Vitamin K and Bone Health

Nutr Res. 2009 Apr;29(4):221-8.

High-dose vitamin K supplementation reduces fracture incidence in postmenopausal women: a review of the literature.

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Although systematic review and meta-analysis of randomized controlled trials (RCTs) have concluded that vitamin K is effective in preventing fractures, the effect of vitamin K on the skeleton remains a matter of controversy. The objective of the present review of the literature was to evaluate the effect of vitamin K supplementation on the skeleton of postmenopausal women. PubMed was used to search the reliable literature for RCTs by using the search terms "vitamin K(1) or vitamin K(2)," "bone," and "postmenopausal women" and the following inclusion criteria: approximately 50 or more subjects per group and study period of 2 years or longer. Seven RCTs met the inclusion criteria. The results of these RCTs showed that vitamin K(1) and vitamin K(2) supplementation reduced serum undercarboxylated osteocalcin levels regardless of dose but that it had inconsistent effects on serum total osteocalcin levels and no effect on bone resorption. Despite the lack of a significant change or the occurrence of only a modest increase in bone mineral density, high-dose vitamin K(1) and vitamin K(2) supplementation improved indices of bone strength in the femoral neck and reduced the incidence of clinical fractures. The review of the reliable literature confirmed the effect of vitamin K(1) and vitamin K(2) supplementation on the skeleton of postmenopausal women mediated by mechanisms other than bone mineral density and bone turnover.

PMID: 19410972 [PubMed - in process]

Osteoporos Int. 2009 Jun;20(6):935-42. Epub 2008 Sep 30.

High prevalence of vitamin K and D deficiency and decreased BMD in inflammatory bowel disease.

Kuwabara A, **Tanaka K**, **Tsugawa N**, **Nakase H**, **Tsuji H**, **Shide K**, **Kamao M**, **Chiba T**, **Inagaki N**, **Okano T**, **Kido S**.

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SUMMARY: Vitamin K and D deficiency and decreased bone mineral density (BMD) were highly prevalent in patients with inflammatory bowel disease (IBD), especially Crohn's disease (CD). Dietary intakes of these vitamins, however, were above the Japanese adequate intakes in IBD patients, suggesting that malabsorption is the basis for hypovitaminosis K and D and decreased BMD. INTRODUCTION: We have studied the possible involvement of vitamin K and D deficiency in the pathogenesis of decreased BMD in IBD. METHODS: Seventy patients with IBD were evaluated for their BMD; plasma levels of vitamin K; phylloquinone (PK), menaquinone-7 (MK-7), and 25OH-D; serum PTH, protein induced by vitamin K absence (PIVKA-II), and undercarboxylated osteocalcin (ucOC) levels; and their food intake. RESULTS: Compared with ulcerative colitis (UC) patients, CD patients had significantly lower plasma vitamin K and 25OH-D concentrations; significantly higher serum levels of PTH, PIVKA-II, and ucOC; and significantly lower BMD scores at almost all measurement sites. More IBD patients were vitamin K deficient in bone than in liver. Multiple regression analyses revealed that low plasma concentrations of vitamin K and 25OH-D were independent risk factors for low BMD and that they were associated with the patients' fat intake, but not with their intake of these vitamins. CONCLUSION: IBD patients have high prevalence of decreased BMD and vitamin K and D deficiency probably caused by malabsorption of these vitamins.

Publication Types:

- Research Support, Non-U.S. Gov't

PMID: 18825300 [PubMed - in process]

Proc Nutr Soc. 2008 May;67(2):163-76.

Importance of calcium, vitamin D and vitamin K for osteoporosis prevention and treatment.

