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SUMMARY OF CLINICAL STUDIES

Product	Tenacity Arthroprotector
SKU	TENACITY
Barcode	866033000246
Formula	2
Date	8 September 2022

Label

Warning: Consult a physician before and during use of all dietary supplements.

Use: Take 2 capsules up to 4 times daily with meals, for a total of 2 to 8 capsules daily.

Storage: Keep cool and dry, away from children.

AprèsFlex AprèsFLEX® is a registered trademark of Laila Nutraceuticals. U.S. Patent #8,551,496 and other patents pending.

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TENACITY ARTHROPROTECTOR

Formula 2

Supports Healthy Joint and Bone
Function for Better Aging*

Dietary Supplement
60 CAPSULES

Supplement Facts

Serving Size 2 Capsules
Servings Per Container 30

Amount Per Serving	% Daily Value
Vitamin D (D3 Cholecalciferol) 50 mcg	250%
Vitamin K (K1 Phylloquinone) 250 mcg	210%
Turmeric Rhizome Extract 500 mg (95% Curcumin)	†
S Adenosyl Methionine (SAME) 300 mg	†
Boswellia Serrata Resin Extract 100 mg (AprèsFLEX® 20% AKBA)	†
Black Pepper Extract (95% Piperine) 5 mg	†
Vitamin K2 (MK7 Menaquinone 7) 100 mcg	†

† Daily Value Not Established

Other Ingredients: Cellulose, Sodium Stearyl Fumarate
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Boswellia Serrata to Support Healthy Joint Function

Boswellia Serrata supplements (dosage at 100 mg to 6 g daily) may enhance joint function for better aging, according to these clinical studies on humans:

- [A pilot, randomized, double-blind, placebo-controlled trial to assess the safety and efficacy of a novel Boswellia serrata extract in the management of osteoarthritis of the knee.](#) In 2019, this study found that “biologically active constituents of BSE, namely, AKBBA and BBA, act synergistically to exert anti-inflammatory/anti-arthritis activity showing improvement in physical and functional ability and reducing the pain and stiffness”. Approximately 24 participants used 338 mg of 30% AKBA extract daily for 120 days.
- [A randomized, double blind, placebo controlled, cross over study to evaluate the analgesic activity of Boswellia serrata in healthy volunteers using mechanical pain model.](#) In 2014, this study found that “Boswellia serrata significantly increased the Pain Threshold and Pain Tolerance force and time compared to placebo”. Participants used 250 mg of non-standardized extract once.
- [A double blind, randomized, placebo controlled clinical study evaluates the early efficacy of aflapin in subjects with osteoarthritis of knee.](#) In 2011, this study found that Boswellia “conferred clinically and statistically significant improvements in

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pain scores and physical function scores”. Participants used 100 mg of 20% AKBA extract daily for 30 days.

- [Clinical evaluation of Boswellia serrata \(Shallaki\) resin in the management of Sandhivata \(osteoarthritis\).](#) In 2011, this study found that “mobility was improved significantly” with Boswellia supplementation. Participants used three doses of 2 g of non-standardized extract for a total of 6 g daily for 2 months.
- [Comparative efficacy and tolerability of 5-Loxin and Aflapin Against osteoarthritis of the knee: a double blind, randomized, placebo controlled clinical study.](#) In 2010, this study of two Boswellia extracts found that both “reduce pain and improve physical functions significantly”. Participants used 100 mg of 20% AKBA extract or 100 mg of 30% AKBA extract daily for 90 days. The 20% AKBA extract was more efficient.
- [A double blind, randomized, placebo controlled study of the efficacy and safety of 5-Loxin for treatment of osteoarthritis of the knee.](#) In 2008, this study found that Boswellia supplementation “reduces pain and improves physical functioning significantly” and “may improve joint health by reducing the enzymatic degradation of cartilage”. Participants used 100 mg or 250 mg of 30% AKBA extract daily for 90 days. The 250 mg dose was more efficient.
- [Efficacy and tolerability of Boswellia serrata extract in treatment of osteoarthritis of knee--a randomized double blind placebo controlled trial.](#) In 2003, this study found that “frequency of swelling in the knee joint was decreased” by Boswellia supplementation. Participants used Boswellia for 8 weeks.

