

Research Bibliography Relating to Bones, Gait and more

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You may find the following articles that relate to bone/skeletal health to be of value. Brief information is given here. Please be responsible and review articles for your own understanding of them before passing information along as "fact." Refer to our article "Reviewing and Using Scientific Research" as a guide.

Many of these have links on the web. Whenever you see an article title in blue with an underline, you can click on it and you will be taken to that web link. However, these links will generally be abstracts. To truly evaluate the quality of the research, you will need access to the entire article. The entire article can generally be obtained through your local library. Many public libraries provide this service—free of charge.

Understanding Bone Mineral Density (BMD)

Since BMD is the primary way in which the traditional medical field is defining bone health, one needs a basic understanding of this measurement and how it is used. Many nice overviews can be found on the web. You can also read our article [Understanding Bone Mineral Density](#).

Affects of Bones for Life® on Bone Mineral Density

<http://www.bonesforlife.com/studies2.asp>

In this pilot study, BMD improved in a significant way in the 31 female participants, aged 28 - 69 years old, who worked with Ruthy Alon for four months, meeting three hours per week.

African Women Bearing Head-Supported Loads

[Energy-saving gait mechanics with head-supported loads](#)

Heglund NC, Willems PA, Penta M, Cavagna GA
Nature. 1995 May 4;375(6526):52-4.

By using a force platform, this study investigates the mechanics of how head-supported loads by Kikuyu and Luo women occurs.

Findings included: “The weight-specific mechanical work, required to maintain the motion of the common centre of mass of the body and load, decreases with load in the African women, whereas it increases in control subjects. The decrease in work by the African women is a result of a greater conservation of mechanical energy resulting from an improved pendulum-like transfer of energy during each step, back and forth between gravitational potential energy and kinetic energy of the centre of mass.”

[Energetic cost of Carrying loads: have African women discovered an economic way?](#)

Maloiy GM, Heglund NC, Prager LM, Cavagna GA, Taylor CR
Nature. 1986 Feb 20-26;319(6055):668-9.

The purpose the study was to whether African women bearing large loads through the use of the head use specialized mechanisms for carrying the loads cheaply. Specifically reviewed was the Luo tribe that can be seen carrying loads equivalent to 70% of their body mass on their heads. Kikuyu women who use straps across the foreheads also carry large loads.

Findings included: Both the Luo and Kikuyu women carry loads of up to 20% of their body weight without increasing rate of energy consumption. The authors suggest that some element of training and/or anatomical change since childhood may allow these women to carry heavy loads economically.

[Walk like a pendulum](#)

Eugenie Samuel
The New Scientist; 13 January 2001; Issue 2273

An easy-to-read review of the research on Luo and Kikuyu load bearing women. It also reviews an older study that compared the performance of American army recruits carrying rucksacks to the newer studies and found significantly more efficient use of energy in these women.

Findings included: Carrying up to 20 percent of their body weight their energy consumption was the same as unloaded. Over 20 percent of body weight, there is no further gain in efficiency and decline begins as the loads continue to increase.

[Energetics of load carrying in Nepalese porters](#)

Bastien GJ, Schepens B, Willems PA, Heglund NC
Science. 2005 Jun 17;308(5729):1755

Nepalese porters routinely carry head-supported loads equal to 100 to 200% of their body weight. This study finds that female porters carry, on average, loads that are 10% heavier than the maximum loads carried by the African women (adjusted for body weight), at a smaller metabolic cost.

[Pendular energy transduction within the step in human walking](#)

Cavagna GA, Willems PA, Legramandi MA, Heglund NC
J Exp Biol. 2002 Nov;205(Pt 21):3413-22

Energy transduction in the walk is examined to further understand how African women carry loads of up to 20% of their body weight on the head without increasing their energy expenditure. The gait of African and European women was reviewed both loaded and unloaded.

Findings included: Loading improves the transduction of energy during the descent of the center of mass (within the pendular motion). The improvement is not significant in European subjects, whereas it is highly significant in African women.

Understanding Fracture Rates in African Women

[Low bone mineral content is common but osteoporotic fractures are rare in elderly rural Gambian women](#)

Aspray TJ, Prentice A, Cole TJ, Sawo Y, Reeve J, Francis RM
J Bone Miner Res. 1996 Jul;11(7):1019-25

Up to this point the low fracture rate in North American black women has been understood to be caused by a high peak bone mass and preservation of bone mineral as they age. This study was performed to whether this is in fact that case.

