

Good bone health is important for **all** women. When we think of bone health we often think of osteoporosis, a condition affecting 1.2 million Australian women. Defined as a systemic skeletal disease, osteoporosis is characterized by a loss of bone mass and a deterioration in their structural integrity leading to bones that become weak and liable to fracture. Osteoporosis may have its origins in childhood, only manifesting itself in older age.

Are some women at a greater risk for developing poor bone health?

Women who are slim, caucasian, smoke, have poor diets (particularly deficient in calcium and vitamin D), drink excessive amounts of alcohol, and do not exercise are often at a greater risk of developing osteoporosis. It is important to remember however, that even elite female athletes, particularly those who experience menstrual disturbances, can be at risk for developing poor bone health.

How can we optimise peak bone mass?

To reduce the risk of osteoporosis in later life, it is important to optimise peak bone mass. Peak bone mass is the highest level of bone accumulation a woman will have in her lifetime. Women often reach their peak bone mass in their twenties, which can predict risk for fracture later in life. The adolescent years are particularly important because it is estimated that almost 25% of adult bone mass is accumulated between the age of 12 and 14 years in girls. Although genetic factors account for 60-80% of the variance in peak bone mass, lifestyle choices during childhood and adolescence, including regular participation in physical activity and adequate nutritional habits, will maximize bone accumulation and peak bone mass. It is therefore critical that we promote smart bone health habits and behaviours from a young age.



WHAT TYPES OF EXERCISE WILL PROMOTE HEALTHY BONES?

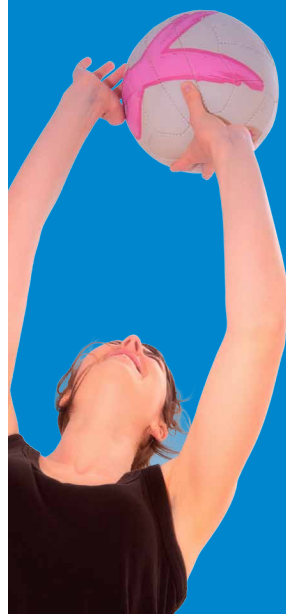
One of the most effective lifestyle choices to promote healthy bones is participation in regular **weight bearing** physical activity and exercise. However, the benefits of exercise on bone are age dependent. A girl who participates in **weight bearing** activity during the growing years will have the greatest capacity to maximize bone gains, whereas a woman who participates in similar activities during the pre and post menopausal years will often experience bone maintenance rather than bone gain.

Not all forms of exercise are equally effective for improving bone health. Our bones will respond best to exercise that is dynamic, variable and unique in terms of the magnitude and direction of loads. For example exercise that incorporates multidirectional jumping and/or running, such as volleyball, basketball and gymnastics, often result in the highest bone density values. Our bones will also adapt positively to activities and sports that produce a range of impact loads, such as soccer and tennis, and high joint reaction forces from vigorous muscle contractions, such as those often produced during progressive resistance training. Non-impact exercise such as swimming and cycling have little or no effect on bone.

Targeting bone loading in children and adolescent girls

Children who participate in weight-bearing sports often record bone mass values approximately 10% higher than their non-active peers. Although the precise exercise prescription for girls is not yet known, school based exercise studies have shown that exercise incorporating dynamic high impact loading, such as plyometrics, gymnastics, jumping, hopping and skipping, or weight-bearing sports will increase and build bone mass in young girls. More specific recommendations are outlined below:

- **Mode:** Weight-bearing activities, including running, jumping, skipping or hopping or dynamic impact loading sports such as netball, basketball, volleyball, hockey, soccer or tennis.
- **Intensity:** Moderate to high impact bone loading forces.
- **Duration:** At least 30 minutes per session, or shorts bout of high impact loading (eg 50 to 100 jumps).
- **Frequency:** At least 3 times a week.