These clinical study reviews confirm that Boswellia Serrata supplements may enhance joint function for better aging:

- [Efficacy of curcumin and Boswellia for knee osteoarthritis: Systematic review and meta-analysis.](#) In 2018, this meta-analysis of 11 studies observed that Boswellia supplementation was “statistically significantly more effective than placebo for pain relief and functional improvement”.
- [Oral herbal therapies for treating osteoarthritis.](#) In 2014, this review of 5 studies

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observed that Boswellia supplementation shows “trends of benefits that warrant further investigation in light of the fact that the risk of adverse events appear low”.

S Adenosyl Methionine to Support Healthy Joint Function and Comfort

S Adenosyl Methionine supplements (dosage at 1200 mg daily) may enhance joint comfort and function for better aging, according to these clinical studies on humans:

- [Comparative clinical trial of S-adenosylmethionine versus nabumetone for the treatment of knee osteoarthritis: an 8-week, multicenter, randomized, double-blind, double-dummy, Phase IV study in Korean patients.](#) In 2009, this study found that SAME supplementation “effectively reduced pain intensity”. Participants used three doses of 400 mg for a total of 1200 mg daily for 8 weeks.
- [S-adenosyl methionine \(SAME\) versus celecoxib for the treatment of osteoarthritis symptoms: a double-blind cross-over trial. \[ISRCTN36233495\].](#) In 2004, this study found that “joint function tests appeared to be steadily improving over the entire study period” with SAME supplementation. Participants used 1200 mg daily for 16 weeks.

This clinical study review confirms that S Adenosyl Methionine supplements may enhance joint comfort and function for better aging:

- [Safety and efficacy of S-adenosylmethionine \(SAME\) for osteoarthritis.](#) In 2002, this review of 11 studies observed that SAME supplementation is effective for “reducing pain and improving functional limitation”.

Turmeric Curcumin to Enhance Joint and Muscle Comfort

Turmeric Curcumin supplements (dosage at 200 mg to 6 g daily) may enhance joint and muscle comfort, according to these clinical studies on humans:

- [Miconia albicans and Curcuma longa herbal medicines positively modulate joint pain, function and inflammation in patients with osteoarthritis: a clinical study.](#) In

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2021, this study found that Curcumin “positively interferes with patients pain and functionality ... leading to functional improvement of these patients.”

- [Effect of Curcumin Supplementation on Exercise-Induced Oxidative Stress, Inflammation, Muscle Damage, and Muscle Soreness.](#) In 2019, this study found that Curcumin “may reduce muscle damage and perceived muscle soreness without negatively impacting a natural inflammatory response following exercise.”
- [Bio-optimized Curcuma longa extract is efficient on knee osteoarthritis pain: a double-blind multicenter randomized placebo controlled three-arm study.](#) In 2019, this study found that Curcumin supplements “showed a rapid and significant decrease of pain in knee.” Participants used two or three servings of 100 mg for a total of 200 to 300 mg daily for three months.
- [Safety and efficacy of curcumin versus diclofenac in knee osteoarthritis: a randomized open-label parallel-arm study.](#) In 2019, this study found that “Curcumin can be an alternative treatment option in the patients with knee [osteoarthritis] who are intolerant to the side effects of non-steroidal anti-inflammatory drugs”. Participants used three servings of 500 mg for a total of 1500 mg daily for one month.
- [A naturally-inspired, curcumin-based lecithin formulation \(Meriva® formulated as the finished product Algocur®\) alleviates the osteo-muscular pain conditions in rugby players.](#) In 2017, this study found that Curcumin supplementation “could represent a promising safe, analgesic remedy in painful osteo-muscular conditions associated with intense, high impact, physical activities”. Participants used two servings of 200 mg for a total of 400 mg daily for 10 days.
- [Curcumin and Piperine Supplementation and Recovery Following Exercise Induced Muscle Damage: A Randomized Controlled Trial.](#) In 2017, this study found that Curcumin “supplementation before and after exercise can attenuate some, but not all, aspects of muscle damage”. Participants used three servings of 2 g for a total of 6 g daily for 4 days.
- [Curcumin supplementation likely attenuates delayed onset muscle soreness \(DOMS\).](#) In 2015, this study found that “curcumin likely reduces pain associated

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with [delayed-onset muscle soreness] with some evidence for enhanced recovery of muscle performance”. Participants used two servings of 2.5 g for a total of 5 g daily for 5 days.