Rural Gambian women and women from the U.K. were studied for their BMC and BMD at various sites.

Findings included: After age adjustment it was found that Gambian women over the age of 64 has 42% lower BMC at the lumbar spine and 31% lower BMD. There the conclusion was that BMD is not well preserved in elderly Gambian women. Since minimal trauma fractures are rare in this population, the results of this study challenge the notion that BMC is the primary determinant of fracture risk.

[Fractures of the hip and distal forearm in West Africa and the United Kingdom](#)

Adebajo AO, Cooper C, Evans JG
Age Ageing. 1991 Nov;20(6):435-8

Findings included: Reviewing age and sex specific rates of proximal femur and distal forearm fractures, the study found significantly lower rates in Ibadan than in two urban communities in England.

[Fractures of the femoral neck in Australian Aboriginals and Torres Strait](#)

Islanders. MacIntosh DJ, Pearson B.
Aust J Rural Health. 2001 Jun;9(3):127-33.

Actual reported femoral neck fractures were compared between indigenous Aboriginal patients and non-indigenous Torres Strait Islander patients between November 1997 and July 2000.

Findings included: "The female age profile is substantially older than the female non-indigenous osteoporotic fracture group. Indigenous females develop osteoporotic type fractures of the femoral neck at a later age than do non-indigenous females. This may reflect a genetic difference in bone mineral density or a healthy lifestyle in earlier days."

Bone Geometry Articles

[Comparison of cross-sectional geometry of the proximal femur in white and black women from Detroit and Johannesburg](#)

Nelson DA, Pettifor JM, Barondess DA, Cody DD, Uusi-Rasi K, Beck TJ
J Bone Miner Res. 2004 Apr;19(4):560-5

Because little is known about ethnic differences in bone architecture, this study reviews the cross-sectional geometric properties of the proximal femur in U.S. black and South African black and white postmenopausal women.

Findings included: Results are consistent with greater bone strength in the black groups in both countries. In the femoral neck, in both countries, the blacks had narrower endosteal diameters in U.S. and South African women, thicker cortices, and a lower buckling ratio despite a similar outer diameter. In the intertrochanteric region, the whites had a greater outer diameter in U.S. and South African women, lower cross-sectional area and a higher buckling ratio. The results suggest that there are fewer differences between the same ethnic groups in the two countries than there are between different ethnic groups within a country.

[Black-white differences in hip geometry. Study of Osteoporotic Fractures Research Group](#)

Theobald TM, Cauley JA, Gluer CC, Bunker CH, Ukoli FA, Genant HK
Osteoporos Int. 1998;8(1):61-7

Previous studies have demonstrated that reduced thickness of the femoral neck and shaft cortex, a wider intertrochanteric region and a longer hip axis length were predictive of hip fracture among Caucasian women. This study hypothesized that racial differences in hip geometry may contribute to explaining the differences in hip fractures between women of African origin and Caucasian women.

Findings included: Women of African origin have thicker cortical bone of the hip, a shorter hip axis length and smaller intertrochanteric widths than Caucasians. "Based on a model developed from hip fractures among Caucasian women, we predict that these observed racial differences could contribute to approximately a 25% decrease risk of hip fracture among blacks."

Effects of Vibration on Bone

[Good Vibrations](#)

Nov 2, 2001

Provides an easy review of the earliest NASA-funded studies on vibration by C Rubin. In his original work he discovered that 30 Hz vibration stimulated a nice result in human bone. Early on he talked about this being similar to the muscle twitch --like the one feels when squatting and resting hands on the

thighs (actual contractions run between 10 and 100 Hz.). Since that early work, there has been much done with vibration plates. However one very interesting study was done with children with CP.

[Low Magnitude Mechanical Loading is Osteogenic in Children with Disabling Conditions](#)

Ward K, Alsop C, Caulton J, Rubin C, Adams J, Mughal Z

J Bone Miner Res. 2004 Mar;19(3):360-9

Findings included: This particular study found that with only 44% compliance in the study group (4.4 minutes per day standing on a vibrating plate) at the end of 6 months there was a net benefit of 17.5% in proximal tibial vTBMD while the spine had negligible results. It is a remarkable result in the tibia given the low compliance and the group being studied.

