

Osteoporosis is not confined to elderly women – it affects men, young women and even children

It's a disease which leads to more deaths in women than cervical, ovarian and womb cancer combined. Early menopause, smoking, pregnancy, alcohol and steroids all raise the risk of osteoporosis

Vitamin K is needed to build new bones – but pollution, anticoagulant drugs, antibiotics and laxatives all reduce the amount of K in our bodies

A flavonoid product is used successfully in Japan and Italy to slow bone loss and encourage bone rebuilding

Oestrogen slows down bone loss. Progesterone, however, may actually increase bone growth

High doses of Omega 6 and 3 PUFAs increase the amount of calcium absorbed – and reduce bone loss

The much-touted calcium supplements will do little to help if you're deficient in Vitamin K and other nutrients, such as magnesium and Vitamin C. Depletion in these nutrients is widespread

Meat and dairy products are rich in calcium, but also in saturated fats, which block bone-building

Chapter 15

Skeleton in the cupboard

Dr Sheila Macrae was 35 when she started working out at the gym. She gradually became more involved in fitness training, and within two years was competing in triathlons.

She felt strong, self-confident, and slim. The only problem was that her periods became very irregular, and she and her husband wanted to start a family. She joined a research project at St Mary's Hospital in London, where they were studying irregular periods in women athletes. The researchers were shocked by what they found. This super-fit athlete had the bones of an old-age pensioner: so weak and fragile they were in danger of fracturing at any moment. She had osteoporosis, caused in large measure by her training routine.

Sheila Macrae's case is not uncommon. Osteoporosis, once a disease of the elderly, is striking younger victims.

A recent survey by the British National Osteoporosis Society found thousands of women in their 50s suffering from fractures, chronic back pain, loss of height and disability. More extreme is the relatively recently discovered osteoporosis of pregnancy, where fractures of the hip or spine occur late in pregnancy in women in their 20s and 30s⁽¹⁴³⁾.

Reports are coming in of ballerinas, athletes like Dr Macrae, and even children

with fragile, osteoporotic bones. Men are involved too⁽²⁰⁰⁾ – approximately a quarter of all fractured hips are male.

Fractured wrists and ankles, although painful and disabling, are the least serious clinical end-point. At the other end of the scale, fractured hips are a huge cause of disability and loss of mobility, with one in five progressing to death within 12 months⁽⁵⁶⁾.

Accumulating crush fractures of the vertebrae lead to stooping, weakness, pain, respiratory and other problems. They're another significant cause of immobilisation and premature death. Many women with stooping (kyphosis) suffer a severe loss of self-confidence and self-esteem, and become isolated. A combination of poor nutrition, lack of Vitamin D and insufficient exercise makes matters worse, and leads to a sad cycle of decline.

BONE FRACTURES AFFECT 50% OF WOMEN

In the last 60 years the incidence of hip fractures has increased dramatically, six-fold in some areas^(102, 192). A third of women over 50 lose height almost certainly due to osteoporotic fractures of the spine, although the majority of these remain undiagnosed.

By the age of 60, one woman in four has had a serious fracture. By the age of 70, it is one in two. One in two women will suffer a bone fracture at some time in their lives. And the latest studies indicate that as many as one in eight men will be similarly affected.

Shattering truth about fragile bones

The litany of injuries above are some of the reasons why osteoporosis is now killing more women than cervical, ovarian and womb cancer combined.

In the USA, osteoporosis costs \$10 billion a year, and is set to hit \$30 billion by the turn of the century⁽⁵⁷⁾. In the UK, it will cost £3 billion by 2002. The situation in many other countries is broadly similar.

It used to be thought that the increasing tide of fractured hips was simply a reflection of an ageing society. Bone loss tends to increase with age, and the average age is increasing in the developed countries. But this is not nearly enough, in itself, to explain the growing problem.

You have 2-3 lbs of calcium in your body!

The average adult's body is 2% calcium by weight.

"I was devastated. All the training I did to make me fit and strong was on the point of crippling me. Thank God they caught it in time. I started HRT, and my bones are slowly recovering, although they're still not good.

"These days the only exercise I get is swimming, and exercise bikes. I can't run any more because the osteoporosis affected my back. I shrank from 5'5" to 5'4"."

Sheila Macrae

DIETS WHICH FIGHT DISEASE : **Bones**

Bone loss can be 4% a year!

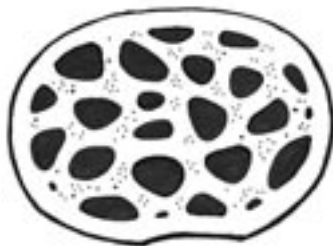
Until recently, doctors believed that bone mass was lost after the menopause at a rate of about 1 per cent a year.

But in May '95, scientists at the Nuffield Orthopaedic Centre in Oxford, England, showed that by the time a woman reaches her late 60s, she will be losing bone at up to **4 per cent a year**.

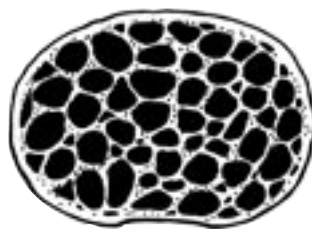
That's 40% of the strength gone in a decade.

Clearly, there is some other growing environmental and/or dietary threat to our bones. The World Health Organisation recognises this, and has called for urgent action to prevent a worldwide epidemic of this silent, crippling disease.

Intensive research programmes are investigating why our bones are crumbling. Eventually the expert committees will reach a consensus position. But nutritional forms of protection are already available.



Bone micro-structure in a healthy bone. Note the thick, strong matrix.



Bone micro-structure in osteoporosis. The structure has become much thinner – it is fragile and easily fractured.

The warning signs are too late

In women over 40, wrist and ankle fractures are often the first indication of osteoporosis. After 50, loss of height, back pain and increasingly stooped posture are common symptoms, as is extensive tooth loss – an unfortunate combination of symptoms stereotyped in folklore as denoting a witch.

If you have one or more of the risk factors or symptoms outlined, or if one or more of your close relatives have or had osteoporosis, you should take a serious interest in early diagnosis and treatment.

Urine tests, which measure the rate of bone loss and therefore the risk of developing osteoporosis, are beginning to become available^(27, 52-55), but are not

universally accepted or widely used. Some doctors use hospital-based bone densitometry measurements (DXA scans) which take a 'snapshot' of bone density. Many, however, take a more passive role and do little until the first fracture occurs.

