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Written by Frances Brown



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EXERCISE & BONE HEALTH E- BOOK

Written by Brisbane physiotherapist, Frances Brown, this book provides evidence based recommendations for exercise interventions to target bone density.

The information in this book can be used as prevention as well as treatment, as the advice aims to reduce bone loss as well as potentially promote the building of new bone.

Disclaimer: information provided is for general knowledge and not a substitute for professional, in-person medical advice. You should consult with a qualified physiotherapist or healthcare professional for any health concerns or before starting any new treatment or exercise program. Content may not be applicable to all individuals. The user assumes all risk for any actions taken based on the information given.

W W W . F K B P H Y S I O . C O M



Hello! I'm Frances. I have a Bachelor of Physiotherapy from the University of Queensland (2010) and a Master of Sports Medicine from the University of Melbourne (2022).

I have worked as physiotherapist for the last 15 years, practicing in Australia, the United Kingdom, and Kuwait. I founded FKB Physio in 2020, wanting to set up a practice that was truly patient-centred, focusing on longer appointment times and an active approach to rehab.

My personal passion for strength training and group exercise has gradually made its way into my work over the years. I have always made strength training a priority in my rehabilitation plans and have always run small group classes, opting for strength training rather than pilates with my own business.

Over the last 5 years, me and my team at FKB Physio have worked with a large number of patients with osteoporosis and osteopenia, prompting continual reading and reviewing of research to make sure the exercise interventions we use are evidence based and up to date.

Educating as many people as possible about the importance of bone health is something I am passionate about. I hope you find value in this e-book.

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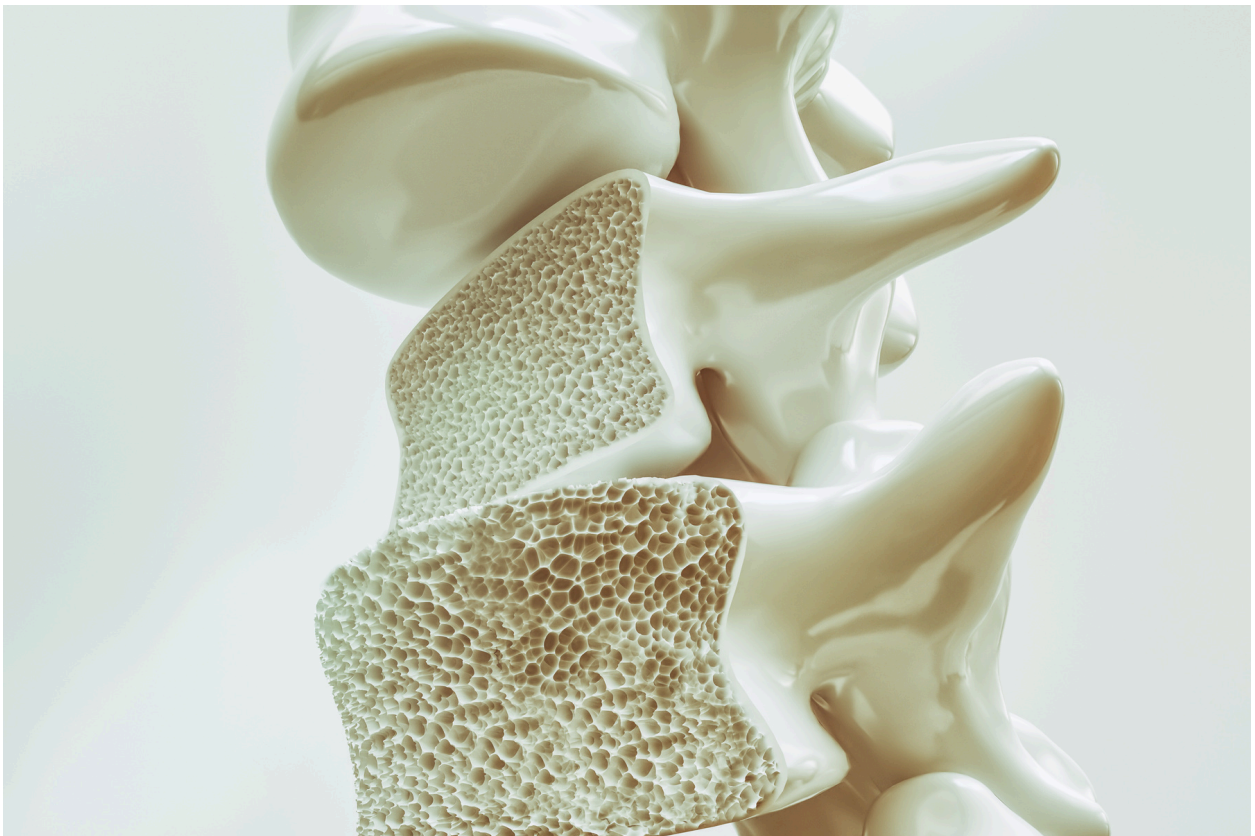
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BONE HEALTH: WHAT IS IT AND WHY SHOULD I CARE?