[Low-frequency vibratory exercise reduces the risk of bone fracture more than walking: a randomized controlled trial](#)

Gusi N, Raimundo A, Leal A

BMC Musculoskelet Disord. 2006 Nov 30;7:92

The aim of this study was to compare the effectiveness of the whole-body vibration (WBV) plates type which uses reciprocating vertical displacements on the left and right side of a fulcrum while increasing the lateral accelerations at frequencies lower than 20 Hz and a walking-based exercise program on BMD and balance in post-menopausal women. The study lasted 8 months.

Findings included: BMD at the femoral neck in the WBV group was increased by 4.3% compared to the Walking group. The BMD at the lumbar spine was unaltered in either groups. Balance was improved in the WBV group by 29%. No change in the walking group. "Using a reciprocating plate is feasible and is more effective than walking to improve two major determinants of bone fractures: hip BMD and balance."

[Low-level, high-frequency mechanical signals enhance musculoskeletal development of young women with low BMD](#)

Gilsanz V, Wren TA, Sanchez M, Dorey F, Judex S, Rubin C

J Bone Miner Res. 2006 Sep;21(9):1464-74

In this 12-month trial, the researchers examined the potential for brief periods of low-magnitude, high-frequency mechanical signals to enhance the musculoskeletal system in young women with low BMD.

Findings included: A noninvasive signal, induced as whole body vibration for at least 2 minutes each day, increased bone and muscle mass in the axial skeleton and lower extremities compared with controls. "Should these musculoskeletal enhancements be preserved through adulthood, this intervention may prove to be a deterrent to osteoporosis in the elderly."

[Effect of whole-body vibration exercise on lumbar bone mineral density, bone turnover, and chronic back pain in post-menopausal osteoporotic women treated with alendronate](#)

Iwamoto J, Takeda T, Sato Y, Uzawa M

Aging Clin Exp Res. 2005 Apr;17(2):157-63

The aim of this study was to determine whether whole-body vibration exercise would enhance the effect of alendronate on lumbar BMD and bone turnover, and reduce chronic back pain in postmenopausal women with osteoporosis. Two groups: exercise plus alendronate or alendronate alone were compared. The exercise was a whole-body vibration using a Galileo machine. The study lasted 12 months.

Findings included: No significant difference between the two groups in lumbar BMD.

The reduction in chronic back pain was great in the group which also had the exercise component. "The results of this study suggest that whole-body vibration exercise using a Galileo machine appears to be useful in reducing chronic back pain, probably by relaxing the back muscles in post-menopausal osteoporotic women treated with alendronate."

[Effect of 6-month whole body vibration training on hip density, muscle strength, and postural control in postmenopausal women: a randomized controlled pilot study](#)

Verschueren SM, Roelants M, Delecluse C, Swinnen S, Vanderschueren D, Boonen S
J Bone Miner Res. 2004 Mar;19(3):352-9

In this randomized controlled trial, hip BMD was measured in postmenopausal women after a 24-week whole body vibration (WBV) training program. Improved isometric and dynamic muscle strength occurred as well as significant increases of hip BMD. No changes in hip BMD were observed in women participating in resistance training or age-matched controls. "These findings suggest that WBV training may be a feasible and effective way to modify well-recognized risk factors for falls and fractures in older women and support the need for further human studies."

[Prevention of postmenopausal bone loss by a low-magnitude, high-frequency mechanical stimuli: a clinical trial assessing compliance, efficacy, and safety](#)

Rubin C, Recker R, Cullen D, Ryaby J, McCabe J, McLeod K
J Bone Miner Res. 2004 Mar;19(3):343-51. Epub 2003 Dec 22

In this 1-year prospective, randomized, double-blind, and placebo-controlled study, when postmenopausal women had a high compliance with brief periods (<20 minutes) of a low-level (0.2g, 30 Hz) vibration applied during quiet standing there was positive results in inhibiting bone loss in the spine and femur, particularly in those subjects with lower body mass.

