

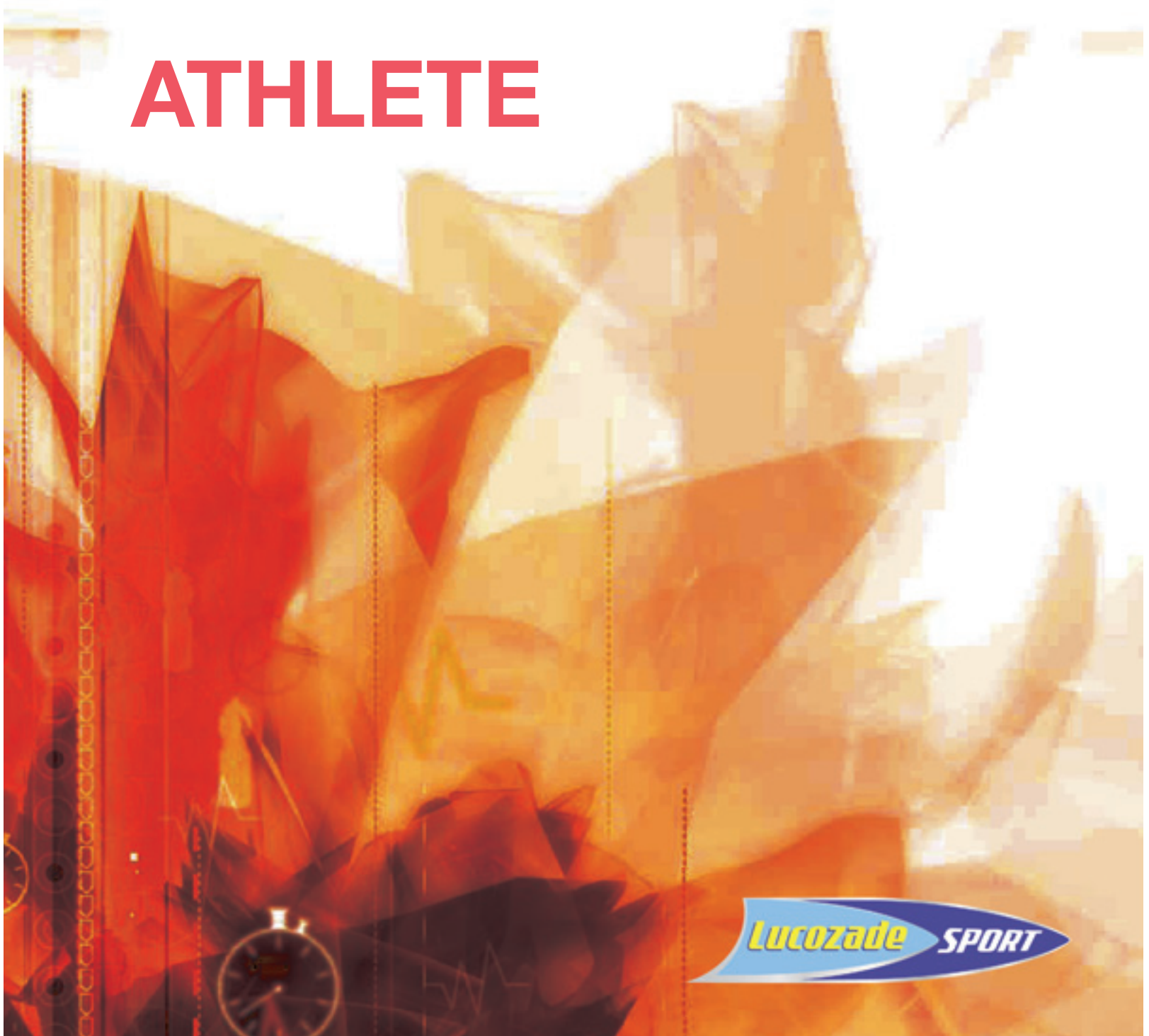


EMPOWERING IRISH SPORT



COACHING IRELAND  
OILIÚINT ÉIREANN

# THE FEMALE ATHLETE



**Lucozade** SPORT

COACHING IRELAND THE LUCOZADE SPORT EDUCATION PROGRAMME



# CONTENTS:

Physical Differences between Male and Female Athletes	5
The Female Triad	8
Who is at Risk	8
Energy Availability	9
How do you identify an athlete with disordered eating	9
Criteria for Anorexia Nervosa and Bulimia Nervosa	9
Menstrual Function	10
Bone Mineral Density	10
Nutrition for the Female Athletes	11
Summary	13