Bone health, as the name suggests, refers to the health of our bones, which really means how structurally sound they are and how resistant they are to the loads placed upon them. Bones are made up of strong, thick shells on the outside, and have lattice type internal structures. The outer shells are made up of cortical bone and the insides are made up of trabecular bone. How strong our bones are and how resistant they are to fracture is a combination of how dense the bones are in combination with their specific architecture.



BONE HEALTH: WHAT IS IT AND WHY SHOULD I CARE?

Although the numbers vary between individuals, we start to lose bone density very slowly from the age of 30, a process which accelerates post menopause. In general, a woman may lose 0.6% a year from 60-69, 1.1% per year from 70-79, and > 2% at >80 (Benedetti et al., 2018). The Australian Bureau of Statistics states that more than 2/3 of all Australian women over 50 have osteopenia or osteoporosis (RACGP, 2017).

While hip fractures are often the consequence we most commonly hear about with osteoporosis, it is also unfortunately possible to sustain other types of fractures as a result of poor bone density. This can be something like sustaining a fracture by putting a hand out to catch yourself from a fall, falling from standing height, or even really innocuous things like sneezing or bracing yourself against a heavy door to open it.

I don't say these things to alarm you, but rather to draw attention to something that is important to know about, so that you can do something to help prevent it. I give these examples based on patients that have come into the clinic, all of whom are fit and active women in their 50s, 60s and 70s.

Often, it is sustaining a fracture that alerts someone to the fact that their bone health is lacking. Osteoporosis has no symptoms, in that you truly would have no idea you have it unless you have a scan or you sustain an injury as a result of it. It is for these reasons that screening is really important, as it may impact some lifestyle choices and intervention decisions.

BONE HEALTH: WHAT IS IT AND WHY SHOULD I CARE?

It makes sense to try and build as much bone mass to start with, and then slow the loss as much as possible, to avoid dipping below the threshold into osteopenia or osteoporosis. In the prevention space, lifestyle modifications are your biggest tools to do this.

If you have already been diagnosed with osteoporosis or osteopenia, it may still be possible to improve your bone density. It depends entirely on the individual, but as we always say to our patients, at the very least, doing what you can to slow the loss is always going to be worthwhile.

For those already with fractures or a diagnosis, medication may be suggested to supplement your treatment. It is absolutely possible to live a full life with osteoporosis or osteopenia and it does not have to be limiting! Education and awareness are an important step in this process. This e-book is not intended to be taken in place of medical advice: it is essential to consult your GP as a first step if you are concerned and to have a plan that is tailored to you.