[Cat's Purr](#)

Elizabeth von Muggenthaler
New Zealand Veterinerian Journal (no other details found)

This scientist hypothesizes that felines purr for healing reasons. Purr frequencies correspond to vibrational/electrical frequencies used in treatment for bone growth/fractures, pain, edema, muscle growth/strain, joint flexibility, dyspnea, and wounds. Domestic cats, servals, ocelots, and pumas produce fundamental, dominant, or strong frequencies at exactly 25 Hz and 50 Hz, the two low frequencies that best promote bone growth/fracture healing.

Fall and Fracture Risk

[Fall-related factors and risk of hip fracture: the EPIDOS prospective study](#)

Dargent-Molina P, Favier F, *et al.*

Lancet. 1996 Jul 20;348(9021):145-9

Most hip fractures result from falls and yet the contributors to fall-related fractures has not been well examined, this study seeks to identify other predictive factors (beyond BMD). 7575 women aged 75 and older with no history of hip fracture were studied in France for an average of 1.9 yrs. Assessments included: femoral-neck BMD, self-reported physical capacity, neuromuscular function, mobility, visual function, and use of medication.

Findings included: four independent fall-related predictors of hip fracture: slower gait speed; difficulty in doing a tandem (heel-to-toe) walk; reduced visual acuity; and small calf circumference. Alone these were valid predictors of fall risk. When BMD was combined with high-fall risk indicators, there was significant improvement in the prediction of hip fracture. So while both are valuable indicators separately, they are more powerful as a combined assessment.

[Risk of subsequent fracture after low-trauma fracture in men and women](#)

Center JR, Bliuc D, Nguyen TV, Eisman JA

JAMA. 2007 Jan 24;297(4):387-94

This study examines long-term risk of a subsequent fracture following an initial osteoporotic fracture in 2245 community-dwelling women and 1760 men aged 60 years or older followed for 16 years from July 1989 through April 2005 in Australia.

Findings included: "After an initial low-trauma fracture, absolute risk of subsequent fracture was similar for men and women. This increased risk occurred for virtually all clinical fractures and persisted for up to 10 years."

Predicting Hip Fractures using BMD

[Bones Density at Various Sites for Prediction of Hip Fractures. The Study of Osteoporotic Fractures Research Group](#)

Cummings, Blak, Nevitt, Browner, Cauley, Ensrud, Genant, Palermo, Scott, Vogt

Lancet 1993 Jan 9;341(8837):72-5

Prior research has shown that women with low bone density at the radius or calcaneus were at increased risk for hip fracture. The study looked at which site: femoral head, spine, radius or calcaneus was more accurate when using dexascan to measure BMD.

Findings included: Low hip bone density is a stronger predictor of hip fracture than low bone density at other sites.

Fracture Intervention Trail (FIT) Research Group

A number of research findings have come for the FIT project in which a large community of 6439 community-dwelling Osteoporotic women aged 55-80 were enrolled. Subsections of this group were studied in a variety of different ways, but still the numbers are generally over 2000 subjects.

Correlates of kyphosis in older women. The Fracture Intervention Trail Research Group

Ensrud, Black, Harris, Ettinger, Cummings
J Am Geriat Soc. 1997 June;45(6):682-7

The study sought to determine how kyphosis (the amount of chronic flexion in the thoracic spine) and spinal osteoporosis (measured by height loss and vertebral fractures) impacted chronic back pain and disability in older women.

Findings included: A correlation between kyphosis and losing height and having a vertebral fracture. Kyphosis was more directly related to thoracic fractures than lumbar. It was more prominent in women with multiple thoracic wedge fractures. It was also related to upper and middle back pain but not lower back pain.

Pharmaceutical Interventions and Effects

Effect of Alendronate limited-activity days and bed-disability days cause by back pain in postmenopausal women with existing vertebral fractures

Nevitt, Thompson, Black
Arch intern Med 2000 Jan 10;160:77-85

The primary question this study posed was: In postmenopausal women with osteoporosis and vertebral fracture, does alendronate reduce back pain and functional limitation caused by back pain?

Findings included: In the defined group, when placed on alendronate sodium, 5 mg/day for 2 years and 10 mg/day for the third year there was a reduction in the days of bed rest (63% fewer days than the control group) and limited activity related to back pain.