By then it's too late.

By the time a hip fractures as much as half of the mineral content of the skeleton (the calcium and magnesium salts which give it strength) may have gone.

There are no warning signs of this de-mineralisation until suddenly, the wrist breaks after a minor fall, or a bone in the spine or hip crumbles.

Why bones break

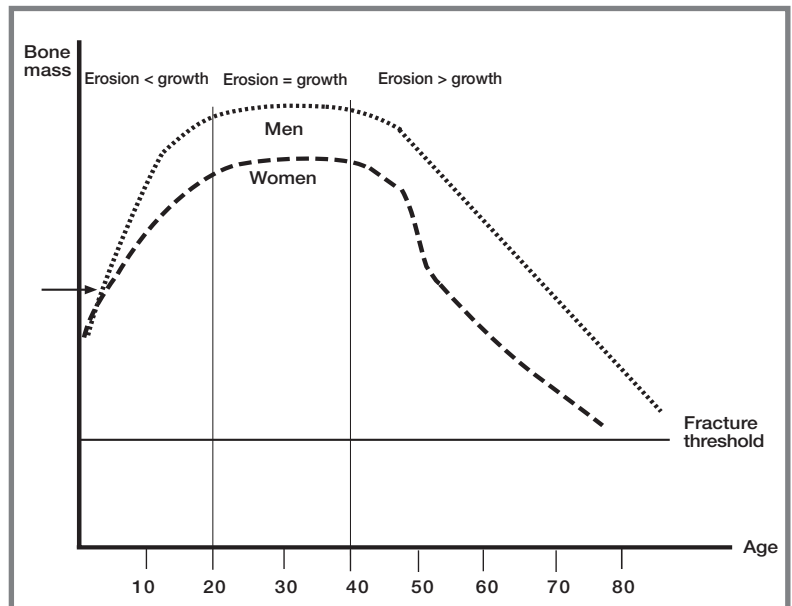
To understand how treatments work, we have to explain how the skeleton works.

Bones are metabolically very active. They're constantly being worn away and rebuilt. The entire skeleton is replaced about once every 10 years. This rebuilding is essential, because the forces transmitted through the bones when we walk, run or jump cause tiny stress fractures.

These have to be repaired before they can spread and cause serious disruption. This is done by an on-going, delicately balanced two-phase repair process. First the osteoclast cells move in, and remove the damaged bone. Then their opposite numbers, the osteoblast cells, arrive and rebuild new bone where the old bone used to be.

In healthy young people the rate of bone growth is faster than the rate of bone loss, and therefore the bones grow and strengthen through the first two decades. During the third and fourth decade the rates of bone loss and regeneration are in balance – so there is little net change. After 50 bone regeneration slows, while bone loss increases – so there is a progressive net loss of bone – see graph.

It's downhill all the way, particularly for women, who lose calcium more rapidly during the menopause, and who generally have smaller bones than men to start with⁽⁵⁷⁾. The bones get thinner and weaker, until a fracture occurs. But although everybody is at risk, some people are more at risk than others.



DIETS WHICH FIGHT DISEASE : **Bones**

Sweating it out

You can lose up to 500mg calcium in sweat during a single aerobic training session⁽¹⁶⁰⁾.

Don't smoke!

Cigarettes attack the bones and increase the risk of hip fracture by up to three times⁽¹⁷⁾.

Soft drinks

These are not recommended, especially for children, if they replace milk drinks.

Colas are particularly bad: they contain phosphoric acid, which, when excreted in the urine, pulls calcium out of the body. Recently identified as a risk factor⁽²⁰¹⁾.

Walk!

A sedentary lifestyle causes bone thinning.

Hormones

An early menopause, whether natural or surgical, increases the risk of an osteoporotic fracture. So do anorexia and bulimia, both of which tend to cause dietary deficiencies and, in younger women, cessation of periods (a kind of mini-menopause).

Eating disorders are on the increase, in men as well as in women, and will add to our osteoporotic problems in the future. Endurance athletes and ballet dancers, who exercise excessively and may eat a wildly unbalanced diet, often have very low oestrogen levels and experience missed periods. They are another recognised high risk group: Dr Macrae was in this category.

Smoking

Passive smoking advances the menopause by two to three years. The smoker herself goes through menopause up to five years early – this is a definite risk factor. Smoking depletes the body of anti-oxidants including Vitamin C, essential for bone growth⁽¹⁷⁾. Smoking also suppresses the bone-building cells, so the current increase in cigarette smoking in young girls is particularly worrying. Combined with poor dietary habits, it confers a high risk of osteoporotic fractures to come.

Too much salt

Consumed in the quantities typically found in the Western diet, salt increases calcium loss from the body. Cutting down salt intake probably reduces the risk of osteoporosis⁽¹⁵⁰⁻¹⁵⁹⁾.

Too much sulphate

Excess sulphate ingestion increases calcium loss. There is not much sulphate in the diet, unless you take high-dose glucosamine sulphate for your joints. This could, paradoxically, damage your bones.

Inactive lifestyle

Healthy bone growth is encouraged by weight-bearing exercise – ie walking, but not swimming. Lack of exercise is a risk factor.

Pregnancy

Another 'risk factor' in women is pregnancy. Osteoporosis of pregnancy is officially uncommon, but is almost certainly

underdiagnosed. The main symptoms are pain in the back or hip, typically in the last trimester or while breast-feeding. This is easily missed, because so many women suffer back pain during pregnancy, which may also be due to postural change.

Symptoms such as loss of height (which can be as much as three inches) are easier to spot, and are caused by crush fractures of the vertebrae. The problems are caused when calcium is leached out of the bones to provide calcium for the growing foetus, and for the milk. Fortunately, bone mass generally recovers to some extent after weaning.

Steroid use and alcohol abuse

Alcohol abuse and long-term oral steroid therapy both increase the risk of osteoporosis. Steroid therapy is implicated in up to 20 per cent of cases of osteoporosis; all the more reason for considering alternatives to steroids (See Chapter 6, Flavonoids & isoflavones).

Depression and stress

Depressive illness (which causes increased steroid synthesis in the body) is a risk factor⁽¹⁸⁹⁾. Chronic stress, which also boosts levels of steroids, is therefore also a candidate risk factor. Both conditions can trigger loss of appetite and reduced physical activity, thus making matters worse.