---

# THE FEMALE ATHLETE

## AN INTRODUCTION

If you are a coach, parent, sports science/medical professional or a female athlete yourself, you need to be aware of a number of factors that should be taken into account when planning and implementing your training and competition programme. Although there are some obvious anatomical differences between male and female athletes the end result of a training and competition programme should be no different. A well-implemented, well-structured, progressive programme should cater for the specific need of the individual and result in improvements in all targeted aspects of fitness.

### A: PHYSICAL DIFFERENCES BETWEEN MALE AND FEMALE ATHLETES

Prior to puberty overall body size and proportions for females and males are generally similar. Following maturation and into adulthood, women tend to be smaller than men in most physical variables including heart and lung size, blood volume and haemoglobin concentration. Another key difference between the sexes relates to the fact that the male hormone testosterone is a much more potent anabolic agent than female oestrogen, hence men tend to have a larger muscle mass and less body fat.

#### Cardio-vascular differences

One of the major limiting factors in aerobic metabolism is the rate at which working muscles can be supplied with oxygen. Oxygen binds to haemoglobin an iron rich protein in the red blood cells which is responsible for transporting oxygen via the blood to the working muscles. Females typically have haemoglobin levels in the blood of 12-14g/dl whereas males levels are generally 14-16g/dl. In addition to a lower heart size, this lower haemoglobin concentration is an important contributory factor to gender differences in VO<sub>2</sub> max because less oxygen is delivered to active muscles for a given volume of blood.

#### Strength differences

After maturation, women generally have a lower muscle mass than men and as a consequence will usually have a lower absolute strength which is generally about two-thirds the strength of males. When expressed relative to body weight, lower body strength of both sexes is usually quite similar, however upper body strength is still somewhat less due to males having a larger proportion of their muscle mass in the upper extremities. Nevertheless both men and women can experience similar improvements in strength gains as a result of resistance training which is usually in the region of about 10-20%. Women can therefore gain considerably from strength training programmes and these strength gains are usually not accompanied by large increases in muscle bulk (hypertrophy). With training strength gains in both males and females are usually proportional, and muscle strength is equivalent in both sexes for the same cross sectional area of muscle.

It is worth noting that differences in strength values observed between male and female trained athletes are generally less than those that exist between sedentary men and women.

#### Body composition

Following puberty women tend to have a higher percentage of body fat compared to men largely due to the role played by the female hormone oestrogen. This additional body fat does not seem to offer any advantage in weight-supported sport such as running as the extra fat does not contribute to muscle power. The extra fat however is an advantage in other sports such as long distance swimming, where the adipose tissue (fat) creates a layer of insulation and improves buoyancy. It is important to remember that a minimum level of body fat is essential for maintaining normal physiological function and

although low body fat levels may be advantageous in some sports there is a large range of body fat levels that are considered healthy and that will not adversely affect performance.

### Hormonal factors

The body shapes of the sexes begin to differ markedly at puberty. The hormone testosterone is responsible for the male shape and the muscularity of the body and the concentration of this hormone is far greater in males than in females. Similarly oestrogen has a significant influence on the female shape. The levels of female sex hormones oestrogen and progesterone fluctuate markedly each month within the post-pubescent female. These hormones are responsible for stimulating and regulating the menstrual cycle, mood swings and weight fluctuations (due to fluid retention at different times of the month). Females are able to exercise throughout their menstrual cycle without any adverse effects on the body, however some women find that stomach cramps and back pain associated with menstruation may mean that they need to modify training for those couple of days. All women are different however and the degree of severity of the symptoms varies markedly and may also vary from month to month. It is possible to regulate or manipulate (e.g. re-time menstruation so that it does not occur during a major competition) the menstrual cycle with the use of the contraceptive pill. This should be done in consultation with a doctor to discuss individual suitability.