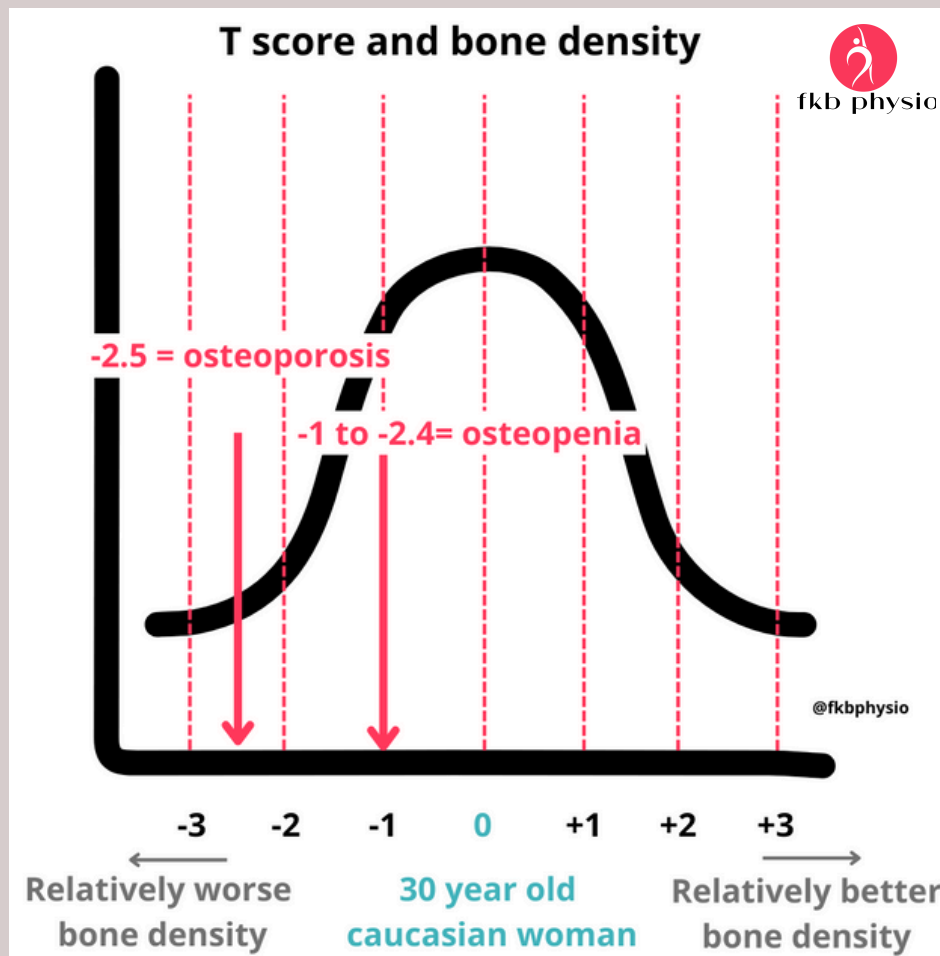
Please do not feel as though you have done something wrong if you have low bone density. It is extremely common, and a number of the risk factors are things that are outside of our control. There is no shame in having low bone mass, and it does not say anything about your health or lifestyle.

BONE HEALTH: WHAT IS IT AND WHY SHOULD I CARE?

TAKE HOME POINTS

- We lose bone density from age 30, and this becomes more rapid post menopause
- Fractures are the main consequence of poor bone health
- Low bone density has no symptoms - you will not know you have it without a DEXA scan, or if an injury occurs as a result of it
- Lifestyle interventions to manage bone density focus on building as much bone mass as possible, then reducing as much loss over time as possible
- It may be possible to improve your bone density, even with a diagnosis of osteoporosis
- Bone building exercise is likely to mitigate bone loss to at least some degree
- Having osteoporosis or osteopenia does not say anything about you or your health

WHAT IS OSTEOPOROSIS OR OSTEOPENIA, EXACTLY?



Osteoporosis or osteopenia are terms that relate specifically to the density of your bones, as this is something that we can measure easily with the current technologies we have, through DEXA scans. Bone density, which is what is measured on a DEXA scan, accounts for about 60% of the total picture of our bone health (Osterhoff et al., 2016).

Osteoporosis or osteopenia are diagnosed by comparing our bone density to that of an average 30 year old of our race and sex. The reason for this is because our bone density hits a peak at around 30 and then gradually starts to decline from there. This data is plotted on a bell curve. If you are between 1 and 2.5 standard deviations away from peak bone health, you are considered osteopenic. More than 2.5 standard deviations away is osteoporotic.

WHAT IS OSTEOPOROSIS OR OSTEOPENIA, EXACTLY?

TAKE HOME POINTS

- Osteopenia is the precursor to osteoporosis
- These diagnoses are made based on DEXA scan & are a measure of how much your bone density has declined compared to an average 30 year old



WHO IS AT RISK?

