-7 levels and therefore may be of particular importance for extrahepatic tissues.

Essential Nutrients for Bone Health and a Review of their Availability in the Average North
Osteoporosis and low bone mineral density affect millions of Americans. The majority of adults in North America have insufficient intake of vitamin D and calcium along with inadequate exercise. Physicians are aware that vitamin D, calcium and exercise are essential for maintenance of bone health. Physicians are less likely to be aware that dietary insufficiencies of magnesium, silicon, Vitamin K, and boron are also widely prevalent, and each of these essential nutrients is an important contributor to bone health. In addition, specific nutritional factors may improve calcium metabolism and bone formation. It is the authors’ opinion that nutritional supplements should attempt to provide ample, but not excessive, amounts of factors that are frequently insufficient in the typical American diet. In contrast to dietary insufficiencies, several nutrients that support bone health are readily available in the average American diet. These include zinc, manganese, and copper which may have adverse effects at higher levels of intake. Some multivitamins and bone support products provide additional quantities of nutrients that may be unnecessary or potentially harmful. The purpose of this paper is to identify specific nutritional components of bone health, the effects on bone, the level of availability in the average American diet, and the implications of supplementation for each nutritional component. A summary of recommended dietary supplementation is included.

Changes in parameters of bone metabolism in postmenopausal women following a 12-month intervention period using dairy products enriched with calcium, vitamin D, and phylloquinone (vitamin K(1)) or menaquinone-7 (vitamin K (2)): the Postmenopausal Health Study II. Calcif Tissue Int. 2012 Apr;90(4):251-62.
The objective of the present study was to examine the effect of dairy products enriched with calcium, vitamin D(3), and phylloquinone (vitamin K(1)) or menaquinone-7 (vitamin K(2)) on parameters of bone metabolism in postmenopausal women following a 12-month intervention. Postmenopausal women were divided into three intervention groups and a control group (CG). All three intervention groups attended biweekly sessions and received fortified dairy products providing daily 800 mg of calcium and 10 ?g of vitamin D(3) (CaD). Furthermore, in two of the three intervention groups the dairy products were also enriched with vitamin K, providing daily 100 ?g of either phylloquinone (CaDK1) or menaquinone-7 (CaDK2). The increase observed for serum 25(OH)D levels in all intervention groups and the increase observed for serum IGF-I levels in the CaDK2 group differed significantly compared to the changes observed in CG (P = 0.010 and P = 0.028, respectively). Furthermore, both the CaDK1 and CaDK2 groups had a significantly lower mean serum undercarboxylated osteocalcin to osteocalcin ratio and urine deoxypyridinoline levels at follow-up compared to the CaD and CG groups (P = 0.001 and P = 0.047, respectively). Significant increases in total-body BMD were observed in all intervention groups compared to CG (P < 0.05), while significant increases in lumbar spine BMD were observed only for CaDK1 and CaDK2 compared to CG (P < 0.05) after controlling for changes in serum 25(OH)D levels and dietary calcium intake. In conclusion, the present study revealed more favorable changes in bone metabolism and bone mass indices for the two vitamin K-supplemented groups, mainly reflected in the suppression of serum levels of bone remodeling indices and in the more positive changes in lumbar spine BMD for these two study groups.

Comparison of the effects of ossein-hydroxyapatite complex and calcium carbonate on bone metabolism in women with senile osteoporosis: a randomized, open-label, parallel-group, controlled, prospective study.

BACKGROUND AND OBJECTIVE: Calcium and vitamin D supplementation is recommended in patients with osteopenia and osteoporosis. One group that could benefit from this treatment is women with senile osteoporosis. Two sources of supplementary calcium are ossein-hydroxyapatite complex (OHC) and calcium carbonate, but, to date, their comparative effects on bone metabolism have not been studied in women with senile osteoporosis. The objective of this study was to compare the effects of OHC and calcium carbonate on bone metabolism in women with senile osteoporosis.