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Throughout the life cycle the skeleton requires optimum development and maintenance of its integrity to prevent fracture. Bones break because the loads placed on them exceed the ability of the bone to absorb the energy involved. It is now estimated that one in three women and one in twelve men aged >55 years will suffer from osteoporosis in their lifetime and at a cost in the UK of > 1.7 pounds x 10(9) per year. The pathogenesis of osteoporosis is multifactorial. Both the development of peak bone mass and the rate of bone loss are determined by key endogenous and exogenous factors. Ca supplements appear to be effective in reducing bone loss in women late post menopause (>5 years post menopause), particularly in those with low habitual Ca intake (<400 mg/d). In women early post menopause (<5 years post menopause) who are not vitamin D deficient, Ca supplementation has little effect on bone mineral density. However, supplementation with vitamin D and Ca has been shown to reduce fracture rates in the institutionalised elderly, but there remains controversy as to whether supplementation is effective in reducing fracture in free-living populations. Re-defining vitamin D requirements in the UK is needed since there is evidence of extensive hypovitaminosis D in the UK. Low vitamin D status is associated with an increased risk of falling and a variety of other health outcomes and is an area that requires urgent attention. The role of other micronutrients on bone remains to be fully defined, although there are promising data in the literature for a clear link between vitamin K nutrition and skeletal integrity, including fracture reduction.

Publication Types:

- Review

PMID: 18412990 [PubMed - indexed for MEDLINE]

Arch Phys Med Rehabil. 2005 Mar;86(3):576-81.

Vitamin K deficiency and osteopenia in elderly women with Alzheimer's disease.

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OBJECTIVE: To analyze the relation between vitamin K status and bone mineral density (BMD) in women with Alzheimer's disease (AD). DESIGN: Cross-sectional study. SETTING: Outpatient departments of neurology and neuropsychiatry at a hospital in Japan. Participants One hundred women with AD (mean age, 79.8 y) and 100 age-matched community dwelling controls (mean age, 80.6 y). INTERVENTIONS: Not applicable. MAIN OUTCOME MEASURES: Patients were divided into 2 groups according to the degree of dementia: the mild AD group was composed of patients with a score in Mini-Mental State Examination (MMSE) of 16 and above (n=42); patients in the severe AD group had MMSE scores below 15 (n=58). We assessed body mass index (BMI). BMD was measured by computed x-ray densitometry. Serum concentrations of vitamin K 1 , 25-hydroxyvitamin D (25[OH]D 3), intact parathyroid hormone (PTH), and Glu osteocalcin (OC) were measured. RESULTS: BMI was significantly lower in women with more severe AD. Metacarpal BMD (P <.02) and serum concentrations of vitamin K 1 (P <.03) and 25(OH)D 3 (P <.001) were significantly lower in the severe AD group than in the mild AD group. Serum levels of intact PTH and Glu OC in severely demented patients were higher than those with mild dementia (P <.001). Serum PTH concentration correlated negatively with serum 25(OH)D 3 level (r =-.241, P =.016). Serum concentration of vitamin K 1 correlated positively with that of 25(OH)D 3 (r =.423, P <.001) and MMSE score (r =.353, P <.001), and negatively with Glu OC (r =-.580, P <.001). CONCLUSIONS: In female AD patients, nutritional vitamin K 1 deficiency may reduce production of fully carboxylated OC, which in turn may cause reduced BMD. Lower BMIs in more severe AD may imply the presence of general malnutrition in such a patient group.

PMID: 15759247 [PubMed - indexed for MEDLINE]

Br J Nutr. 2009 May 19:1-8. [Epub ahead of print]

The effect of menaquinone-7 (vitamin K2) supplementation on osteocalcin carboxylation in healthy prepubertal children.