The average age for the commencement of menstruation (menarche) is 12.7yrs however this can vary amongst individuals by as much as 2 years. Female athletes for example in general appear to reach puberty at a later age than the non-exercising counterparts. Delayed onset of menarche is not thought to have any long term effect on future fertility.

### Injury Risk

Most injuries that occur in sport are sports-specific rather than sex-specific. Injuries to female athletes occur mainly in practice and are thought to be due to improper training, inadequate facilities and poor coaching. In basketball and soccer it is reported that females have a 3-5 times increased risk of anterior cruciate ligament knee injuries compared to males. This is thought to be due to anatomical differences (knee hyperextension and a smaller notch for the anterior cruciate to fit in to) as well as the

failure in developing basic coordination skills at early ages. However a further study found very little difference in the pattern of injury between men and women competing in comparable sports. Female athletes can help decrease their chance of injury by increasing their muscle strength and coordination through appropriate resistance/strength and agility training.

### Flexibility

Women tend to have a greater range of motion in their joints compared with their male counterparts. This is advantageous in sports such as gymnastics and dance where greater flexibility is required. The higher level of flexibility may also offer some protection in preventing over reach injuries although may be associated with injuries caused by joint laxity or hyper mobility. The evidence supporting a link between flexibility and injury prevention and performance is currently conflicting and controversial. Flexibility requirements are specific to each individual. Nevertheless any balanced training programme should incorporate some flexibility training focusing on the joints and muscles used in the particular sport.

### Pregnancy

Exercise during pregnancy has become an accepted activity and is now widely recommended, and more importantly a safe practice, for the vast majority of expectant mothers to engage in. Continuing regular exercise during pregnancy can have a number of positive benefits for both mother and child. There appears to be no reason why women who train regularly and who are in good health should not engage in exercise during pregnancy and should be openly encouraged to do so. Nevertheless some pregnant women may not be able to train during pregnancy due to a specific conditions or complications, therefore it is important to consult with a doctor or obstetrician before hand.

During pregnancy training will help sustain fitness by building muscle tone as well as maintaining aerobic conditioning and strength. Regular exercise can also help an expectant mother physically prepare and cope more effectively with pregnancy and the exhausting demands of labour and delivery. There is some evidence to suggest that weight bearing exercise throughout pregnancy can reduce the length of labour and decrease delivery complications. Participation in physical training during

pregnancy has also been shown to have a number of other positive health benefits including:

- Promotes positive mood state
- Enhance energy levels and reduces tiredness
- Helps the body cope with weight gain
- Improves posture and helps reduce back ache
- Decreases constipation, bloating and swelling
- Reduces blood pressure circulation problems
- Makes it easier to regain pre-pregnancy fitness levels

In the vast majority of cases with a normal pregnancy, engaging in regular training is safe for both mother and foetus, with the health benefits far outweighing any potential risk. In order to gain the health benefits associated with physical exercise, women should therefore be encouraged to continue to engage in regular training during pregnancy as well as after child birth.

## B. THE FEMALE ATHLETE TRIAD

The dramatic increase in participation rates in organised and in particular performance sports among women has lead to a rise in several medical conditions which have become more prevalent as the number of female athletes has risen. In response to this the American College of Sports Medicine (ACSM) in 1992 adopted the term 'the female athlete triad' to describe these potential medical disorders. The ACSM updated their position stand in 2007 and defined the female athlete triad (or 'Triad') is a medical condition identified by the complex interaction between energy availability (with or without eating disorders), menstrual function and bone health (Figure 1) and may manifest clinically as:

1. Disordered eating
2. Amenorrhea (the absence of periods for > 3 months)
3. Osteoporosis (low bone mineral density)

Physical signs and symptom of those diagnosed with the female athlete triad include general weakness and fatigue, disordered eating, cold intolerance, dry skin, dehydration, noticeable weight loss, cessation of menstrual cycle, increased incidence of stress fractures and extended healing time from injuries. Affected females may also struggle with low-self esteem, withdrawal and possibly depression. Unless appropriately diagnosed and treated, the potential effect of each condition, in combination, may not only impact on athletic performance but also long-term health.