- [Reduction of delayed onset muscle soreness by a novel curcumin delivery system \(Meriva®\): a randomised, placebo-controlled trial.](#) In 2014, this study found that “Curcumin has the potential for preventing [delayed-onset muscle soreness], as suggested by its effects on pain intensity and muscle injury”. Participants used two servings of 200 mg for a total of 400 mg daily for 4 days.
- [Efficacy and safety of Curcuma domestica extracts compared with ibuprofen in patients with knee osteoarthritis: a multicenter study.](#) In 2014, this study found that Curcumin supplementation resulted in “significant improvement”. Participants used 1500 mg daily for 4 weeks.
- [Comparative evaluation of the pain-relieving properties of a lecithinized formulation of curcumin \(Meriva®\), nimesulide, and acetaminophen.](#) In 2013, this study found that Curcumin supplementation “showed clear analgesic activity”. Participants used 400 mg once.
- [Efficacy of turmeric \(curcumin\) in pain and postoperative fatigue after laparoscopic cholecystectomy: a double-blind, randomized placebo-controlled study.](#) In 2011, this study found that “Turmeric (curcumin) improves postoperative pain- and fatigue-related [patient-reported outcomes]”. Participants used four servings of 500 mg for a total of 2 g daily for 3 months.
- [Efficacy and safety of Meriva®, a curcumin-phosphatidylcholine complex, during extended administration in osteoarthritis patients.](#) In 2010, this study found that “joint pain and improvement in joint function were observed” with Curcumin supplementation. Participants used two servings of 100 mg for a total of 200 mg daily for 8 months.
- [Product-evaluation registry of Meriva®, a curcumin-phosphatidylcholine complex, for the complementary management of osteoarthritis.](#) In 2010, this study found that “joint pain and improvement in joint function were observed” with Curcumin supplementation. Participants used two servings of 100 mg for a total of 200 mg

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daily for 3 months.

- [Efficacy and safety of Curcuma domestica extracts in patients with knee osteoarthritis.](#) In 2009, this study found that with Curcumin supplementation “the main outcomes were improvement in pain on level walking, pain on stairs, and functions of knee”. Participants used 2 g daily for 6 weeks.

These clinical study reviews confirm that Turmeric Curcumin supplements may enhance joint comfort:

- [Efficacy of curcumin and Boswellia for knee osteoarthritis: Systematic review and meta-analysis.](#) In 2018, this meta-analysis of 11 studies observed that Curcumin supplementation was “statistically significantly more effective than placebo for pain relief and functional improvement”.
- [Efficacy of Turmeric Extracts and Curcumin for Alleviating the Symptoms of Joint Arthritis: A Systematic Review and Meta-Analysis of Randomized Clinical Trials.](#) In 2016, this review of 8 studies observed that the studies “provide scientific evidence that supports the efficacy of turmeric extract”.

This clinical study indicates that Black Pepper supplements (in a 1 to 100 ratio) may enhance the efficacy of Turmeric Curcumin:

- [Influence of piperine on the pharmacokinetics of curcumin in animals and human volunteers.](#) In 1998, this study found that “piperine enhances the serum concentration, extent of absorption and bioavailability of curcumin in both rats and humans with no adverse effects” and “the increase in bioavailability was 2000%”.