The biggest risk factor for low bone health is essentially age. We build most of our bone density before we are 20. We continue to add to our skeleton up until age 30, and from there, the goal is to hang on to as much of it as possible as the years go by.

If you have any children or grandchildren, make sure they are participating in as much load bearing and multi directional exercise as possible!. Non-load bearing sports like swimming, rowing and cycling have little to no positive impact on bones. Protein, calcium, and an adequate intake of food overall are also key.

RISK FACTORS (FROM RACGP)

- Age >70
- Age >60 for men, and >50 for women, plus any of the following:
 - Family or personal history of minimal trauma fracture
 - Smoking
 - High alcohol intake (>2-4 standard drinks a day for men, less for women)
 - Low calcium diet
 - Low body weight
 - Recurrent falls
 - Sedentary lifestyle over many years
- Certain medical conditions and medications:
 - Endocrine disorders (e.g. hypogonadism, Cushing syndrome, hyperparathyroidism, hyperthyroidism)
 - Inflammatory conditions e.g. Rheumatoid arthritis
 - Malabsorption e.g. Coeliac
 - Organ or bone marrow transplant
 - Chronic liver disease
 - Chronic kidney disease
 - Multiple myeloma
 - Particular medications: anti-epileptic, anti-oestrogen, anti-androgen, corticosteroids, excessive thyroxine, SSRIs

HOW CAN I CHECK MY BONE DENSITY?

The only way to really know the status of your bone health is to have a DEXA scan. For people with certain risk factors, you can get one of these through a referral from your GP and have the cost subsidised by medicare.

There is a list of who is eligible for a rebate here.

Alternatively, you can get a scan done yourself without a referral. It is essential that it is done on a proper DEXA machine.

DEXA scans used to diagnose osteoporosis or osteopenia tend to specifically only look at lumbar spine and hip (occasionally forearm) bone density. To be able to diagnose these conditions, the machine needs to have a particular government certification. You may get a full body DEXA that shows your bone density, but be aware this is not as sensitive as the ones used to diagnose poor bone health, and may not detect a problem when there is one.

If you believe you may have low bone density, it is best to get a referral for a scan from the GP that is specifically used to diagnose osteoporosis/osteopenia.

WHY DO OUR SKELETONS BECOME LESS DENSE?

The skeleton is alive and is constantly remodelling based on the loads placed upon it.

There is a constant process of bone removal and bone replacement, where the body clears away dead bone cells and replaces them with new ones. Ideally, this process should be exactly even, where the density of the bone is unaffected.

For this to be the case, there needs to be optimal conditions for bone health: adequate load on the skeleton; adequate calcium, protein, vitamin D, and total calories; and hormone balance. It is common for any or all of these to be sub-optimal, resulting in a faster rate of bone clearance than bone building. It can be particularly challenging as we age and hormone levels start to decline.

To me, there are two clear goals when it comes to bone health:

1. Build as strong/ solid/ heavy/ dense skeleton as possible
2. Hold onto as much of that as you can over time

Any and all measures taken at any stage in the lifespan can have a positive impact on your bone health.

WHY DO OUR BONES BECOME LESS DENSE & WHO IS MOST AT RISK?

TAKE HOME POINTS

- We lose bone density over time due to imbalances in bone building vs bone clearing mechanisms, which can occur as a result of some of the processes of ageing as well as chronic health conditions and energy availability (adequate nutrition)
- Certain risk factors can make you more likely to develop low bone density.
- If you have any of these risk factors (listed on page 11), it is worth getting a DEXA scan to check.

I WALK AND DO YOGA, WHICH ARE WEIGHT- BEARING. IS THIS ENOUGH?

A common scenario in the clinic working with patients diagnosed with osteoporosis or osteopenia is that they are told that as long as they are doing weight-bearing exercise, they are doing enough for their bone health from an exercise perspective. This term is vague, and I find people often take it to mean that walking, walking with small weights, a weighted vest, or doing intentionally heavy foot falls will be enough.