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Vitamin K contributes to bone health, probably through its role as cofactor in the carboxylation of osteocalcin. Intervention studies in adults have demonstrated that markedly higher osteocalcin carboxylation is obtained by intakes of vitamin K well above the current recommended dietary intake. However, the relationship between increased vitamin K2 intake and enhanced osteocalcin carboxylation has never been shown in healthy children. The objective was to study the effect of 45 mug menaquinone-7 (MK-7; one of the vitamin K2 species) on the circulating levels of undercarboxylated osteocalcin (ucOC) and carboxylated osteocalcin (cOC) in healthy prepubertal children. We hypothesised that MK-7 supplementation will reduce the ucOC:cOC ratio (UCR), indicating an improved vitamin K status. The present study is a double-blind randomised placebo-controlled trial examining the effect of 8 weeks MK-7 supplementation on the carboxylation of osteocalcin in healthy children (n 55). Serum levels of ucOC, cOC and MK-7 were measured at baseline and after 8 weeks, together with bone markers and coagulation parameters. The UCR was used as an indicator of vitamin K status. In the MK-7-supplemented group (n 28), the circulating concentration of inactive ucOC reduced and the UCR improved whereas the concentration of MK-7 increased. Within the placebo group, ucOC, cOC, UCR and MK-7 did not significantly change over time. In both groups, bone markers and coagulation parameters remained constant over time. These findings demonstrate that in healthy, prepubertal children, modest supplementation with MK-7 increases circulating concentrations of MK-7 and increases osteocalcin carboxylation.

PMID: 19450370 [PubMed - as supplied by publisher]

Int J Artif Organs. 2009 Feb;32(2):67-74.

Coagulation meets calcification: the vitamin K system.

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Morbidity and mortality are massively increased in patients with chronic kidney disease (CKD) and patients with end-stage renale disease (ESRD). Bone disease (renal osteodystrophy) and vascular disease (accelerated arteriosclerosis) are two typical entities contributing to this excess morbidity and mortality. Vitamin K and vitamin K-dependent-proteins play pivotal roles in the physiology of mineralization and in preventing ectopic calcification: two of these vitamin K-dependent-proteins are osteocalcin (regulating bone mineralization) and matrix-Gla protein (MGP, local calcification inhibitor in the vessel wall). Vitamin K deficiency impairs the physiological function of osteocalcin and MGP and, therefore, presumably contributes to bone demineralisation and vascular calcification (the so-called calcification paradox). In this context, the usage of vitamin K antagonists for long-term oral anticoagulation therapy might be risky especially in CKD patients exhibiting a high background level of vascular calcification. We present a summary of data describing the potential role of vitamin K deficiency and supplementation in bone and vascular disease in patients with CKD or ESRD.

PMID: 19363777 [PubMed - in process]

Am J Clin Nutr. 2008 Aug;88(2):356-63.

Vitamin K, circulating cytokines, and bone mineral density in older men and women.

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BACKGROUND: Vitamin K modulates cytokines involved in bone turnover, including interleukin-6 (IL-6) and osteoprotegerin in vitro. OBJECTIVE: The objective of this study was to assess 1) associations between measures of vitamin K status [plasma phylloquinone and serum percentage of undercarboxylated osteocalcin (%ucOC)] and IL-6, osteoprotegerin, and C-reactive protein (CRP) concentrations and 2) the effect of daily 500 mug phylloquinone supplementation for 3 y on cytokine concentrations. DESIGN: Concentrations of IL-6, osteoprotegerin, and CRP and bone mineral density (BMD) were measured at baseline and after 3 y of follow-up in 379 healthy men and women (60-81 y; 58.5% women) participating in a randomized trial that studied the effect of vitamin K supplementation on bone loss. RESULTS: Cross-sectionally, plasma phylloquinone was inversely associated with IL-6 and CRP, whereas serum %ucOC was inversely associated with IL-6. Osteoprotegerin was associated positively with plasma phylloquinone and inversely with %ucOC. No differences were observed in the 3-y change in IL-6, osteoprotegerin, and CRP concentrations between participants who received phylloquinone supplementation and those who did not. Overall, no association was observed between the 3-y changes in circulating cytokines and BMD. CONCLUSIONS: 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. The healthy status of this cohort may explain a lack of effect of vitamin K supplementation on cytokine concentrations. This trial was registered with www.clinicaltrials.gov as NCT00183001.

PMID: 18689371 [PubMed - indexed for MEDLINE]

Clin Exp Rheumatol. 2008 May-Jun;26(3):484-91.

Extremes in vitamin K status of bone are related to bone ultrasound properties in children with juvenile idiopathic arthritis.