Effects of continuing or stopping alendronate after 5 years of treatment: the Fracture Intervention Trial Long-term Extension (FLEX): a randomized trial

Black DM, Schwartz AV, *et al.*
JAMA, 2006 Dec 27;296(24):2927-38

Findings included: When discontinuing alendronate after 5 years there was a moderate decline in BMD, a gradual rise in biochemical markers but no higher fracture risk other than for clinical vertebral fractures compared with those who continued alendronate.

Change in bone turnover and hip, non-spine, and vertebral fracture in alendronate-treated women: the fracture intervention trial

Bauer DC, Black DM, Garnero P, *et al.*, Fracture Intervention Trial Study Group

J Bone Miner Res. 2004 Aug;19(8):1250-8. Epub 2004 May 24

Review of results in bone turnover after 1 year of alendronate or placebo treatment was reviewed in relationship to subsequent hip, non-spine, and spine fracture risk. This study seeks to understand the relationship between short-term change in biochemical markers of bone turnover and non-spine fractures.

Findings included: A clear connection to the improved bio-chemical markers for bone turnover after 1 year of treatment with alendronate and decreased fractures rate over the mean of 3.6 years following the 1 year base measurement.

[A 55-year-old woman with osteopenia](#)

Cummings SR

JAMA. 2006 Dec 6;296(21):2601-10.

This synopsis is short and included in its entirety directly from PubMed: "About half of postmenopausal women have a bone density T score at the femoral neck between -1.0 and -2.5. Bone density in this range was termed "osteopenia" by a World Health Organization working group. Osteopenia is not a disease and the label can cause unnecessary anxiety. Osteopenia encompasses a wide range of fracture risks; an individual patient's risk can be estimated from her age, bone mineral density, and clinical risk factors. Regardless of bone mineral density, regular exercise and adherence with vitamin D and calcium intake may reduce the risk of hip fracture. Osteopenia by itself is not an indication for treatment. Decisions about pharmacological treatment to prevent fractures should be based on the patient's risk of fractures, evidence about the efficacy and nonskeletal effects of the specific treatment, and the patient's preferences."

[Osteonecrosis of the jaw: maxillofacial recommendations for bisphosphonate prescribers.](#)

Landis BN, Dojcinovic I, Richter M, Hugentobler M.

J Intern Med. 2007 Jan;261(1):101-2

This Letter to the Editor is available in full on-line and worth having on hand for all those people who ask you about this side-effect. The article points out that while the major risk has thus far been in intravenous use of bisphosphonates in disease states such as metastatic cancer, there are increasing reports in osteoporosis patients. It provides some cautions for physicians and encourages them to be concerned about oral and periodontal conditions before prescribing the drugs as a means for reducing the outcome of osteonecrosis (which is currently incurable).

[Jaw osteonecrosis related to bisphosphonate therapy: a severe secondary disorder](#)

Dannemann C, Gratz KW, Riener MO, Zwahlen RA

Bone. 2007 Apr;40(4):828-34. Epub 2007 Jan 22

This is primarily a review of the treatment of all 23 patients admitted to the Department of Cranio-Maxillofacial Surgery of the University of Zurich with bisphosphonate-related osteonecrosis (BON). All patients had in common that:

- before signs of BON were observed, a local traumatic incidence had occurred. All
- signs of infection which could be remarkably reduced by antibacterial treatment.

Findings included: “The etiology of BON appears to depend on multiple factors: period and type of bisphosphonate therapy and trauma paving the way for an invasion of pathogens. Because evidence based therapy protocols for complete remodeling of bone defect are still missing, prevention in bisphosphonate-treated patients seems to be of utmost importance. A close interdisciplinary collaboration is required.”

[Osteonecrosis of the jaw and bisphosphonates--putting the risk in perspective](#)

Bolland M, Hay D, Grey A, Reid I, Cundy T.
N Z Med J. 2006 Dec 1;119(1246):U2339

“Osteonecrosis of the jaw is a poorly understood condition that has recently been associated with the use of potent bisphosphonate treatment. The prevalence appears to be approximately 1-10% in patients with malignancy treated with very high doses of intravenous bisphosphonates...The aim of this article is to put the risks of osteonecrosis of the jaw into context with the benefits of bisphosphonate treatment in these clinical scenarios.”

[Proton pump inhibitor therapy and hip fracture risk](#)

Geller JL, Adams JS.