To date, the precise causes of the Triad are not fully understood, however it appears that the three elements are interrelated through both the physiological and psychological mechanisms of the body associated with the stresses of intense training and competition.

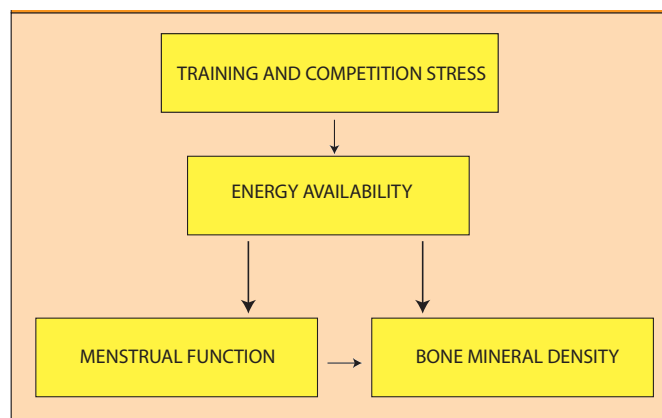


Figure 1. The female athlete triad.

## WHO IS AT RISK?

Potentially all physically active girls and women are at risk of developing one or more components of the Triad. Biological changes, peer pressure, society's drive for thinness and body-image preoccupation that occur during puberty make adolescence the most vulnerable time. The female athlete triad can cause several medical, reproductive and psychological problems. The existence of the Triad is often denied by the athlete and goes unrecognised by coaches and parents, and is therefore very much under-reported. Participation in sports that emphasise low body weight can also be a risk factor. Such sports include:

- Sports in which performance is subjectively scored (e.g. dance, ballet, figure skating, diving, gymnastics, aerobics)
- Endurance sports emphasising a low body weight (e.g. distance running, cycling)
- Sports requiring contour-revealing clothing for competition (e.g. volleyball, swimming, diving, athletics)
- Sports using weight categories for participants (e.g. lightweight rowing, judo, tae kwon doe, horse-racing)
- Sports emphasising a pre-pubertal look (e.g. gymnastics, figure skating, diving)

A recent study assessing the incidence amongst female athletes from a range of sports has suggested that about 4% of female athletes exhibit all three components of the female athlete triad with an additional 26% possessing at

least two of the criteria. The same study suggested that the female athlete triad may not be exclusive to those training and competing at a high level as up to 3% of non-athletic women aged between the ages of 13-29 were also found to possess all three elements of the triad. Despite these findings most female athletes are fully able to participate in rigorous training programmes without developing any part of the Triad.

## 1. ENERGY AVAILABILITY

Energy availability, or rather the lack of energy, appears to be a key causative factor in the development of the female athlete triad. Energy availability like energy balance relates to differences between energy intake and energy expenditure. The energy necessary for sustaining daily activity (which includes training) and normal physiological function is created through the consumption and absorption of nutrients in our diet. In the case of female athlete triad, high daily energy expenditure from intense training combined with low energy intake, possibly associated with eating disorders, but not necessarily so, will lead to low energy availability.