Other risk factors

Some genes and symptoms have been identified which may increase the risk of osteoporosis⁽⁸⁴⁻⁸⁷⁾ – but these are still hotly debated. Watch this space!

Digging up the past

Doctors can slow the progress of the disease with HRT, and prescribe painkillers; but to stem the tide of broken bones we need to know why Western women are twice as likely today to suffer hip fractures as their mothers were, and treat the cause of the problem.

A significant clue was unearthed by Dr John Stevenson at the Wynn Institute in London, who compared contemporary bones with those of people who died 200 years ago. He found that

Risk factors for osteoporosis

- **Excessive exercise**
- **Smoking**
- **Excessive salt intake**
- **Sedentary lifestyle**
- **Alcohol and steroid intake**
- **Depression**
- **Chronic stress**
- **Excessive sulphate intake (rare, except in those taking glucosamine sulphate for their joints)**
- **Excessive intake of cola drinks**

DIETS WHICH FIGHT DISEASE : **Bones**

Building bone in a nutshell

The minerals (calcium and magnesium) in bone need a mesh of micro-fibres to key on to.

This biological mesh – called the osteoid – is basically the extra-cellular matrix, and consists of the proteins collagen and elastin and various glucosamine polymers.

To build the proteins you need Vitamin C, B6, copper, and zinc. To increase the glucosamine polymers you need glucosamine and manganese. Then the matrix is activated by Vitamin K.

This osteoid mesh is essentially pre-calcified bone. Only when this matrix is built, can it then be impregnated with calcium and magnesium salts to form solid bone.

This explains why you cannot treat osteoporosis by simply taking calcium supplements alone. You must also supply the micro-nutrients needed to build the matrix, before new bone can be laid down.

women’s bones have become significantly more fragile.

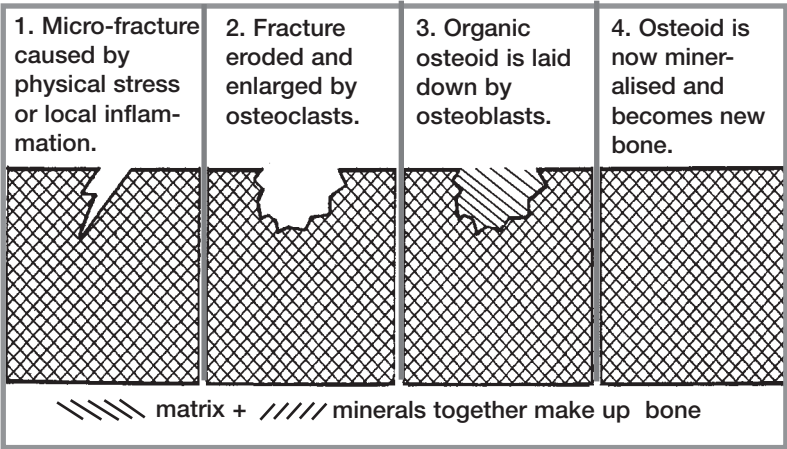
This could be because we do more deskwork than our ancestors and less walking. Inactivity is bad for bones; astronauts, whose bones do little work under zero gravity, lose massive amounts of calcium.

Conversely, in patients who have osteoporosis, exercise programmes which increase stresses on the skeleton can help rebuild their thinning bones. But Dr Stevenson found that even the sedentary workers of 200 years ago had better bones than contemporary subjects. This suggests that the current epidemic of osteoporosis may be due to widespread micro-nutrient depletion.

Fibre-reinforced bones

Bone consists of two phases: organic and inorganic. The organic matrix, a mesh of biological micro-fibres built by the osteoblasts, provides a framework which is then impregnated and stiffened with inorganic calcium and magnesium phosphates.

The matrix is constantly being eroded and replaced; but if the rate of loss outstrips the rate of regrowth, there is a net loss of bone. If there is insufficient matrix, there is nothing for the minerals to latch onto – which explains why calcium (and magnesium) tablets have so little effect in treating osteoporosis.



Vitamin K and other micro-nutrients such as Vitamins C, B6 and D, and the trace minerals zinc, copper and manganese are vital for matrix regrowth; without them calcium supplements cannot be effective, because there is no matrix for the calcium to latch onto. Most people are depleted in most of these micro-nutrients, but Vitamin K may just be the most important.

The calcium fallacy

Calcium intake during the early years, when the bones are growing, is important in contributing to peak bone mass. Young girls who eat more dairy products appear to have more calcium taken up into the bones⁽⁹⁷⁾. But this may not confer much protection in later life.

There are plenty of communities with a low calcium diet and very little osteoporosis (such as Africa), and there are equally countries with a high calcium diet where osteoporosis is common (such as Sweden).

The fact is that we evolved with the ability to adapt to variations in our calcium intake. And although there is some correlation between high calcium intake during childhood and a reduced risk of osteoporotic fracture later in life (because you start off with more calcium in

the bone bank), the clinical results of calcium supplementation in later life are disappointing^(126-128, 148).

Bones are made of calcium, loss of calcium leads to osteoporosis, which can be easily measured – so let's throw calcium at the problem, runs the oversimplified thinking. But we've failed to see beyond the most superficial layer of evidence – and misread an effect as a cause.

Calcium in the diet or in supplements cannot be built into bone unless the other elements necessary for bone growth are also present.

One reason calcium is being lost in the first place is because the other necessary bone-building factors are not there at sufficient levels. It is these we should concentrate on putting right.

Special K

Vitamin K is well known as an essential co-factor for the carboxylation (and activation) of various blood clotting proteins, but it also activates at least three proteins made by the bone forming cells, the osteoblasts. These proteins are osteocalcin, matrix GLA protein and Protein S⁽¹¹⁹⁻¹²¹⁾. Although the function of these proteins is not understood, osteocalcin levels reflect osteoblast, bone-building activity^(162, 164); and it seems likely that activated osteocalcin is essential to the bone-building process.

Some scientists believe that low levels of activated osteocalcin predict hip fracture⁽¹²⁴⁾; and have shown that reduced levels of activated osteocalcin correlate with reduced bone mineral density of the femoral neck⁽¹²⁵⁾.

K for Koagulation!

Danish researchers discovered Vitamin K was essential for blood to clot. And the Danish for clotting is 'Koagulation'.

Vitamin K is safe even at very high doses⁽²⁰⁸⁾, except in patients receiving K-antagonists such as warfarin.