METHODS: This was a randomized, open-label, parallel-group, controlled, prospective study to compare the effects of OHC (treatment group) and calcium carbonate (control group) on bone metabolism. Patients were included between 2000 and 2004 and followed up for a maximum of 3 years. The study was carried out at the bone metabolism unit of two university hospitals in Barcelona, Spain. Subjects were women aged >65 years with densitometric osteoporosis of the lumbar spine or femoral neck. The treatment group received open-label OHC (Osteopor®) at a dose of two 830?mg tablets every 12 hours (712?mg elemental calcium per day). The control group received open-label calcium carbonate at a dose of 500?mg of elemental calcium every 12 hours (1000?mg elemental calcium per day). Both groups also received a vitamin D supplement (calcifediol 266??g) at a dose of one vial orally every 15 days. Biochemical markers of bone remodelling (osteocalcin by electrochemiluminescence, tartrate-resistant acid phosphatase using colorimetry) were measured at baseline and annually for 3 years. Bone mineral density (BMD) at the lumbar spine and femoral neck was also measured.

RESULTS:
One hundred and twenty women were included (55 in the OHC group and 65 in the calcium carbonate group), of whom 54 completed 3 years of follow-up. Levels of serum osteocalcin increased to a greater extent in the OHC group compared with the calcium carbonate group (by a mean?±?SD of 0.84?±?3.13?ng/mL at year 2 and 1.86?±?2.22?ng/mL at year 3 in the OHC group compared with a mean?±?SD decrease of 0.39?±?1.39?ng/mL at year 2 and an increase of 0.31?±?2.51?ng/mL at year 3 in the calcium carbonate group); the differences between treatment groups were statistically significant (p?<?0.05) at both years. Changes over time in serum osteocalcin level were also statistically significant (p?<?0.05) in the OHC group, but not in the calcium carbonate group. Changes in mean BMD at the lumbar spine and femoral neck between baseline and year 3 were -1.1% and 2.5% for OHC and -2.3% and 1.2% for calcium carbonate, respectively.

CONCLUSION: OHC had a greater anabolic effect on bone than calcium carbonate.

Efficacy of ossein-hydroxyapatite complex compared with calcium carbonate to prevent bone loss: a meta-analysis.

OBJECTIVE: There is increasing evidence to suggest that ossein-hydroxyapatite complex (OHC) is more effective than calcium supplements in maintaining bone mass. The aim of this meta-analysis was to determine whether OHC has a different clinical effect on bone mineral density (BMD) compared with calcium carbonate (CC).

METHODS: A meta-analysis of randomized controlled clinical trials was carried out to evaluate the efficacy of OHC versus CC on trabecular BMD. We identified publications on clinical trials by a search of electronic databases, including MEDLINE (1966-November 2008), EMBASE (1974-November 2008), and the Cochrane Controlled Clinical Trials Register. The primary endpoint was percent change in BMD from baseline. Data were pooled in a random-effects model, and the weighted mean difference was calculated. A sensitivity analysis that excluded trials without full data was performed.

RESULTS: Of the 18 controlled trials initially identified, 6 were included in the meta-analysis. There was no significant heterogeneity among the included trials. The percent change in BMD significantly favored the OHC group (1.02% [95% CI, 0.63-1.41], P < 0.00001). These results were confirmed in the sensitivity analysis.

CONCLUSIONS: OHC is significantly more effective in preventing bone loss than CC.

Vitamin K2 induces phosphorylation of protein kinase A and expression of novel target genes in osteoblastic cells.
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Vitamin K is known as a critical nutrient required for bone homeostasis and blood coagulation, and it is clinically used as a therapeutic agent for osteoporosis in Japan. Besides its enzymatic action as a cofactor of vitamin K-dependent gamma-glutamyl carboxylase (GGCX), we have previously shown that vitamin K(2) is a transcriptional regulator of bone marker genes and extracellular matrix-related genes, by activating the steroid and xenobiotic receptor (SXR). To explore a novel action of vitamin K in osteoblastic cells, we identified genes up-regulated by a vitamin K(2) isoform menaquinone-4 (MK-4) using oligonucleotide microarray analysis. Among these up-regulated genes by MK-4, growth differentiation factor 15 (GDF15) and stanniocalcin 2 (STC2) were identified as novel MK-4 target genes.
genes independent of GGCX and SXR pathways in human and mouse osteoblastic cells. The induction of GDF15 and STC2 is likely specific to MK-4, as it was not exerted by another vitamin K(2) isofrom MK-7, vitamin K(1), or the MK-4 side chain structure geranylgeraniol. Investigation of the involved signaling pathways revealed that MK-4 enhanced the phosphorylation of protein kinase A (PKA), and the MK-4-dependent induction of both GDF15 and STC2 genes was reduced by the treatment with a PKA inhibitor H89 or siRNA against PKA. These results suggest that vitamin K(2) modulates its target gene expression in osteoblastic cells through the PKA-dependent mechanism, which may be distinct from the previously known vitamin K signaling pathways.