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OBJECTIVE: Osteopenia is a common complication of juvenile idiopathic arthritis (JIA). In adults, low bone density and increased fracture risk are associated with low vitamin K status of bone. The vitamin K-dependent protein osteocalcin plays an important role in bone metabolism. Its activity depends upon post-translational carboxylation in which vitamin K is an essential co-factor. Hence, vitamin K deficiency leads to under-carboxylated (i.e., inactive) osteocalcin (ucOC). Little is known about the vitamin K status and bone health in children with juvenile idiopathic arthritis (JIA). We studied the vitamin K status of bone and its association with bone mass properties in children with JIA compared to healthy children. METHODS: We performed a cross sectional study in 55 children with JIA and 54 healthy controls between 6-18 years of age. Bone markers, ultrasound bone mass properties and vitamin K status of bone were determined. RESULTS: Overall, no differences in vitamin K status of bone were found between the study groups. Among children with JIA, a high ratio of ucOC/cOC indicating low vitamin K status was associated with low bone ultrasound parameters, whereas children with a high vitamin K status had markedly higher bone properties. This association was independent of physical activity, age, gender and BMI. CONCLUSION: These results suggest that vitamin K may be one of multiple risk factors for low bone mass in children with JIA, in addition to other recognized determinants of bone mass. The question remains whether JIA patients would benefit from increased dietary vitamin K intake.

Publication Types:

- Research Support, Non-U.S. Gov't

PMID: 18578975 [PubMed - indexed for MEDLINE]

Vitam Horm. 2008;78:417-34.

Diagnosis of osteoporosis with vitamin k as a new biochemical marker.

Heiss C, **Hoesel LM**, **Wehr U**, **Wenisch S**, **Drosse I**, **Alt V**, **Meyer C**, **Horas U**, **Schieker M**, **Schnettler R**.

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Osteoporosis is a metabolic bone disease characterized by reduced bone quality and quantity. As a consequence, patients are at risk for fractures, subsequent immobility, and higher mortality especially among elder patients. Because of the high incidence of complications and the associated financial burden for the health system, new parameters for diagnostic and therapeutic purposes are urgently needed. In this regard, research focused on vitamin K as a biochemical bone marker has provided promising results. Vitamin K represents an important enzyme-cofactor for the posttranslational modification and activation of several proteins involved in bone metabolism. Vitamin K has been proven to be a valuable diagnostic as well as therapeutic parameter especially in osteoporosis. Patients with osteoporosis have been shown to have decreased levels of vitamin K. Further, regular intake of vitamin K may increase bone mineral density (BMD), thereby lowering the fracture risk. Yet vitamin K alone may not sufficiently indicate the mineral status of the bone. However, the usefulness of a combination of several biochemical bone markers as improved surrogate markers of bone metabolism has been shown recently. Therefore, this review will focus on the significance and importance of vitamin K for bone metabolism. Beyond this, aspects on the current and prospective use of vitamin K as well as other newly developed biochemical bone markers will be discussed.

Publication Types:

- Review

PMID: 18374203 [PubMed - indexed for MEDLINE]

Vitam Horm. 2008;78:393-416.

Vitamin K and bone health in adult humans.

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Vitamin K is receiving more attention in relation to its role in bone metabolism. Vitamin K is a coenzyme for glutamate carboxylase, which mediates the conversion of glutamate to gamma-carboxyglutamate (Gla). The gamma-carboxylation of the Gla proteins is essential for the proteins to attract Ca2+ and to incorporate these into hydroxyapatite crystals. The best known of the three known bone-related Gla proteins is osteocalcin (OC). Even though the exact role of OC is not known, a number of studies have shown that vitamin K insufficiency or high levels of undercarboxylated osteocalcin (ucOC) is associated with an increase in the concentration of circulating ucOC. Furthermore, several studies have demonstrated that vitamin K insufficiency is associated with low bone mineral density (BMD) and increased fractures. Vitamin K supplementation, on the other hand, has been shown to improve the bone turnover profile and decrease the level of circulating ucOC. Dietary recommendations are based on saturation of the coagulation system, and in most countries the dietary intake is sufficient to obtain the amount recommended. In relation to bone, requirements might be higher. The aim of this chapter is to give an overview of the importance of vitamin K in relation to bone health in adult humans and thereby in the prevention of osteoporosis. Furthermore, I will shortly discuss the interaction with vitamin D and the paradox in relation to warfarin treatment.