While it is true that any exercise can have a positive effect on maintaining bone density, there is a difference between mitigating bone loss, and actually trying to build new bone. There are also magnitudes to both. It might be that doing light forms of exercise, like walking and yoga, means your bone loss may be slower than someone who is sedentary, however the loss may still be significant enough to really negatively impact your overall bone health.

I WALK AND DO YOGA, WHICH ARE WEIGHT-BEARING. IS THIS ENOUGH?

Bear in mind that everyone is different. I am certain there are people out there who have never done any form of targeted exercise or prioritised eating calcium and have pristine bones all the way into their 80s and 90s. Humans are so varied, no one thing can be true for any two people.

However, if we look at general concepts and ideas, particularly for people who know that this is likely to be a concern for them, then it makes sense to determine what is the type of exercise that is most likely going to be able to have a positive influence on bone building and mitigate bone loss the most significantly.



Walking might be enough to reduce bone loss in some people, though it is not likely to be hugely osteogenic (bone building).

WHAT IS THE BEST EXERCISE TO BUILD/MAINTAIN BONE?

The following list has been compiled using the Australian, Canadian, and UK guidelines for exercise to treat osteoporosis, as well as a number of systematic reviews looking at the topic. These look at what types of exercise might be the most **osteogenic**, that is, bone building.

This is GENERAL advice; for some people, they may maintain their bone density effectively without ever picking up a weight. However, for those people who have osteoporosis/osteopenia and are wanting to try and change their situation through exercise, it is necessary to provide realistic advice about what might be the most effective way to go about doing this.

Though exercises like yoga and pilates are a form of resistance training, it is difficult to progressively overload them in a way that is likely to build bone (Fernández-Rodríguez, 2020). As such, while these types of exercise may have a positive impact on bone health initially, it may not be sustained over time, though again it is hard to generalise this to every individual.

WHAT IS THE BEST EXERCISE TO BUILD/MAINTAIN BONE?

Exercise therapy to mitigate bone loss & potentially build new bone should be guided by the following:

- It is important to meet minimum exercise guidelines, that is at least 150 minutes, but ideally 300 minutes of exercise per week, ideally 75-150 minutes of it being of moderate to vigorous intensity.
 - It is important to continue to do types of exercise you enjoy, even if they are not inherently bone building.
- Exercise must target all major muscle groups to effectively target the whole skeleton, as effects on bone density are local (i.e. bone can only be stimulated directly where the muscle/tendon attaches; effects are local rather than global).
 - The most efficient way to do this is via resistance training that is progressive, i.e. the weight increases once the exercise becomes easy to perform.
 - This type of exercise should be performed a minimum of 2-3x per week

WHAT IS THE BEST EXERCISE TO BUILD/MAINTAIN BONE?

Exercise therapy to mitigate bone loss & potentially build new bone should be guided by the following:

- Impact loading should be completed, on most days.
 - For those safe to do so, impact loading should be moderate to high intensity, that is at least 2-4x body weight, which is achieved through exercises such as jumping. This should be done in short bursts of up to 50 impacts in total.
 - For those not safe to do so, aim to perform regular low impact exercise such as walking on most days.
- A combination of interventions is likely to be more beneficial than a sole intervention (i.e. strength training + impact training)
- Balance training should be incorporated to reduce falls risk.
 - For people who do not have a particularly high falls risk, a lot of the exercises done for strength or impact will double as balance exercises (e.g. lunges, single leg deadlifts, jumping, hopping). For people at lower functional levels, specific balance exercises may need to be prescribed, e.g. standing on one leg, calf raises, walking heel to toe.

WHAT IS THE BEST EXERCISE TO BUILD/MAINTAIN BONE?

Exercise therapy to mitigate bone loss & potentially build new bone should be guided by the following:

- **Precautions**

- Individualised exercise prescription from a trained health professional is recommended
- Rapid, repetitive, end of range, sustained or weighted end of range twisting and flexion spine movements should be avoided for those at high risk of fracture

In particular, anyone with a diagnosis of osteoporosis, or who has sustained an insufficiency fracture should seek individualised advice from a healthcare professional before starting any type of exercise.



WHY IS RESISTANCE TRAINING SUPERIOR TO SWIMMING OR CYCLING FOR BONES?