DIETS WHICH FIGHT DISEASE : **Bones**

K-foods

1 mg of Vitamin K per day for 14 days reduced calcium loss and encouraged new bone growth^(4, 212).

The richest food source for Vitamin K is natto, a fermented soy bean dish eaten in Japan – an acquired taste!⁽²¹³⁾

K's other benefits

Vitamin K blocks the production of Interleukin 6. A messenger substance which triggers inflammatory changes, this appears to be involved not just in osteoporosis⁽⁹⁾ but also in rheumatoid arthritis⁽⁹⁾, and cancer⁽¹¹⁾.

K supplements should, therefore, help in the treatment of all these disease conditions.

Glucocorticoids (steroids) are bone-toxic, and a risk factor of osteoporosis. Vitamin K2 prevents steroid-induced bone loss^(209, 210).

K – Kaution!

High-dose Vitamin K may exacerbate periodontal disease⁽¹⁰⁾.

With age, the proportion of inactive osteocalcin increases^(4,5, 122-125); bone mineral density decreases; and the risk of osteoporotic fracture increases markedly. Patients with osteoporosis^(1-3, 134) and osteoporotic fractures⁽¹⁶⁷⁾ have particularly low levels of K. These pieces of evidence strongly suggest that the increase in inactive osteocalcin, the run-down in effective osteoblast activity, the loss of bone mass and the increase in fracture are all related to Vitamin K depletion.

This is supported by the fact that intensive nutritional support enhances bone mending in fracture patients⁽¹⁶³⁾. More specifically, Vitamin K1 (1mg a day for 14 days) increased carboxylated osteocalcin to 'normal' levels⁽⁴⁾. This improved bone metabolism as urinary calcium and hydroxyproline excretion (bone-loss markers) both fell⁽⁴⁾. Larger doses (45-90mg K2 a day) resulted in reduced hip fractures and preserved lumbar spine density^(161, 209-211); although at these doses K may be acting at additional sites, eg by inhibiting bone re-absorption^(165, 166).

Scientists have recently found that post-menopausal women do indeed have very low levels of K activity with particularly high levels of unactivated osteocalcin⁽¹²²⁻¹²⁵⁾. This strongly suggests that in these women, a lack of Vitamin K is preventing osteocalcin activation, and hence slowing the building of new bone^(4, 5). This may in turn explain why post-menopausal women are particularly at risk of osteoporosis, and why they lose such large amounts of calcium in their urine.

These findings indicate that a Vitamin K supplement should slow, stop or even help reverse the disease process. By activating more osteocalcin, it should encourage the growth of new bone, and reduce calcium loss⁽²¹⁷⁻²¹⁹⁾.

Dr Hodges' latest discovery concerns the way Vitamin K is stored in bone. Bones don't just thin with age – the bone marrow changes too. It becomes more fatty, and Vitamin K has a high affinity for fat.

When Dr Hodges analysed the bone marrow in elderly patients receiving hip replacements, he found higher than normal levels of Vitamin K inside their thinning bones⁽⁷⁾.

This pool of Vitamin K was locked inside the fat, unavailable to help build bones, and therefore useless in warding off

osteoporosis. It seems that as the numbers of fat cells inside the bones accumulate with age, they may 'steal' Vitamin K from the bone-building cells where it is most needed; and thereby contribute to the increased risk of osteoporosis with age.

Vitamin K2 supplements are routinely used to prevent and treat osteoporosis in Japan; and are now available on the internet.

WARNING

People at risk from blood clots who are receiving anti-K coagulants such as Warfarin **must not** take extra Vitamin K, as it reduces the effectiveness of the anti-coagulant and may cause thrombus formation.

Everyone else, however, can take K supplements safely as they do not in themselves increase the risk of blood clots. In Japan, thousands of osteoporosis patients now take 45mg of Vitamin K2 per day prophylactically. The only side effect is that, at high doses, K acts as an anti-inflammatory analgesic – which makes it useful (but expensive) for treating arthritis!

TOP VITAMIN K FOODS

micrograms/100g

	K1	K2
Meat	0.5-3	1-8
Cheese	2.5-15	0.5-80
Green vegetables	100-750	0
Natto	20-30	800-1000
K1 is made by plants, K2 by bacteria ⁽²¹⁵⁻²¹⁶⁾ .		

K clue to brittle bone epidemic

The K factor could explain the osteoporosis epidemic.

Industrial chemicals called PCBs, which were dumped in large amounts in the '60s, '70s and '80s, have a strong anti-K effect. The dumped PCBs leaked into our water supplies and the food chain. As a result, we now all have traces of these toxic chemicals in our bodies.

Dutch research indicates that this is the cause of a 'new' disease, Late Haemorrhagic Disease of the Newborn, where month-old babies suffer from catastrophic and often fatal bleeding.

Vitamin K is routinely and safely⁽²⁹⁾ given to newborn infants to prevent haemorrhage, but in these babies the effects of the K injection were overcome by the high doses of PCBs they got from their mother's milk.

If exposure to four weeks' worth of PCBs via breast milk can kill newborn babies, what damage would 20 years of exposure to these toxic chemicals do to the bones of a middle-aged woman?

The new 'organo-phosphate' pesticides (OPs) may

also be strong K blockers, which is a serious worry; and modern medicine is implicated too.

Anticoagulant drugs like Warfarin were introduced in the '50s to prevent blood clotting in at-risk patients. These drugs are powerful Vitamin K2 blockers, and long-term use could interfere with Vitamin K's bone-building activities, leading to thinning of the skeleton⁽²²⁰⁾.

Antibiotics and laxatives are further candidates. Some Vitamin K is made by intestinal bacteria, and anything that disturbs these bacteria could cause a Vitamin K deficiency. Laxatives became very popular in the '50s, and antibiotics were prescribed in enormous numbers through the '60s and '70s.

The wide spectrum antibiotics, in particular, have been shown to cause severe K deficiency states⁽¹⁰¹⁾. Here is yet another possible cause of crumbling bones.

Finally, decreased consumption of fruit and vegetables (including green leaf vegetables) has reduced our dietary intake of Vitamin K1.

Broccoli

Comfrey (traditionally known as knit-bone) is an old herbal remedy for broken bones – and a rich source of Vitamin K1⁽⁶⁾.

Comfrey also contains substances that may cause liver damage, so try broccoli, another excellent source of K1, instead⁽⁶⁾.

As K is fat soluble, finely chop and stir-fry the broccoli to get the maximum K yield.