Turmeric and Boswellia for Healthy Joint Function and Comfort

The combination of Turmeric Curcumin and Boswellia Serrata supplements may enhance joint comfort and function for better aging, according to these clinical studies on humans:

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- [Fast Relief of Acute Musculoskeletal Pain in Different Body Parts Following Exercise – A Randomized Double-Blind Placebo-Controlled Human Study with Curcuma longa and Boswellia serrata Extracts.](#) In 2022, this study found that [combined Curcumin and Boswellia] “can be recommended as a fast-acting alternative to current therapies for acute musculoskeletal pain affecting head and neck, upper and lower limbs, trunk, and general body pain.”
- [Efficacy and safety of curcumin and its combination with boswellic acid in osteoarthritis: a comparative, randomized, double-blind, placebo-controlled study.](#) In 2018, this study found that “a significant effect of [combined Curcumin and Boswellia] compared to placebo was observed both in physical performance tests and the WOMAC joint pain index” and “Curcumin in combination with boswellic acid is more effective.”
- [Co-analgesic therapy for arthroscopic supraspinatus tendon repair pain using a dietary supplement containing Boswellia serrata and Curcuma longa: a prospective randomized placebo-controlled study.](#) In 2015, this study found that combined Curcumin and Boswellia supplementation “alleviated short and partially mid-term pain, while long-term pain was unchanged [but] this limitation can probably be addressed by a dosage increase.”

Vitamin D to Support Healthy Mobility and Better Aging

Approximately 93% of people in the United States consume less than the estimated average requirement for Vitamin D from natural sources and fortified foods, and a larger unknown percentage consume less than optimal amounts, according to these studies:

- [Second National Report on Biochemical Indicators of Diet and Nutrition in the U.S. Population.](#) In 2012, this study observed that “dietary deficiencies are well documented, and they have characteristic signs and symptoms. In addition, recent findings have determined that less than optimal biochemical concentrations (representing suboptimal status) have been associated with risks of adverse health effects.”
- [Foods, Fortificants, and Supplements: Where Do Americans Get Their Nutrients?](#)

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In 2011, this study observed that “without enrichment and/or fortification and supplementation, many Americans did not achieve the recommended micronutrient intake levels set forth in the Dietary Reference Intake.”

Vitamin D supplements may support healthy mobility, according to these clinical studies:

- [The effect of vitamin D and exercise on balance and fall risk in postmenopausal women: A randomised controlled study.](#) In 2021, this study found that Vitamin D “has positive effects on balance and [quality of life].”
- [Comprehensive Interventions Including Vitamin D Effectively Reduce the Risk of Falls in Elderly Osteoporotic Patients.](#) In 2021, this study concluded that “active vitamin D is better than non-active vitamin D to improve physical ability and the BMD of lumbar vertebrae and reduce the risk of falls.”
- [A higher dose of vitamin d reduces the risk of falls in nursing home residents: a randomized, multiple-dose study.](#) In 2007, this study found that higher doses of Vitamin D resulted in “a lower number of fallers and a lower incidence rate of falls.” Participants used between 5 and 20 mcg Vitamin D daily for five months.
- [Low-dose vitamin D prevents muscular atrophy and reduces falls and hip fractures in women after stroke: a randomized controlled trial.](#) In 2005, this study found that “Vitamin D may increase muscle strength by improving atrophy of type II muscle fibers, which may lead to decreased falls and hip fractures.” Participants used 25 mcg Vitamin D daily for two years.

Vitamin D supplements may support healthy mobility, according to this clinical study review:

- [Fall prevention with supplemental and active forms of vitamin D: a meta-analysis of randomised controlled trials.](#) In 2009, this review of eight studies observed that “supplemental vitamin D in a dose of [17.5 to 25 mcg] a day reduced the risk of falling among older individuals by 19% and to a similar degree as active forms of vitamin D.”

This study reported divergent results for a combination of daily and monthly doses

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above the upper limit of 250 mcg:

- [High-Dose Monthly Vitamin D for Prevention of Acute Respiratory Infection in Older Long-Term Care Residents: A Randomized Clinical Trial.](#) In 2017, this study found that Vitamin D supplementation “was associated with a higher rate of falls without an increase in fractures.” Participants used up to 25 mcg Vitamin D daily plus an extra 300 to 2500 mcg Vitamin D once per month for twelve months.