It is thought that the way that bone adapts and grows in response to exercise is through loading that is large enough to deform the bone and cause bone strain (Frost, 2003). This damage to the bone results in the local cells laying down new bone to replace the damaged bone.

The way to generate significant bone strain is to create large muscle forces (Frost, 2003). Lifting weights that are progressively heavier requires a high degree of muscle force. As you get stronger and can lift more weight you can create progressively more muscle force and consequently bone strain. Impact loading, that is, jumping, also creates significant force through bones, due to a combination of significant force being required to propel bodyweight off the ground, as well as the muscle strength required to absorb ground reaction forces upon landing, and from the compression of the bone itself (Warden et al., 2022).

WHY IS RESISTANCE TRAINING SUPERIOR TO SWIMMING OR CYCLING FOR BONES?

Lifting light loads and activities such as walking probably do not create enough of a stimulus or strain on the bone to encourage new bony growth, as it is thought that the loading needs to be significantly more than habitual day to day loading to do so. That said, lifting light weights towards failure, that is, going until you are unable to lift the weight any more, may be effective at building muscle and consequently bone (Souza et al., 2020). Unfortunately, however, lifting small weights significantly below maximal effort is unlikely to have positive ongoing effect (Watson et al., 2017).

Lifting progressively heavier weights can come with some risks, as we are specifically placing high demand on the skeleton to facilitate change, which can be a little risky in skeletons that are lacking density. It is for this reason that this needs to be done strategically and progressively, and generally under supervision by a health professional for those who have diagnosed osteoporosis.

WHY IS RESISTANCE TRAINING SUPERIOR TO SWIMMING OR CYCLING FOR BONES?

When it comes to impact loading, repetitive loads, with minimal variation, also seem to be less effective at helping to build bone.

It appears that the receptors on our bones that detect loading become desensitised if they are exposed to a high volume of loading that is of a similar nature. Running, for example, is a moderate to high intensity form of bone loading, but does not seem to cause significant positive bony adaptations (Warden et al., 2019).

In practice, this means short episodes of impact loading of a high magnitude that is multidirectional is likely to be the most effective. An example would be hopping in different directions 10-20 times per leg, a few times a day. Bear in mind this is only appropriate for people who are conditioned to it and this is NOT a suggestion to try this out - simply a practical application of how this information can be used.

WHY IS RESISTANCE TRAINING SUPERIOR TO SWIMMING OR CYCLING FOR BONES?

Most of our understanding of bone health comes from animal and observational data, which means a lot of our knowledge is based on assumptions and educated estimates.

The premise that strength training and impact loading may be beneficial for bones comes in part from data that shows that runners who cross train by competing in other sports that involve jumping and direction changes, such as basketball, and runners who that strength train, have significantly lower rates of bony stress injuries than those who don't, indicating a degree of bony protection from these activities.

Observational data also shows a difference in bone density between different sports, with strength and impact based sports such as gymnastics showing higher bone density compared to repetitive or low load sports such as running, cycling or swimming (Warden et al., 2019). We can infer from this that including strength training and impact loading have benefits to bone.

WHY IS RESISTANCE TRAINING SUPERIOR TO SWIMMING OR CYCLING FOR BONES?

Interestingly, high volumes of cycling and swimming may actually result in lower BMD, with some research showing that endurance athletes in both of these sports have a lower BMD than their sedentary counterparts (Odilon et al., 2022). This may mean people who have participated in these sports across the lifespan should pay particular attention to their bone health. A potential reason for this could be metabolic, in that it is challenging to meet the energy demands required in these sports which may result in a negative overall energy balance that is detrimental to bone health.

This does NOT mean that exercise like yoga, bike riding, pilates or swimming is not worthwhile. ALL exercise is good and is worth doing. It's simply that it is not likely to improve bone health, and may not be able to maintain it that effectively, either.

WHAT IS THE BEST EXERCISE TO BUILD/MAINTAIN BONE?