Ipriflavone

The flavonoid ipriflavone reduces bone loss and promotes bone rebuilding.

There have been **60** clinical studies, including 16 randomised controlled human trials, showing significant benefit: but it's not available in the US or UK.

Additional therapies

Although Vitamin K is vital for skeletal health, there are four other powerful nutritional weapons in the fight against osteoporosis – flavonoids, hormones, PUFAs and minerals. These can be used in conjunction with K.

You may be surprised that minerals – particularly calcium – don't top the list. Calcium (and magnesium, and phosphorus, etc) can only be deposited in bone if the overall nutritional state is favourable. If it is, a low calcium diet won't harm you. If it isn't, all the calcium you can swallow won't help much.

1 Flavonoids

As long ago as the early '70s, the flavonoid ipriflavone was found to limit bone loss in rats, chickens and sheep. Scientists realised that they might have a useful anti-osteoporosis agent on their hands, and went on to use it to treat experimental osteoporosis in animal models, with great success⁽³¹⁻³³⁾.

As a result of these and other studies, ipriflavone is now licensed for use as an anti-osteoporosis medicine in Italy, Hungary and Japan. In Britain, the USA and elsewhere, patients are denied access to this safe and effective nutritional remedy. Doctors to whom I spoke dismissed it as 'unknown, untested, irrelevant'. These views are a sad reflection of the current state of medical education.

In fact, ipriflavone has been intensively studied, and there is a fair degree of consensus as to its multiple bone-building effects. It enhances the effect of oestrogen on preventing bone loss^(35, 36). Ipriflavone also slows down the bone-corroding osteoclasts and increases the growth of the bone-building osteoblasts⁽⁴⁴⁻⁴⁹⁾. This last effect makes ipriflavone look more like a progesterone mimic than the oestrogen mimic it is sometimes thought to be⁽⁷¹⁾ – see pages 255-256.

A well-designed dose-response study in Japan with assessment of bone mass increase and a safety profile evaluation showed that a daily oral dose of 600mg of ipriflavone was the optimal treatment for osteoporosis. Other clinicians have used a 1200 mg dose without problems.

The overall assessment of scientists who have worked with ipriflavone is that it reduces bone resorption and enhances bone formation in an entirely physiological way⁽³⁷⁾.

In a series of studies of post-menopausal women with low bone mass, ipriflavone produced a significant increase in total bone mass within 12-24 months^(35,38-41,94,114,115,149,168,193, 205,206). It also reduced bone pain^(42, 43, 114).

Ipriflavone is also effective in treating thinning bones caused by osteogenesis imperfecta, an inherited disease which causes multiple fractures in men and in women⁽⁹¹⁻⁹³⁾.

No abnormalities have been found in the structure of the new bone that is encouraged to form by the flavonoid, and no side effects have been noted. However, in patients with renal problems, ipriflavone should be used with caution, as there is a theoretical, if slight, possibility of flavonoid build-up in the body⁽³⁴⁾.

2 **Proteins and hormones**

The recently discovered Bone Morphogenic Proteins (BMPs), which stimulate new bone growth, hold considerable promise but are still at the research stage.

There are several hormones which play an important role in creating a favourable climate for bone growth. Oestrogen (in HRT) and calcitonin are both used to reduce calcium loss, but cannot replace lost bone.

Testosterone, growth hormone and some of the anabolic steroids have been used to promote bone formation in men, but are not suitable for all patients.

In any case, you won't get any of these hormones without a prescription, and you won't get a prescription unless you can persuade your physician that you are at significant risk of developing osteoporosis, or already have osteoporosis.

HRT is the easiest of the hormone products to obtain. Calcium loss accelerates during the menopause, and for many years doctors assumed this was because of the fall in levels of the sex hormone oestrogen which occurs at the menopause.

Natural sources

Ipriflavone is found in alfalfa and various types of beans.

HRT may not reduce bone loss

HRT is often prescribed at too low a dose to prevent bone loss⁽⁵¹⁾.

A recent study found that the bones of older women, who had been on long-term oestrogen therapy, were no better than the bones of women who had not received oestrogen treatment⁽⁵⁸⁾.

Bone stimulants

A combination of micro-nutrients including Vitamins K, D and B6 has been shown to be effective in stimulating bone regeneration in post-menopausal women⁽¹⁴⁷⁾.

The good news about being fat!

Adipose tissue continues to make oestrogen. In obese post-menopausal women, the adipose tissue keeps oestrogen levels high enough to give partial protection against osteoporosis, but not enough to protect against heart attacks.

Eroding bone

Oestrogen slows down erosion by encouraging the osteoclasts, cells that erode bone, to commit suicide⁽¹⁸⁹⁾.

Saturated fats

Cut down on animal (saturated) fats. These reduce progesterone synthesis in the body. Switch to mono-unsaturated oils when possible.

The logical response was to prescribe oestrogen replacement therapy, but this was found to increase the risk of breast and uterine cancer, so they added progestogens to the mix and called it Hormone Replacement Therapy, HRT.

Women on HRT live an average three to four years longer than women not on HRT. In women after the menopause, who take HRT for five years or more (which is longer than most women remain on HRT), the risk of fracture is slightly reduced^(149, 150).

Unfortunately, the HERS, WEST and WHI trials all show that HRT increases the risks of breast cancer, stroke and heart attacks, which make it unsuitable for many women. And, although it reduces the risk of osteoporosis for a while, it doesn't give anything like as much protection as it should if oestrogen really were the key to the problem⁽¹³³⁾.

Could it be progesterone? At the menopause, levels of oestrogen fall to well below the levels needed to prepare the lining of the womb for pregnancy, but not to zero. Other tissues, like the adrenal glands, liver and adipose tissue continue to make oestrogen.

Levels of progesterone, however, fall away to nothing. And the fascinating thing about this is the timing. Levels of progesterone start to fall a year or so before the menopause, and there is evidence that the rate of calcium loss also begins to increase just before the menopause⁽⁸⁰⁾.

Progesterone is produced during the second half of the menstrual cycle by the group of cells left behind in the ovary after an egg has been released (the corpus luteum).

The ovulation process is complex and easily disturbed. If the egg is not released, progesterone is not produced.

Excessive exercise and weight loss both block ovulation and lead to so-called anovulatory cycles, where oestrogen levels are normal but progesterone falls away almost to nothing. A recent study of young women athletes with normal oestrogen levels found many with anovulatory cycles, very low progesterone levels and all the biochemical signs of developing osteoporosis⁽⁶²⁾.