JAMA. 2007 Apr 4;297(13):1429

Nexium, Prilosec, Prevacid are from the proton pump inhibitor class and commonly prescribed for acid reflux. This study found that there was an increased risk of hip fractures with long-term use of such drugs.

Criticism of this study can be found at [JAMA. 2007 Apr 4;297\(13\):1429](#). In the letter, concerns are raised about the accuracy because Vitamin D insufficiency was not taken into consideration.

Jumping

[Jumping improved hip and lumbar spine bone mass in prepubescent children; a randomized controlled trail](#)

Fuchs, Bauer, Snow

J Bone Miner Res. 2001 Dec;16(12):2368; author reply: 2369

In a study of 89 children between the ages of 5.9 and 9.89 years the effectiveness of jumping were examined on both boys and girls. The control group participated in non-impact stretching while the jumper performed 100, two-footed jumps off 61 cm boxes 3 times a day. Both groups participated for 7 months.

Findings included: Jumpers had significantly greater improvement in BMC than non-jumpers. BMD changes were more significant in the lumbar spine than the femoral neck. The conclusion was the

jumping at ground reaction forces of eight times body weight is a safe, effective and simple method of improving bone mass at the hip and spine in children.

[Gains in hip bone mass from high-impact training are maintained: a randomized controlled trial in children](#)

Fuchs RK, Snow CM

J Pediatr. 2002 Sep;141(3):357-62

In this follow-up study, 74 of the jumpers, were “de-trained” and then remeasured. Despite lack of the impact activity of jumping, the gains in BMD were maintained at the hip. They were not maintained in the spine.

[A School-Based Exercise Intervention Elicits Substantial Bone Health Benefits: A 2-Year Randomized Controlled Trial in Girls](#)

Kerry J. MacKelvie, PhD, Karim M. Khan, MD, *et al.*

PEDIATRICS Vol. 112 No. 6 December 2003, pp. e447-e452

A study over 2 years of high-impact, circuit-based, jumping intervention (10 minutes, 3 times a week) and the changes in bone mineral content (BMC) over 20 months

Findings included: Bone-mass gain at the lumbar spine and femoral neck by 3.7% and 4.6%, respectively, in girls who were 10 years old. These results suggest that an exercise program begun in early puberty might result in a significantly greater peak bone mass compared with no involvement during these formative years.

Men

[Osteoporosis in men: epidemiology, diagnosis, prevention, and treatment](#)

Olszynski WP, Shawn Davison K, *et al.*

Clin Ther. 2004 Jan;26(1):15-28

This article reviews the most current information about the epidemiology, diagnosis, prevention, and treatment of osteoporosis in men.

Findings included: The rate of fracture-related mortality 1-year post hip fracture is approximately double in men compared with women. There is a lack of consensus on how osteoporosis should be diagnosed in men. Significant risk factors for osteoporosis or fracture include low bone mineral density, previous fragility fracture, maternal history of fracture, marked hypogonadism, smoking, heavy alcohol intake or alcoholism, low calcium intake, low body mass or body mass index, low physical activity, use of bone-resorbing medication such as glucocorticoids, and the presence of such conditions as hyperthyroidism, hyperparathyroidism, and hypercalciuria. When treatment is indicated, the bisphosphonates are the first choice.

[Quality of life, morbidity, and mortality after low trauma hip fracture in men](#)

Pande I, Scott DL, O'Neill TW, *et al.*

Ann Rheum Dis. 2006 Jan;65(1):87-92.

These researchers studied 100 consecutive men aged 50 years and over, with incident low trauma hip fracture, admitted to Royal Cornwall Hospital, UK during 1995-97 and compared them to 100 controls. Mortality and morbidity, including health status assessed using the SF-36, were evaluated over a 2-year follow up period.

Findings included: Survival after 2 years was 37% in fracture cases compared with 88% in controls. In the first year 45, patients died but only one control. By 2 years, 58 patients died but only 8 controls had died. Patients with hip fracture died from various causes, the most common being bronchopneumonia, heart failure, and ischemic heart disease. By 24 months, 7 patients could not walk and 12 required residential accommodation. Impaired function before fracture is a key determinant of mortality after fracture.