Vitamin D supplements may support better aging, according to these clinical study reviews:

- [Vitamin D Supplementation Trials Aimed at Reducing Mortality Have Much Higher Power When Focusing on People with Low Serum 25-Hydroxyvitamin D Concentrations.](#) In 2017, this study found that “Vitamin D supplementation trials aimed at reducing mortality in older adults have much higher power when focused on those with low serum ... concentrations”.
- [Vitamin D supplementation for prevention of mortality in adults.](#) In 2014, this review observed that “Vitamin D3 seemed to decrease mortality in elderly people living independently or in institutional care”.
- [Vitamin D and multiple health outcomes: umbrella review of systematic reviews and meta-analyses of observational studies and randomised trials.](#) In 2014, this review observed that “supplementation with vitamin D3 significantly reduces overall mortality among older adults”.
- [Vitamin D status and ill health: a systematic review.](#) In 2014, this review observed that Vitamin D “supplementation in elderly people (mainly women) ... seemed to slightly reduce all-cause mortality”.
- [Meta-analysis of long-term vitamin D supplementation on overall mortality.](#) In 2013, this review observed that “supplementation of vitamin D is effective in preventing overall mortality in a long-term treatment”.

Vitamin D3 supplements may be more effective than Vitamin D2 supplements,

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according to these clinical studies on humans:

- [Vitamin D3 seems more appropriate than D2 to sustain adequate levels of 25OHD: a pharmacokinetic approach.](#) In 2015, this study found that “D2 and D3 were equally effective in elevating 25OHD levels after a loading dose. ... In the long term, D3 seems more appropriate for sustaining 25OHD”.
- [Vitamin D\(3\) is more potent than vitamin D\(2\) in humans.](#) In 2011, this study found that “D3 is approximately 87% more potent in raising and maintaining serum 25(OH)D concentrations and produces 2- to 3-fold greater storage of vitamin D than does equimolar D2”.
- [Vitamin D2 is much less effective than vitamin D3 in humans.](#) In 2004, this study found that “Vitamin D(2) potency is less than one third that of vitamin D(3)”.

Vitamin K Complex to Support Healthy Bone Function

Approximately 31% of people in the United States consume less than the estimated average requirement for Vitamin K from natural sources and fortified foods, and larger unknown percentages consume less than optimal amounts, according to these studies:

- [Second National Report on Biochemical Indicators of Diet and Nutrition in the U.S. Population.](#) In 2012, this study observed that “dietary deficiencies are well documented, and they have characteristic signs and symptoms. In addition, recent findings have determined that less than optimal biochemical concentrations (representing suboptimal status) have been associated with risks of adverse health effects”.
- [Foods, Fortificants, and Supplements: Where Do Americans Get Their Nutrients?](#) In 2011, this study observed that “without enrichment and/or fortification and supplementation, many Americans did not achieve the recommended micronutrient intake levels set forth in the Dietary Reference Intake”.

Vitamin K Complex supplements, including K1 (dosage at 1000 mcg daily) and K2 as MK4 (dosage at 600 mcg to 45000 mcg daily) or MK7 (dosage at 100 mcg to 420 mcg

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daily), may enhance bone function for better aging, according to these clinical studies on humans:

- [Low-Dose Daily Intake of Vitamin K\(2\) \(Menaquinone-7\) Improves Osteocalcin \$\gamma\$ -Carboxylation: A Double-Blind, Randomized Controlled Trials.](#) In 2015, this study concluded that Vitamin K “was suggested to improve osteocalcin γ -carboxylation.” Participants used 100 mcg of K2 MK7 for 3 months.
- [Dietary intake of vitamin K in relation to bone mineral density in Korea adults: The Korea National Health and Nutrition Examination Survey \(2010-2011\).](#) In 2015, this study found that “low dietary vitamin K intake was associated with low bone mineral density”.
- [Low-dose vitamin K2 \(MK-4\) supplementation for 12 months improves bone metabolism and prevents forearm bone loss in postmenopausal Japanese women.](#) In 2014, this study found that Vitamin K supplementation “improved bone quality”. Participants used 1500 mcg of K2 MK4 daily for 12 months.
- [Low-dose menaquinone-4 Improves \$\gamma\$ -Carboxylation of Osteocalcin in Young Males: A Non-Placebo-Controlled Dose-Response Study.](#) In 2014, this study found that “menaquinone-4 supplementation at 600 μ g/day or more is likely to be important in terms of vitamin K requirements for bone health.” Participants used 600 mcg of K2 MK4 daily for 1 week.
- [Menatetrenone versus alfacalcidol in the treatment of Chinese postmenopausal women with osteoporosis: a multicenter, randomized, double-blinded, double-dummy, positive drug-controlled clinical trial.](#) In 2014, this study found that “[bone mineral density] among patients ... significantly increased”. Participants used 45000 mcg of K2 MK4 daily for 1 year.
- [Three-year low-dose menaquinone-7 supplementation helps decrease bone loss in healthy postmenopausal women.](#) In 2013, this study found that Vitamin K supplementation may “prevent bone loss”. Participants used 180 mcg of K2 MK7 daily for 36 months.
- [Dietary vitamin K2 supplement improves bone status after lung and heart](#)

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[transplantation](#). In 2010, this study found that Vitamin K supplementation had a “favorable effect on lumbar spine [bone mineral density]”. Participants used 180 mcg of K2 MK7 daily for 12 months.

- [Vitamin K2 supplementation improves hip bone geometry and bone strength indices in postmenopausal women](#). In 2007, this study found that Vitamin K supplementation “helps maintaining bone strength”. Participants used 45000 mcg of K2 MK4 daily for 36 months.
- [Vitamin K2 treatment for postmenopausal osteoporosis in Indonesia](#). In 2006, this study found that Vitamin K supplementation “resulted in a significant increase in lumbar [bone mineral density] and a significant decrease in undercarboxylated [osteocalcin] levels”. Participants used 45000 mcg of K2 MK4 daily for 48 weeks.
- [Vitamin K2 inhibits glucocorticoid-induced bone loss partly by preventing the reduction of osteoprotegerin \(OPG\)](#). In 2005, this study found that Vitamin K supplementation may “play a role in the prevention and treatment of ... bone loss”. Participants used 15000 mcg of K2 MK4 daily for 12 months.
- [Vitamin K1 supplementation retards bone loss in postmenopausal women between 50 and 60 years of age](#). In 2003, this study found that Vitamin K supplementation “may substantially contribute to reducing ... bone loss”. Participants used 1000 mcg of K1 daily for 36 months.
- [Effect of continuous combined therapy with vitamin K\(2\) and vitamin D\(3\) on bone mineral density and coagulofibrinolysis function in postmenopausal women](#). In 2002, this study found that Vitamin K supplementation “may be useful for increasing vertebral bone mass”. Participants used 45000 mcg of K2 MK4 daily for 24 months.
- [Vitamin K2 \(menatetrenone\) effectively prevents fractures and sustains lumbar bone mineral density in osteoporosis](#). In 2000, this study found that Vitamin K supplementation “effectively prevents the occurrence of new fractures”. Participants used 45000 mcg of K2 MK4 daily for 24 months.

These clinical study reviews confirm that Vitamin K supplements may enhance bone

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function for better aging:

- [Vitamin K and the prevention of fractures: systematic review and meta-analysis of randomized controlled trials](#). In 2006, this review of 7 studies observed that “supplementation with [Vitamin K] reduces bone loss”.