These findings have stimulated clinicians to take a new look at

the workings of the sex hormones. It turns out that although oestrogens reduce the rate at which bone is eroded⁽⁶⁴⁾, there is a compensatory decrease in bone formation. So, although there are some benefits⁽¹³⁹⁾, the end result is little more than a temporary slowing of the rate of bone loss⁽⁵⁹⁾.

Although progesterone is a similar molecule, it seems to have a different mode of action. There is evidence that it binds to, and activates, the bone-building osteoblast cells^(63, 81), in a way that resembles the effects of Growth Hormone⁽⁹⁹⁾. And there is evidence that, like growth hormone, progesterone can help build stronger bones^(69,103-108).

The American John Lee has used progesterone to treat many women⁽⁶⁵⁻⁶⁸⁾. He claims his patients increase their bone density by up to 30 per cent after a few years of treatment, with women of 60 and 70 (treated for osteoporosis) developing bones resembling those of a woman of 35, the age when the skeleton is at its peak. These are dramatic results. But sadly, Dr Lee's trials are poorly designed and documented. They may be very important – but we cannot be sure until they are duplicated. However ...

The progesterone molecule is very similar to the male sex hormone testosterone, which has long been known to be vital to bone health in men. Osteoporosis frequently occurs in men who are deficient in testosterone⁽⁶⁰⁾; and when testosterone is given to these men, it prevents and even reverses their osteoporosis^(61, 72,145).

As well as post-menopausal osteoporosis, other clinical conditions where there is rapid bone loss have also been shown to respond to progestogen therapy. In patients taking high-dose steroids for asthma⁽¹⁰⁹⁻¹¹⁰⁾, and in certain other conditions progestogens stop and reverse the otherwise unremitting loss of bone⁽¹¹¹⁻¹¹²⁾.

Why the menopause can cause osteoporosis

It is probable that both oestrogen and progesterone contribute to bone health. Oestrogen slows down bone loss, and progesterone may increase bone growth. When progesterone levels fall, before the menopause, the body starts to lose

Growing bone

Progesterone may halt osteoporosis, by encouraging new bone growth⁽⁸²⁾.

Bone loss and the menopause

It may be the dual effect of lower progesterone **and** lower oestrogen at the menopause that triggers accelerated bone loss.

calcium possibly because it can no longer be built so efficiently into the skeleton. Then oestrogen levels fall, and now the rate of bone loss accelerates too. Slower bone building and increased bone loss is a recipe for osteoporosis – and explains why these menopausal changes result in post-menopausal problems.

Hormones without Prescription

In many countries such as the UK progesterone is an 'unlicensed medicine', only available on prescription.

In the USA, 'progesterone cream' can be bought in health food shops. Alternatively, try yams, which contain the compound diosgenin. (Edible yams contain less diosgenin than medicinal yams, as it is quite bitter.) Diosgenin increases calcium uptake by certain cells⁽⁸⁸⁻⁹⁰⁾; and is metabolised in the body NOT to progesterone (as often claimed), but to DHEA^(6, 175).

DHEA is an important anti-ageing 'parent' hormone with a considerable 'feel good' effect⁽¹⁶⁰⁾. It appears to offer protection against diabetes and coronary artery disease^(169, 170, 185); obesity^(182, 183); cancer^(174, 181, 188) and osteoporosis^(173, 184, 187). In one study, DHEA given as a

topical cream for 12 months led to a significant increase in bone density at the hip⁽¹⁸⁰⁾.

DHEA exerts a number of different osteo-protective effects, including:

- anti-corticosteroid actions^(173, 177-179, 184, 186);
- anti-inflammatory actions^(168, 171, 172, 176); and
- a direct stimulation of the bone-building osteoblasts⁽¹⁹¹⁾.

This may be why in countries where yams are a staple food, osteoporosis is thought to be relatively uncommon. However, other variables such as higher activity levels and lower life expectancy must also be considered.

3 PUFAs

A third group of nutrients which play a role in maintaining bone health are the Omega 3 and Omega 6 fatty acids. These are found in fish oil, and evening primrose (or starflower/borage) oil respectively. Oils that contain **both** Omega 3 and 6 in a near ideal ratio include hemp oil.

In large doses these oils increase the absorption of calcium from the gut⁽¹²⁾, rather like Vitamin D does. In this way they can make up for a low calcium diet, and are a more efficient way of increasing calcium uptake than simply taking huge calcium supplements. (A high calcium intake interferes with iron absorption in the gut, and increases the risk of anaemia⁽⁵⁰⁾.)

Not only do the PUFAs increase calcium absorption, they also reduce calcium loss. Excretion of calcium in the urine is

Importance of PUFAs

A diet which contains normal amounts of calcium, but is deficient in PUFAs, increases the risk of osteoporosis^(20, 21).

significantly reduced, as is the risk of kidney stones^(13, 14).

This double effect increases the amount of calcium stored in the body. Some doctors were concerned about whether the extra calcium is going into the bones, or elsewhere. However high-dose PUFAs actively prevent the abnormal deposition of calcium in soft tissues, where it is not wanted⁽¹⁹⁾ and increase the calcium content of the bones^(16, 17, 190).

And because they are doing all these good things, it should come as no surprise to find that high-dose PUFAs slow the bone loss that otherwise comes after the menopause⁽¹⁵⁾, or even that they stimulate the growth of new bone^(16, 18, 190).

4 Minerals

If I were still at medical school, I would be very concerned that there had been no mention of minerals. Well, here they are. And they are important, because even if the bone-building environment is positive, you still need the right minerals to make new bone – they are, after all, the inorganic construction materials. But they can only be used by the body if the other hormonal or nutritional factors are already in place.

• **CALCIUM** ✓

A reasonable amount of calcium in the diet is important, together with Vitamin D which is essential in improving calcium absorption from the gut, and promoting its uptake into new bone.

It's important to start early in life. By encouraging children to eat calcium-rich foods and take plenty of exercise, their bones grow thicker and stronger. They're building up a calcium reserve, so that even if they do start to lose calcium later in life, they're starting off from a stronger position. But is what is good for children necessarily good for adults?

One problem is that many of the richest sources of calcium are meat and dairy products. And for many reasons, we're encouraged to cut back on these, due to their high content of saturated fats.