Targeting bone loading in pre-and-postmenopausal women

The main role of exercise in pre-and-postmenopausal women is to maintain and preserve bone rather than to increase it. There is some evidence in recent research to indicate that high intensity bone loading activities may lead to modest bone gains at targeted sites in pre-menopausal women. For example, short bouts of high intensity hopping and jumping may result in bone gains at the hip. However, in post-menopausal women, participation in weight-bearing exercise and resistance training is recognized primarily to slow bone loss. Regular walking appears to have no effect on bone, and extended periods of bed rest in older women can result in rapid bone loss, which is irreversible. It is therefore essential that women of all ages remain as active as possible and try to follow these simple exercise guidelines:

- **Mode:** Weight bearing activities combining impact loading and resistance training, such as stair climbing, brisk or hill walking, jogging and progressive resistance exercise.
- **Intensity:** Moderate to high intensity and impact loading
- **Frequency:** Weight bearing activities 3-5 times per week and resistance exercise 2-3 times per week
- **Duration:** At least 30 minutes of a combination of weight bearing activities. Activities should always target major muscle groups.

Women with osteoporosis should be cautious when participating in certain types of physical activity and exercise. It is important to avoid excessive trunk flexion and dynamic exercises of the abdomen, which may result in high compressive forces on the spine and increase the risk of fracture.

Bone health in athletic girls and women

Even though weight-bearing exercise promotes good bone health in young girls and women, there is the potential for excessive exercise to become harmful. Female athletes who engage in sports that promote leanness or an 'ideal' body appearance with low body fat, or participate in extremely high intensity and volumes of training, will often be more vulnerable to disordered eating and menstrual irregularities, which can adversely affect bone health. Amenorrhea (no menstrual periods for 3 months or more) and/ or extreme energy deficiency (high-energy output with a low caloric food intake) may counteract the beneficial effects of exercise on bone, thus increasing the risk of premature osteoporosis or stress fracture injury.

Athletes who have one or a combination of poor nutrition, low bone density and irregular, unusual or non-existing periods may be diagnosed with the Female Athlete Triad. One of the challenges with this condition is that many girls and young women athletes do not report symptoms related to the Female Athlete Triad, making it difficult to detect. As a result, the International Olympic Association has endorsed strategies for the early detection of at risk athletes. If a coach, parent or other members of an athletes integrated support team suspects an athlete is suffering with one or more of the components of the triad, it is important that they refer the athlete to a sports medical physician. An important strategy for early detection of risk factors for the Female Athlete Triad should include annual screening by a sports physician.

Top tips for women and female athletes to promote "smart bone habits" over their life span

- Maximize bone mass accumulation though weight bearing physical activity during the childhood and adolescent years
- Do not smoke
- Maintain a well balanced diet rich in calcium and Vitamin D
- Weight-bearing physical activity should be maintained throughout life
- Athletes, coaches and parents should be educated on the risk of the Female Athlete Triad
- Optimise energy availability following training sessions to prevent energy deficiency



FOR FURTHER INFORMATION



Sports Medicine Australia

www.sma.org.au • www.smartplay.com.au
03 9674 8777

International Osteoporosis Federation

www.iofbonehealth.org

Osteoporosis Australia

www.osteoporosis.org.au

ACSM Position Statement of Female Athlete Triad

www.acsm.org/access-public-information/position-stands/position-stands/lists/position-stands/the-female-athlete-triad

2014 Female Athlete Triad Coalition Consensus Statement

www.femaleathletetriad.org/new-2014-coalition-consensus

References

For a full list of references, contact Sports Medicine Australia.

Acknowledgments

Authored by Dr. Rachel L Duckham (PhD) & Dr. Jenny Gianoudis (Bphty (Hons), PhD), Deakin University

Sports Medicine Australia wishes to thank the sports medicine professionals and Active Women in Sports Project partners who provided expert feedback in the development of this factsheet.

This factsheet has been developed with support from the Victorian Department of Transport, Planning and Local Infrastructure.

Disclaimer

The information contained in this fact sheet is in the nature of general comment only, and neither purports, nor is intended, to be advice on a particular matter. No reader should act on the basis of anything contained in this fact sheet without seeking independent professional medical advice. No responsibility or liability whatsoever can be accepted by Sports Medicine Australia or the authors for any loss, damage or injury that may arise from any persons acting on any statement or information contained in this fact sheet and all such liabilities are expressly disclaimed.

BONE HEALTH FOR ACTIVE WOMEN