Publication Types:

- Review

PMID: 18374202 [PubMed - indexed for MEDLINE]

Br J Nutr. 2008 Oct;100(4):852-8. Epub 2008 Feb 18.

Vitamin K status is associated with childhood bone mineral content.

van Summeren MJ, **van Coeverden SC**, **Schurgers LJ**, **Braam LA**, **Noirt F**, **Uiterwaal CS**, **Kuis W**, **Vermeer C**.

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In adult bone, vitamin K contributes to bone health, probably through its role as co-factor in the carboxylation of osteocalcin. In children, the significance of vitamin K in bone-mass acquisition is less well known. The objective of this longitudinal study was to determine whether biochemical indicators of vitamin K status are related to (gains in) bone mineral content (BMC) and markers of bone metabolism in peripubertal children. In 307 healthy children (mean age 11.2 years), BMC of the total body, lumbar spine and femoral neck was determined at baseline and 2 years later. Vitamin K status (ratio of undercarboxylated (ucOC) to carboxylated (cOC) fractions of osteocalcin; UCR) was also measured at both time points. Markers of bone metabolism, sex steroids, vitamin D status and growth hormones were measured at baseline only. Large variations in the levels of the UCR were found at both time-points, indicating a substantial interindividual difference in vitamin K status. Improvement of vitamin K status over 2 years (n 281 children) was associated with a marked increase in total body BMC (r -49.1, P<0.001). The UCR was associated with pubertal stage, markers of bone metabolism, sex hormones and vitamin D status. A better vitamin K status was associated with more pronounced increase in bone mass in healthy peripubertal children. In order to determine the significance of these findings for childhood bone health, additional paediatric studies are needed.

Publication Types:

- Research Support, Non-U.S. Gov't

PMID: 18279558 [PubMed - indexed for MEDLINE]

Mayo Clin Health Lett. 2007 Nov;25(11):4.

Vitamin K linked to bone strength.

[No authors listed]

Publication Types:

- News

PMID: 18232068 [PubMed - indexed for MEDLINE]

J Endocrinol Invest. 2007;30(6 Suppl):24-8.

Role of vitamin K on biochemical markers, bone mineral density, and fracture risk.

Francucci CM, **Rilli S**, **Fiscaletti P**, **Boscaro M**.

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Osteoporosis is a multifactorial chronic disease that may become even more prevalent and more of a public health problem in the decades to come. Recent research has indicated that a number of macro- and micronutrients are involved in the development of bone health. In the past decade it became evident that vitamin K played a significant role in human health beyond its well-established function in blood clotting. In fact, among the proteins known or suspected to be involved in bone and vascular biology there are several members of the vitamin K dependent or gamma-carboxyglutamic acid protein family. Based on the current evidence from epidemiologic and intervention studies, there are insufficient data to recommend a routine supplementation of vitamin K for optimal bone health. New experimental and placebo-controlled studies in humans should clarify our understanding of the role vitamin K plays in improving bone health.

Publication Types:

- Review

PMID: 17721070 [PubMed - indexed for MEDLINE]

Clin Calcium. 2007 Nov;17(11):1717-26.

[Serum vitamin K concentration and nutrition]

[Article in Japanese]

Tsugawa N, **Okano T**.