Vitamin D and Calcium Supplementation among Aged Residents in Nursing Homes.

Background: Aged residents in nursing homes are at particularly high risk of fractures. Vitamin D and calcium have a preventative role. Objective: To describe the use of vitamin D and calcium supplementations, and their association with nutritional factors among nursing home residents. Methods: Our study is a cross-sectional assessment of long-term residents in all nursing homes in Helsinki during February 2003. We collected residents' background information, nutritional status (Mini Nutritional Assessment, MNA), and data on daily nursing routines in institutions, including nutritional care. Vitamin D and calcium supplementations were inquired after in the questionnaire and retrieved from residents' medication lists. Results: 2 114 (87%) of all 2424 eligible residents had available data on the use of vitamin D and calcium supplementation. Their mean age was 83 years, and 80.7% were female. Of all participants, 32.9% received vitamin D supplementation and 27.7% calcium supplementation. Altogether 20.0% received both. However, only 21.3% received vitamin D in the therapeutic dose of 10mg (400 IU) or more, and 3.6% in the recommended dose of 20 microg (800 IU) or more. In logistic regression analysis, residents who received vitamin D supplementation also had better nutritional status (MNA), ate snacks between meals, did not have constipation and their weight was checked more frequently. Conclusions: Regardless of the known benefit and recommendation of vitamin D supplementation for the elderly residing mostly indoors, the proportion of nursing home residents receiving vitamin D and calcium was surprisingly low.

Potential benefit of oral calcium/vitamin d administration for prevention of symptomatic hypocalcemia after total thyroidectomy.
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Objective. To evaluate routine oral calcium and vitamin D administration for preventing symptoms of hypocalcemia after total thyroidectomy. Subjects and methods. A total of 487 consecutive patients were prospectively randomized into two groups in terms of routine oral calcium and vitamin D supplementation: In the control group (244 patients) the treatment was not routinely started after surgery, whereas the treated group (243 patients) received routine supplementation that started on postoperative day 1. Results. Patients of treated group had only minor hypocalcemia symptoms, whereas 7 patients of control group experienced carpopedal spasm as a major symptom (p Conclusions. Routine postoperative calcium and vitamin D supplementation therapy may be useful for the prevention of
symptomatic hypocalcemia after total thyroidectomy and may allow for a safe and early discharge from the hospital. Keywords: Thyroidectomy Hypocalcemia Calcium – Vitamin D – Dietary supplementation.

**Prevention of Osteoporosis: Four-Year Follow-Up of a Cohort of Postmenopausal Women Treated with an Ossein-Hydroxyapatite Compound.**
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**BACKGROUND:** The long-term effects of ossein-hydroxyapatite compound (OHC), a drug used for osteoporosis prevention, have not been previously reported. The aim of this study was to assess the long-term efficacy of OHC in postmenopausal women with bone mineral density (BMD) in the osteopenia range.

**METHODS:** We performed a retrospective 4-year follow-up study in a primary-care setting to assess changes in BMD in a cohort of 112 postmenopausal women included in an osteoporosis programme that included health and dietary advice and who were treated with OHC 1660mg every 12 hours. BMD was measured annually in the distal part of the forearm, with T- and Z-score values being calculated for trabecular and total bone.

**RESULTS:** A progressive and statistically significant increase in BMD was observed in trabecular and total T- and Z-score mean values. At baseline, mean ± SD trabecular T- and Z-scores were -1.27 ± 0.7 and -1.03 ± 0.7, respectively, and -0.86 ± 0.7 and -0.62 ± 0.7, respectively, at the end of the 4-year follow-up period (both p < 0.0001). Mild constipation was observed in 3.2% of patients during the follow-up period.

**CONCLUSION:** Ossein-hydroxyapatite compound could be an effective and safe agent for the prevention of bone loss in postmenopausal osteopenic women, with significant increases in BMD being observed in this group of patients.