These clinical studies reported divergent results for Vitamin K1 and K2 MK4:

- [Vitamin K treatment reduces undercarboxylated osteocalcin but does not alter bone turnover, density, or geometry in healthy postmenopausal North American women](#). In 2009, this study (Binkley) found that Vitamin K supplementation had no effect “on lumbar spine or proximal femur [bone mineral density] or proximal femur geometric parameters”. Participants used 1000 mcg of K1 or 45000 mcg of K2 MK4 daily for 12 months.
- [Effect of vitamin K supplementation on bone loss in elderly men and women](#). In 2008, this study (Booth) found that Vitamin K supplementation “does not confer any additional benefit for bone health at the spine or hip”. Participants used 500 mcg of K1 daily for 36 months.
- [Vitamin K, circulating cytokines, and bone mineral density in older men and women](#). In 2008, this study (Shea) found that “poor vitamin K status was associated with high concentrations of cytokines involved in bone turnover, but vitamin K supplementation did not confer a decrease in cytokine concentrations”. Participants used 500 mcg of K1 daily for 36 months.
- [Vitamin K supplementation in postmenopausal women with osteopenia \(ECKO trial\): a randomized controlled trial](#). In 2008, this study (ECKO) found that Vitamin K supplementation “does not protect against age-related decline in BMD”. Participants used 5000 mcg of K1 daily for 2 years.
- [Factors affecting bone loss in female endurance athletes: a two-year follow-up study](#). In 2003, this study (Braam) found that “supplementation with vitamin K did not affect the rate of bone loss”. Participants used 10000 mcg of K1 daily for 24 months.

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These clinical study reviews challenge the studies that reported divergent results:

- [The Synergistic Interplay between Vitamins D and K for Bone and Cardiovascular Health: A Narrative Review](#). In 2017, this review observed about the Binkley study that “the relatively short study duration and the inclusion of healthy women could explain the null finding. It is however questionable if [bone mineral density] can be improved in 12 months since changes in [bone mineral density] usually require at least 1 year of follow-up time”.
- [Vitamin K and bone](#). In 2017, this review observed about the ECKO study that “despite a lack of effect on bone mineral density and bone resorption, the incidence of clinical vertebral fractures among women in the [Vitamin K] group was significantly lower ... the effect of [Vitamin K] on bone may not be related to changes in bone mineral density or bone turnover, but rather on [Vitamin K] effects on bone quality”.
- [Bone health nutrition issues in aging](#). In 2010, this review observed about the Booth study that “there was no difference in [bone mineral density] but the percent of undercarboxylated osteocalcin was reduced in those receiving additional vitamin K”.
- [Vitamin K, circulating cytokines, and bone mineral density in older men and women](#). In 2008, this study observed about the Shea study (itself) that “the healthy status of this cohort may explain a lack of effect of vitamin K supplementation on cytokine concentrations”.
- [Vitamin K2 supplementation improves hip bone geometry and bone strength indices in postmenopausal women](#). In 2007, this study observed about the Braam study that “in another study from the same group, however, a synergistic effect ... with minerals and vitamin D was found. In this study the rate of bone loss in postmenopausal women was reported to be 35% lower in the presence of minerals and vitamins K1 and D as compared to the group receiving minerals and vitamin D without vitamin K”.

This clinical study indicates that Vitamin K2 MK7 supplements are more dose-efficient than Vitamin K2 MK4 supplements:

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- [Comparison of menaquinone-4 and menaquinone-7 bioavailability in healthy women.](#) In 2012, this study found 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”. Participants used 420 mcg of either K2 MK4 or K2 MK7 once.

Vitamin D and Vitamin K to Enhance Bone Function

The combination of Vitamin D and Vitamin K supplements may enhance bone function more than Vitamin K alone, according to these clinical studies on humans:

- [Effect of continuous combined therapy with vitamin K\(2\) and vitamin D\(3\) on bone mineral density and coagulofibrinolysis function in postmenopausal women.](#) In 2002, this study found that “combined therapy with vitamin [K2 and D3] for 24 months markedly increased bone mineral density.” And, more than vitamin K2 alone, “revealed stimulation of both bone formation and resorption activity.”
- [Use of vitamin K2 \(menatetrenone\) and 1,25-dihydroxyvitamin D3 in the prevention of bone loss induced by leuprolide.](#) In 1999, this study found that “Vitamin K2, especially when combined with [D3], can partially prevent bone loss caused by estrogen deficiency.”

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