Restricted energy intake due to disordered eating is the first part of the female athlete triad and is viewed as the precipitating event for the Triad. The term disordered eating refers to a wide spectrum of abnormal eating behaviours. At the severe end of the spectrum are those athletes who fulfil the diagnostic criteria for anorexia nervosa or bulimia nervosa. At the other end are those who inadvertently under-eat to reduce body-weight. Although the latter may appear to be eating a healthy diet (one that would be adequate for a sedentary female) the female athlete's caloric needs are higher. Despite the fact that most female athletes do not meet the diagnostic criteria for eating disorders such as anorexia nervosa or bulimia many may still adopt what is termed 'disordered eating' habits associated with restricted energy intake such as skipping meals, fasting, binge eating and even purging. By restricting their diets, athletes worsen the problem of low energy availability which may have a direct impact on the other two components of the Triad, namely menstrual function and bone health.

Regardless of how the disordered eating behaviour develops long-term restriction of energy may lead to poor nutritional status, reduced immunity to bacterial and viral infections, reduced effectiveness of training, poor exercise performance, increased disordered eating behaviours, increased risk of exercise induced menstrual dysfunction, and osteoporosis.

## HOW DO YOU IDENTIFY AN ATHLETE WITH DISORDERED EATING?

It is beyond the scope of this fact sheet to offer anything beyond general guidelines. Recognising an athlete with disordered eating can be very difficult, but learning to recognise the behavioural and physical signs suggestive of disordered eating is imperative. Table 1 provides some of the behavioural signs of disordered eating.

**Table 1. Behavioural signs suggestive of disordered eating**

Preoccupation with food and weight
Repeatedly expressed concerns about being fat
Increased criticism of one's body
Compulsiveness and rigidity, especially regarding eating and exercise
Anxiety
Social withdrawal
Trips to the bathroom during or following meals
Continuous drinking of diet/no-calorie drinks or water
Complaining of always being cold

**Table 1. Behavioural signs suggestive of disordered eating Thompson & Sherman 1993**

## CRITERIA FOR ANOREXIA NERVOSA AND BULIMIA NERVOSA

The symptoms of anorexia nervosa include morbid fear of obesity, distorted body image and the refusal to maintain a weight at least 85% of that expected for height and age. There are two forms of anorexia nervosa. Those with the restrictive type do not regularly engage in bingeing and purging. Those with the bingeing/purging type use this behaviour regularly during an episode of anorexia nervosa.

The symptoms of bulimia nervosa include recurrent episodes of binge eating with a sense of lack of control over eating. Bulimics may purge by vomiting or taking laxative and/or diuretics. Non-purging activities that can substitute for purging include fasting and exercising excessively. To fit the definition, the bulimia must occur at least twice a week for at least 3 months. Bulimics are overly concerned with body shape and weight, but they do not have the markedly distorted body image of anorexic women. Table 2 outlines some of the signs and symptoms of Anorexia Nervosa and Bulimia Nervosa.

Table 2. Signs and symptoms of Anorexia Nervosa and Bulimia Nervosa	
Anorexia Nervosa	Bulimia Nervosa
Amenorrhoea (absence of periods for > 3 months)	Menstrual irregularity
Dehydration (especially in the absence of training and competition) and electrolyte abnormalities	Dehydration (especially in the absence of training and competition) and electrolyte abnormalities
Gastrointestinal problems <ul style="list-style-type: none"> <li>• Constipation</li> <li>• Diarrhoea</li> <li>• Bloating</li> <li>• Distress after eating</li> </ul>	Gastrointestinal problems <ul style="list-style-type: none"> <li>• Abdominal pain</li> <li>• Constipation</li> </ul>
Hyperactivity	Erosion of tooth enamel/gum disease
Cold intolerance	Swollen parotid glands
Lanugo (fine hair on face and arms)	Sore throat/esophagitis
Dry skin and hair	Bloodshot eyes
Fatigue beyond that normally expected in training and competition	Fatigue beyond that normally expected in training and competition

Source - Thompson & Sherman 1993

Table 2. Signs and symptoms of Anorexia Nervosa and Bulimia Nervosa

## 2. MENSTRUAL FUNCTION

The precise causes of menstrual cycle dysfunction in female athletes may vary amongst individuals and is probably due to a number of factors. Therefore the general consensus amongst sports medicine physicians is that there is no reason for female athletes to avoid training or competition during menstruation.