TAKE HOME POINTS

- ALL exercise is good and worthwhile and you should do types of exercise you enjoy
- If your bone health is continuing to decline despite the exercise you are doing, you may need to prioritise including exercise that is more inherently bone building
- This is likely to involve resistance training that targets the full body a minimum of x2 per week, and impact loading most days (when safe to do so)
- Balance training should also be part of any bone health program to combat falls risk

MITIGATING BONE LOSS VS BUILDING NEW BONE

As with many things in the human body, it is easier to try to maintain bone and muscle mass than it is to try and increase them.

It may be that lifting sub maximal lighter loads is adequate to maintain bone mass. For example, this study found that body pump, a high repetition gym class that does not involve heavy lifts or going towards failure can maintain BMD in the lumbar spine (Nicholson et al., 2015).

However, as is the case for so many studies in this space, this was conducted over a short time (6 months), and also features the introduction of resistance training to women that were previously not doing any. It may be that because this is a new stimulus for their skeletons it was effective for the 6 months studied, but it is harder to know whether this effect would continue over 5, 10 or 20 years.

MITIGATING BONE LOSS VS BUILDING NEW BONE

It makes sense that the type of exercise required to actually build new bone needs to feature larger degrees of bone strain, to encourage the body to actually lay down new tissue. There is some promise in the research about being able to build bone density even in post-menopausal women, though the extent to which it is possible is modest, and seems more effective in the lumbar spine than in the hip (Kumar et al., 2025).

The general consensus is that this type of exercise needs to be hard, that is going towards failure, to have an effect (Souza et al., 2020).

For people that are already doing a lot of exercise, but still losing bone mass, this point is important: it might be this group in particular that would benefit from trialling more intense forms of exercise that are progressive, and continue to increase over time, as opposed to a high volume of exercise that is fairly low intensity.

MITIGATING BONE LOSS VS BUILDING NEW BONE

The easiest type of exercise to consistently add load to is resistance training, and it is efficient to do this by increasing the weight rather than indefinitely increasing the reps (otherwise your workout might take hours!).

To be able to lift heavy weights, for relatively low reps (meaning approaching failure in say less than 15 repetitions), it takes time and practice. It is a skill to learn how to lift weights that feel heavy. Exercise for bone health is a long game, in that it needs to be maintained to have an ongoing positive effect, which means there is no rush to learn these skills!



MITIGATING BONE LOSS VS BUILDING NEW BONE

TAKE HOME POINTS

- It is easier to reduce bone loss than it is to build new bone
- Your individual circumstances may dictate how much you try to focus on exercise that is more 'bone building'
- It is likely that exercise that is taken towards failure is going to be the most effective whether this is higher rep or lower rep

OTHER LIFESTYLE INTERVENTIONS TO CONSIDER

Aside from trying to meet these outlined exercise guidelines, there are other lifestyle factors that are likely to help as well, as stated on the Health Bones Australia website:

- Getting adequate vitamin D
 - Seek advice from GP, get blood test to check levels
- Eat adequate calcium
 - 1300mg/day for post menopausal women
- Eat adequate protein
 - 1g/kg of body weight/day
- Eat enough calories in general
 - Specific to the person, but beware of the risks of dieting & the low calorie diets associated with medications like Ozempic and Wegovy
- Avoid smoking
- Avoid drinking alcohol
- Avoid excessive caffeine

Seeking advice from an accredited dietitian is recommended if you have osteopenia or osteoporosis and would like to investigate these concepts further.

OVERALL TAKE HOME POINTS

- Exercise can both reduce bone loss as well as build bone density in some cases
- It is never too late to start; however, the earlier you start, the better
- A combination of lifestyle modifications and exercise is likely to be the most helpful
- The most effective types of exercise for building bone are most likely progressive resistance training and impact loading
- Meeting exercise guidelines as well as including these types of exercise is important for bone health
- Including balance training is necessary to reduce falls risk, particularly as age advances

NEXT STEPS

If you want to get started with a tailored bone density program specific to you and your needs, get in touch to book in with one of our physiotherapists, either in person or online

www.fkbphysio.com/services

COMING SOON

If you want to get started with exercise for bone health, we have a few options:

Introduction to resistance training (no equipment, at home, complete beginner) free program

Beginner bone building 12 week program (at home or at the gym)

Bone building 12 week program (gym equipment required)

Bone building 12 week program **for runners** (gym equipment required)

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