Nutrition and Vitamins

[Calcium plus vitamin D supplementation and the risk of fractures](#)

Jackson RD, LaCroix AZ, *et al.*, Women's Health Initiative Investigators

N Engl J Med. 2006 Feb 16;354(7):669-83

In this study of 36,282 women enrolled in the Women's Health Initiative (WHI) clinical trial participants were randomly assigned to receive 1000 mg of elemental [corrected] calcium as calcium carbonate with 400 IU of vitamin D3 daily or placebo. Fractures were ascertained for an average follow-up time of 7.0 years. Bone density was also measured.

Findings included: In healthy postmenopausal women, calcium with vitamin D supplementation creates small but significant improvement in hip bone density but it does not significantly reduce hip fracture. A negative side effect is increased risk of kidney stones.

[Nutrition and bone growth and development](#)

Prentice A, Schoenmakers I, *et al.*

Proc Nutr Soc. 2006 Nov;65(4):348-60

This is primarily a literature review of available links between nutrition and bone mass and fractures.

“There is evidence to suggest that peak bone mass and later fracture risk are influenced by the pattern of growth in childhood and by nutritional exposures in utero, in infancy and during childhood and adolescence...However, it is not possible at the present time to define dietary reference values using bone health as a criterion, and the question of what type of diet constitutes the best support for optimal bone growth and development remains open.”

[Vitamin K status in the elderly](#)

Booth SL

Curr Opin Clin Nutr Metab Care. 2007 Jan;10(1):20-3

The summary of this review is “Evidence is emerging to support recommendations to increase intakes of vitamin K among the elderly to reduce bone loss and fracture risk. Much more research is required, however, to identify non dietary determinants of vitamin K status, and their impact on the elderly.”

[Impact of seafood and fruit consumption on bone mineral density](#)

Zalloua PA, Hsu YH, *et al.*

Maturitas. 2007 Jan 20;56(1):1-11. Epub 2006 Jun 27

This study of 5848 men and 6207 women, aged 25-64 in rural China looked at environmental determinants, specifically dietary habits and relationship to BMD

Findings included: Higher seafood was associated with greater BMD in women and higher fruit intake with greater BMD in both sexes. High vegetable consumption did not positively impact BMD.

[Diet, nutrition and the prevention of osteoporosis](#)

Prentice A

Public Health Nutr. 2004 Feb;7(1A):227-43

This review on the available evidence on diet and nutrition relating to osteoporosis is particularly good review and worth getting the entire article just for understanding the complexity of using BMD assessments appropriately.

Findings included: “There is insufficient knowledge linking bone mineral status, growth rates or bone turnover in children and adolescents to long-term benefits in old age for these indices to be used as markers of osteoporotic disease risk. For adults, the evidence of a link between intakes of any dietary component and fracture risk is not sufficiently secure to make firm recommendations, with the exception of calcium and vitamin D.”

Barefoot Running

There has been increased interest in the value of walking or running barefoot primarily as a means of restoring the potential senses of the foot.

[Mechanical comparison of barefoot and shod running](#)

Divert C, Mornieux G, *et al.*

Int J Sports Med. 2005 Sep;26(7):593-8

In this study of shod vs. barefoot running, 35 subjects participated.

Findings included: “...when performed on a sufficient number of steps, barefoot running leads to a reduction of impact peak in order to reduce the high mechanical stress occurring during repetitive steps. This neural-mechanical adaptation could also enhance the storage and restitution of elastic energy at ankle extensors level.”

[Athletic footwear, leg stiffness, and running kinematics](#)

Bishop M, Fiolkowski P, Conrad B, Brunt D, Horodyski M.

J Athl Train. 2006 Oct-Dec;41(4):387-92

In this small study, the researchers look at the effects of footwear on the legs' capacity to act as a linear spring during running and hopping and adaptation to the stiffness of the surface.

Findings included: "A significant increase in leg stiffness from the barefoot to the 'cushioned' shoe condition was noted during hopping. When running shod, runners landed in more dorsiflexion but had less ankle motion than when running barefoot. No differences were seen between the types of shoes...At the ankle, barefoot runners increased ankle motion to a significantly greater extent than did shod runners as speed increased... Footwear influences the maintenance of stiffness in the lower extremity during hopping and joint excursion at the ankle in running."

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