Primary amenorrhoea (delayed menarche) is the absence of menstruation by the age of 16 with otherwise normal development. Secondary amenorrhoea is the absence of three or more consecutive cycles after menarche. Complex hormonal balances create the monthly menstrual cycle. Food restriction, weight loss as well as intense physical training may interfere with this hormonal balance and disrupt the menstrual cycle. The primary cause of athletic amenorrhoea has now been identified as low energy availability resulting from either severe calorie restriction or excessive training load or a combination of the two, which in turn leads to a negative energy balance. It is now thought that a negative energy balance, (failing to match energy expenditure with adequate food intake) is the most important trigger for menstrual dysfunction. Collectively this stress appears to disrupt the function of key hormones principally responsible for regulating the reproductive function which in turn results in the menstrual cycle being temporarily 'switched-off' in order to conserve energy. It is important to note, however, that in non-athletic populations severe dietary restriction alone is sufficient to disrupt normal reproduction function in women. Additionally exercise and training has no direct impact on reproductive function, only in so much that it may increase energy expenditure and therefore reduce energy availability to sustain normal physiological function. As a result any disruption to normal menstrual function can be prevented or reversed with appropriate energy

intake and without the need to modify any training programme.

Athletes who are legitimately trying to lose weight (and do not have disordered eating) or who have excessively high training loads may also be susceptible to amenorrhoea. The prevalence of secondary amenorrhoea appears quite varied but is reported to occur in 3%-66% of female athletes (depending on the sport studied and the criteria used to define amenorrhoea), compared only to 2%-5% of women in the general population.

Although some athletes may not be concerned by the absence of periods it is an easily recognisable warning sign that something is not right. Athletic amenorrhoea is itself almost invariably reversible when the stresses responsible for its development are eliminated. Treatments can be as simple as eating a well-balanced diet that supplies sufficient energy to match the athletes' needs. In certain cases, training may need to be decreased, or the inclusion of hormonal controls such as the contraceptive pill, or in more serious cases Hormone Replacement Therapy (HRT) may be advised. Identifying and implementing the appropriate treatment should be done in conjunction with a suitably qualified professional.

Regardless of the cause of the amenorrhoea, treatment should be sought as soon as the condition is recognised. Amenorrhoea can have long-term effects on the athletes' bone mineral density due to the fall in oestrogen levels. The circulating levels of oestrogen affect the rate of bone loss of existing bone and deposition of new bone. Because the shortfall in bone density from prolonged amenorrhoea might not be restored after menstrual periods are resumed, athletic amenorrhoea should not be ignored as being a benign condition.

## 3. BONE MINERAL DENSITY

The final component of the Triad is the loss of bone mineral content, increasing bone fragility, which if left untreated will increase the risk of osteoporosis. Osteoporotic bone has decreased bone mineral content compared with normal bone and is more susceptible to fracture (either complete fractures, or more commonly in athletes stress fractures). Osteoporosis is often associated with the hormonal changes that occur at menopause however a women's bone health is often determined much earlier in life. During childhood bone is laid down during the growing years. In adolescence bones become thicker and stronger. By her early 20's a woman's bones will have achieved the maximum density that they will reach throughout her life. After age 30 a

woman can expect to lose an average of 0.5% of bone density per year, a rate that accelerates to 2% after menopause. Thus it is vital to maximise bone density when younger. If oestrogen levels decline during adolescence due to the Female Athlete Triad (especially amenorrhoea) the lifetime maximum bone density may be inadequate to prevent future osteoporotic fractures.

Evidence would suggest that there appears to be a direct relationship between menstrual function and bone health as a number of studies have shown that female athletes suffering from amenorrhoea generally have a lower bone mineral density. It is generally accepted that two of the key causes of such bone loss are low estrogen levels due to amenorrhea as a result of low energy availability and also calcium and vitamin D deficiencies, necessary for healthy bone development, caused by inadequate nutrient intake.