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Vitamin K (VK) is well known for its role in the synthesis of a number of blood coagulation factors. VK is also an important factor for bone metabolism via gamma-carboxylation of VK-dependent proteins such as osteocalcin, matrix Gla protein, and protein S. Recently, it is rare that severe VK deficiency is observed. However, low dietary VK intake or low VK status has been shown to be associated with low bone mineral density and increased hip fracture risk. These studies suggest that there is potential VK insufficiency in bone, even in sufficient VK status for blood coagulation. In the present review, the studies concerning relationship between serum VK concentration and bone health, including pharmacokinetics of VK analogues (such as phylloquinone and menaquinone) and factors which affect on blood circulation of VK, are reviewed.

Publication Types:

- English Abstract
- Review

PMID: 17982192 [PubMed - indexed for MEDLINE]

Clin Calcium. 2007 Nov;17(11):1678-84.

Related Articles, Links

[Vitamin K and bone quality]

[Article in Japanese]

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Meta-analysis involving previous clinical studies showed that VK(2) decreased the incidence of fracture. In particular, the results based on the data on bone mineral density and fracture suggested that VK(2) improves bone quality. Preclinical studies regarding bone quality reported that VK(2) improved the trabecular microarchitecture (connectivity and width) in an ovariectomized model, and that VK(2) increased the bone strength without influencing the bone mineral content in a model fed a low-Mg diet and a vitamin C deficiency model, increasing the collagen level and proline hydroxylation. Thus, improvement in bone quality via actions on the bone geometry and collagen level/quality may be involved in a VK(2)-related decrease in the incidence of new fracture in clinical studies.

Publication Types:

- English Abstract
- Review

PMID: 17982187 [PubMed - indexed for MEDLINE]

Int J Vitam Nutr Res. 2006 Nov;76(6):385-90.

A preliminary assessment of vitamin K1 intakes and serum undercarboxylated osteocalcin levels in 11-13 year old Irish girls.

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Low vitamin K1 intakes have been associated with low bone mineral density in women and reduced bone turnover in girls. No European data exist on the relationship between vitamin K1 and serum undercarboxylated osteocalcin (ucOC), an indicator of K1 status in adolescents. The aim of the current study was to assess intakes of vitamin K1 in relation to serum ucOC status in Irish girls. A detailed dietary history method, which measured habitual intakes from a typical 14-day period, was used to estimate vitamin K1 intakes in 18 girls aged 11-13 years. Recently compiled and validated food composition data for vitamin K1 were used to determine vitamin K1 intakes. An enzyme immunoassay was used to measure ucOC in fasting serum samples. The mean (+/- SD) intake of vitamin K1 in the girls was 72.4 microg/day (SD 34.4). Vegetables (particularly broccoli, composite dishes, and lettuce) contributed 53% of total vitamin K1 intakes. Thirty-Seven percent of the girls failed to meet the current U.S. adequate intake for adolescents of 60 microg/day vitamin K1. Serum ucOC levels were inversely related to body weight-adjusted vitamin K1 intakes, controlling for energy intake (partial correlation r = -0.538; p = 0.026). The data indicate that large-scale studies to examine relationships between vitamin K1 (and green vegetable) intakes and bone growth and development in adolescents are warranted.

PMID: 17607958 [PubMed - indexed for MEDLINE]

Med Monatsschr Pharm. 2007 Jan;30(1):35-6.

[Vitamin K for prevention of fracture]

[Article in German]

Ecker-Schlipf B.

PMID: 17262902 [PubMed - indexed for MEDLINE]

Nippon Rinsho. 2006 Sep;64(9):1639-43.

[Active vitamin D and vitamin K as therapeutic agents for osteoporosis]

[Article in Japanese]

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Active vitamin D has been most widely used in Japan for the treatment of osteoporosis. However, clinical evidence for its efficacy as an anti-osteoporotic drug is scarce in terms of fracture prevention. Recent reports suggest that active vitamin D may prevent fracture not only through enhancement of intestinal calcium absorption but also by improving bone quality and/or strength independently of bone mass and by improving neuromuscular function to reduce the number of fall. Low serum concentrations of vitamin K have been reported in patients with osteoporosis, and serum osteocalcin appears to be undercarboxylated in these individuals, a process dependent on vitamin K. Undercarboxylated osteocalcin is also a significant risk for hip fracture. Clinical studies in Japan suggest that menatetrenone (vitamin K2) reduces skeletal losses and, in a small randomized clinical trial, it reduced the rate of vertebral fractures. Menatetrenone is currently used in Japan, the Republic of Korea and Thailand.