Omega 3 & 6 build bone

Many studies show that the combination of Omega 3 and 6 fatty acids has a positive effect on bone metabolism.

To obtain clinical benefits, however, they must be taken in high doses (up to 10g a day) in conjunction with the other micro-nutrients recommended for osteoid formation.

Calcium RDAs

Current RDAs for calcium and magnesium are 800mg and 300mg respectively.

These are excessive. Based on the misconception that mineral supplements alone are an appropriate treatment, they may increase the risk of prostate and breast cancer⁽²⁰²⁻²⁰⁴⁾.

When combined with appropriate micro-nutrient support for osteoid formation, I believe the daily requirement for calcium and magnesium could be cut dramatically.

Over half of young people fail to meet the RDA for calcium

If young people don't build enough bone density in the first 30 years of life, they will have insufficient reserves to call on later. That's partly due to a 30% drop in milk consumption – and a generally poor diet⁽²⁰⁷⁾.

These fats block progesterone synthesis, and compete with the vital, bone-building PUFAs in fish oil and plant oils, and interfere with their bone-building properties.


One answer is to switch to soy products, which are a good source of calcium in a highly digestible form. They also supply the essential PUFAs, are a good source of dietary fibre (see Chapter 6, Flavonoids & isoflavones), and have anti-cancer properties (see Chapter 13, Cancer).

TOP CALCIUM FOODS					
Yoghurt	415mg	8oz	Broad beans	128mg	1 cup
Milk	300mg	8oz glass	Broccoli	122mg	1 cup
Cheddar cheese	200mg	1oz	Almonds	80mg	1oz
Tinned salmon	200mg	3oz	Sardines	90mg	3oz
Tofu	260mg	1 cup			

• **MAGNESIUM** ✓

An adequate magnesium intake is just as important as getting enough calcium. It may even be more important, because magnesium is not just a major structural element in bone, it also regulates the active transport and metabolism of calcium. Magnesium depletion could be another contributing factor to the current osteoporosis epidemic.

In a recent two-year study, high-dose magnesium supplements given to post-menopausal women prevented fractures, and resulted in a significant increase in bone density. The optimal ratio of calcium to magnesium in the diet, or in supplements, is approximately 2 to 1. Very large doses of calcium may actually reduce magnesium absorption from the gut.



Caution

Excessive doses of calcium reduce the absorption of phosphorus and increase the risk of phosphorus insufficiency⁽²¹⁴⁾.

TOP MAGNESIUM FOODS

Beans	121mg	1 cup	Peanuts	52mg	1oz
Tofu	118mg	1/2 cup	Oatmeal	56mg	1 cup
Almonds/cashews	84mg	1oz	Yoghurt	40mg	8oz
Lentils	70mg	1 cup	Bread	23mg	1 slice
Potato	55mg	1 medium	(wholewheat)		

When you have insufficient levels of magnesium (and calcium) in your blood, your body pulls them from your bones, precipitating osteoporosis.

• **BORON AND MOLYBDENUM** ✓

These are also thought to be essential for bone formation. They are not built into the bone as calcium and magnesium are, but are needed in tiny amounts to help the enzymes which take part in bone growth.

For example, boron depletion results in excessive urinary calcium loss and abnormally low levels of the sex hormones – which are both risk factors for osteoporosis⁽³⁰⁾. Conversely, boron supplements reduce calcium loss in the urine, and raise oestrogen and testosterone levels⁽⁹⁸⁾.

The bones of people who take boron supplements are reported to be harder than average. In other respects, too, boron appears to be essential for healthy bones. A boron deficiency may increase the risk of arthritis, and in areas where there is a high boron intake, due to geographical factors, the incidence of arthritis is much lower than average⁽¹⁰⁰⁾.

• **ALUMINIUM** ✗

Aluminium is also involved in bone building, but in an entirely negative way. This highly toxic metal is taken up into growing areas of bone⁽²²⁾, where it damages the bone building process⁽²³⁾. One of the many appalling symptoms of aluminium poisoning, which occurred quite



LOOK FOR

...

an anti-osteoporosis supplement that includes at least 600mg of calcium, 300mg of magnesium, 8mg of manganese, 2mg of boron and 2mg of copper a day, together with Vitamins K, D and B6.

Optionally add ipriflavone at

Magnesium and boron help build bones

You need magnesium to ensure calcium is absorbed; and Vitamin D and boron (probably) for the enzymes that encourage bone growth.

DIETS WHICH FIGHT DISEASE : **Bones**

Silicates

Aluminium interferes with bone growth. Silicic acid binds with aluminium to neutralise this effect⁽¹⁹⁴⁻¹⁹⁹⁾.

Silicates in bone may also initiate the deposition of calcium salts and magnesium salts.

Cut down on salt and sulphates

A high intake of sodium leads to increased calcium loss.

Switch to a salt substitute, eg PanSalt, which is based on potassium and magnesium, and which is also cardio-protective.

If you take glucosamine sulphate for your joints, switch to glucosamine hydrochloride.

New hormones

Parathyroid hormone may become a medical treat⁽¹³²⁾ – but is not yet proven.

frequently in kidney patients during the early days of dialysis, was bone fragility and breakage^(24, 25).

Our exposure to aluminium is increasing for a variety of reasons, and it could be that this is another contributory factor underlying the increase in osteoporotic fractures. For this reason, anyone keen on warding off osteoporosis should take silicic acid (see Chapter 17, A healthy brain). This natural compound binds to any aluminium in the gut and turns it into harmless sand.

A silicic acid supplement has been shown to reduce the absorption of aluminium by 85 per cent or more⁽²⁶⁾, and should be a part of any anti-osteoporosis regime.

- **SODIUM (AS IN TABLE SALT) X**

Excessive salt intake leads to increased calcium losses in the urine. There has been one report⁽²⁸⁾, that calcium loss can be reduced by large doses of potassium bicarbonate – but this is not yet proven.

- **MANGANESE ✓**

The trace element manganese is essential for the formation of osteoid (the precursor for bone)⁽¹⁴⁰⁾.

5 Other treatments

- **GROWTH HORMONE / ARGININE**

Growth hormone is known to increase bone growth, but is expensive, is **not** risk free, and is generally unavailable without a prescription.

The amino acid arginine stimulates the formation and release of growth hormone in the body, with resulting tissue-building effects⁽¹¹⁸⁾. This should logically help to combat osteoporosis.