Publication Types:

- English Abstract
- Review

PMID: 16972672 [PubMed - indexed for MEDLINE]

Clin Calcium. 2006 Sep;16(9):1526-34.

[Protective effects of vitamin K against osteoporosis and its pleiotropic actions]

[Article in Japanese]

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Vitamin K is a nutrient originally identified as an essential factor for blood coagulation. Recently, vitamin K has emerged as a potential protector against osteoporosis and hepatocarcinoma. Accumulated evidence indicates that subclinical non-hemostatic vitamin K deficiency in extrahepatic tissues, particularly in bone, exists widely in the otherwise healthy adult population. Both vitamin K(1) and K(2) have been shown to exert protective effects against osteoporosis. Moreover, therapeutic potential of vitamin K(2) as an anti-hepatoma drug has been recently highlighted. Most of the new biological functions of vitamin K in bone and hepatoma cells are considered to be attributable to promotion of gamma-carboxylation of glutamic acid residues in vitamin K-dependent proteins, which is shared by both vitamins K(1) and K(2). In contrast, vitamin K(2)-specific, gamma-carboxylation-unrelated functions have also been demonstrated. These functions include stimulation of steroid and xenobiotic receptor (SXR)-mediated transcription and anti-oxidant property. Thus, biological differences between vitamins K(1) and K(2), and a potential involvement of gamma-carboxylation-independent actions in the new roles of vitamin K remain open issues. Molecular bases of coagulation-unrelated pleiotropic actions of vitamin K and its implications in human health deserve further investigations.

Publication Types:

- English Abstract
- Review

PMID: 16951479 [PubMed - indexed for MEDLINE]

Arch Intern Med. 2006 Jun 26;166(12):1256-61.

Vitamin K and the prevention of fractures: systematic review and meta-analysis of randomized controlled trials.

Cockayne S, **Adamson J**, **Lanham-New S**, **Shearer MJ**, **Gilbody S**, **Torgerson DJ**.

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BACKGROUND: Observational and some experimental data suggest that low intake of vitamin K may be associated with an increased risk of fracture. OBJECTIVE: To assess whether oral vitamin K (phytonadione and menaquinone) supplementation can reduce bone loss and prevent fractures. DATA SOURCES: The search included the following electronic databases: MEDLINE (1966 to June 2005), EMBASE (1980 to June 2005), the Cochrane Library (issue 2, 2005), the ISI Web of Science (1945 to June 2005), the National Research Register (inception to the present), Current Controlled Trials, and the Medical Research Council Research Register. STUDY SELECTION: Randomized controlled trials that gave adult participants oral phytonadione and menaquinone supplements for longer than 6 months were included in this review. DATA EXTRACTION: Four authors extracted data on changes in bone density and type of fracture. All articles were double screened and double data extracted. DATA SYNTHESIS: Thirteen trials were identified with data on bone loss, and 7 reported fracture data. All studies but 1 showed an advantage of phytonadione and menaquinone in reducing bone loss. All 7 trials that reported fracture effects were Japanese and used menaquinone. Pooling the 7 trials with fracture data in a meta-analysis, we found an odds ratio (OR) favoring menaquinone of 0.40 (95% confidence interval [CI], 0.25-0.65) for vertebral fractures, an OR of 0.23 (95% CI, 0.12-0.47) for hip fractures, and an OR of 0.19 (95% CI, 0.11-0.35) for all nonvertebral fractures. CONCLUSIONS: This systematic review suggests that supplementation with phytonadione and menaquinone-4 reduces bone loss. In the case of the latter, there is a strong effect on incident fractures among Japanese patients.

Publication Types:

- Meta-Analysis
- Review
- PMID: 16801507 [PubMed - indexed for MEDLINE]