This is still only theory⁽¹¹³⁾, but as arginine is cheap, non-toxic and widely available, it seems to be worth trying.

- **FLUORIDE**

Fluoride salts have been tried, with only mixed results^(130,131).

- **VITAMIN D**

Vitamin D is essential for calcium uptake and distribution in the body. Dairy products are fortified with Vitamin D, but, although the RDA is 5mcg per day, many people eat only half of this or less. Vitamin D depletion is very prevalent^(117, 135- 138), particularly in the winter when the skin isn't exposed to much sunlight⁽¹⁴¹⁾.

In conjunction with a calcium/magnesium supplement it may reduce the risk of other health problems⁽²⁰²⁻²⁰⁴⁾, therefore Vitamin D may be helpful^(116, 137). Doses as high as 17.5mcg per day have been shown to reduce bone loss in post-menopausal women^(96, 129, 142) but doses of D higher than 20mcg/day are not recommended without medical supervision.

D for bones

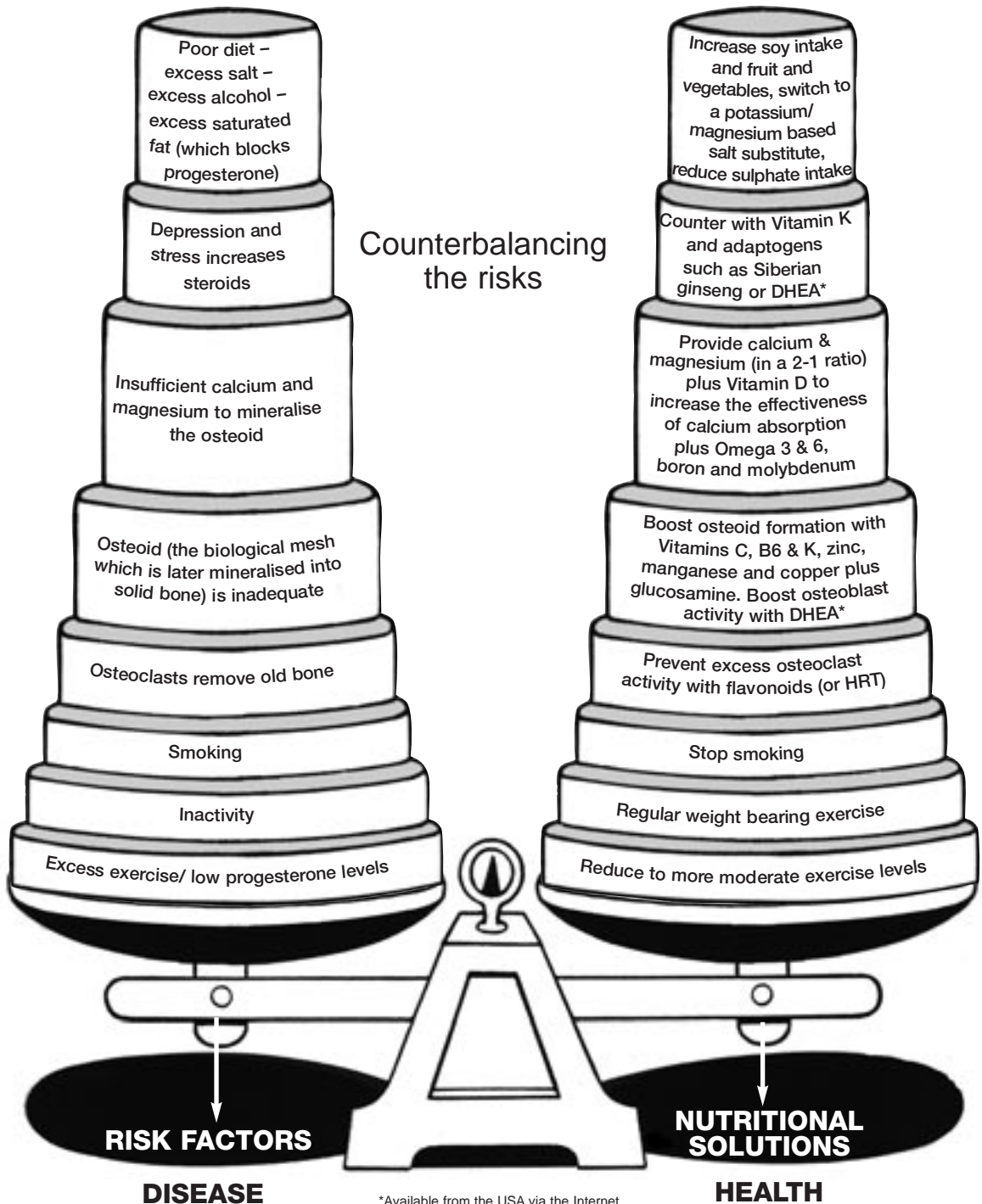
A 1997 study showed that men and women over 65 can cut the risk of bone fractures by 50% with a simple supplement of 18mcg of Vitamin D (700IU) plus 500mg of calcium.

A more comprehensive supplement would have given even better results.

TOP VITAMIN D FOODS

Sardines	25mcg	in 3oz	Milk	2.5 mcg	in 8oz
Cod liver oil	11mcg	in 1 tsp	Salmon	9mcg	in 3oz
Mackerel	23mcg	in 3oz	Egg	0.6mcg	each

Preventing osteoporosis



SUMMARY

The Good Bones Guide

To prevent osteoporosis:

- Regular exercise, from childhood, builds stronger bones. Excessive exercise may weaken them.
- Smoking suppresses bone-building cells, so quit!
- Take 60mcg Vitamin K, together with 15-20mcg Vitamin D3, 7.5mg Vitamin B6, 500mg Vitamin C, 10mg zinc, 4mg manganese, 2mg copper and 500mg glucosamine. This will help build osteoid and encourage calcium absorption.
- Take up to 600mg calcium and 300mg magnesium.
- Add traces of boron and molybdenum, plus a silicic acid supplement to protect against aluminium.
- My specific anti-osteoporosis recommendation is on page 261.
- Switch to soy products rather than meats and dairy produce for calcium.
- Cut down on saturated fats. When these are metabolised in the body they reduce the ability to make progesterone.
- Cut down on salt and sulphates (ie glucosamine sulphate) which increase calcium excretion, as do cola drinks.
- If you already have other risk factors (such as a smoking habit), a shift to mono-unsaturates, such as olive oil, may be a wise decision.