The prevalence of osteoporosis among athletes in general is unknown but as the risk of bone loss increases with the duration of amenorrhoea, appropriate measures (such as a dual energy x-ray absorptiometry [DEXA] scan or similar study) should be considered in athletes with amenorrhoea lasting at least 6 months. Pre-participation medical screening can help detect a history of amenorrhoea and menstrual history may predict current bone density in athletes.

It is important to remember that physical activity and in particular weight bearing exercise which provides an impact loading is a potent stimulator of bone deposition and should be encouraged in young girls to increase peak bone mass, and in older women to delay bone loss.

### Prevention

Prevention of the Female Athlete Triad through appropriate athlete education is crucial. The growing body of evidence would suggest that the Triad develops on a continuum which underlines the importance of early detection and treatment to prevent it progressing towards the extremes of the Triad. But like many medical conditions, prevention is better than cure. When an athlete is found to have Triad symptoms a multidisciplinary approach is required to initiate behavioural change. This approach involves parents, coaches, physicians, and health care professionals (dietitians, psychologists etc.) as well as the athlete herself. In particular, emphasis should be placed on optimising energy availability through the implementation of appropriate dietary practices and balanced training programmes both of which should be

reviewed regularly.

## C: NUTRITION FOR THE FEMALE ATHLETES

Basic dietary principles are similar for both sexes, but women have increased requirements for certain nutrients especially if they participate actively in sport or exercise. The most common nutrition issues in active women are poor energy intake and/or poor food selection. This can lead to poor intake of proteins, carbohydrates and essential fatty acids and low levels of certain micronutrients especially the bone-building nutrients - calcium, iron, the B vitamins and zinc.

(Danore 2002)

### Energy requirement (calorie intake)

Female athletes generally require fewer calories than their male counterparts (but more than sedentary females) in order to maintain their body weight. This is mainly to do with size. However, even comparing a male and female athlete of similar body weight the female athlete will require fewer calories per day. Specific energy requirement of female athletes will vary across individuals and sports and will be determined by training volume, intensity and frequency.

### Calcium requirement

Calcium is a mineral that plays an essential role in growth, muscle contraction and transmission of nerve impulse. Females require a greater calcium intake than men and have changing calcium needs throughout their life cycle (see Table 3).

Table 3. Recommended calcium intake (females)	
Appropriate for	Daily requirement (mg/day)
Girls (11-17 yrs)	1200
Menstruating women	800
Post menopausal women	1000
Pregnant/lactating women	1200

Table 3. Recommended calcium intake (females)

The following foods provide approximately 200mg of calcium:

- 200ml low fat/skim milk
- 200g (1 tub) yoghurt
- 40g hard cheese



- 80g sardines/salmon (with bones)
- 2.5 cups beans
- 250g tofu

It is not necessary to take a calcium supplement if the daily requirement is met from dietary sources. Most vegetarian women can meet calcium requirements through a regular consumption of low fat dairy foods, however vegans risk inadequate intake. Alternative calcium sources include fortified soy drinks, nuts and seeds and dark green vegetables.

**Note:** Calcium absorption is reduced by excessive caffeine, unprocessed bran, oxalate (found in spinach and rhubarb) and alcohol. Excess protein and salt can reduce the body's retention of calcium. Calcium from vegetables is not absorbed as efficiently as that from dairy products.

### Iron requirement

Iron is an essential constituent of haemoglobin (a protein found in the red blood cells) is responsible for transporting oxygen to the working muscle as well as playing a vital role in energy production. Women have a lower haemoglobin concentration than men and menstruating women lose a significant amount of iron each month. Iron stores can become depleted, resulting in anaemia. The recommended daily allowance of iron is outlined in Table 4.

**Table 4. Recommended iron intake (females)**

Appropriate for	Daily requirement (mg/day)
Children	8-10 mg per day
Adolescents	14 mg/day
Menstruating women	14 mg/day
Pregnant women	15 mg/day
Athlete females	Min of 16 mg/per day

**Table 4. Recommended iron intake (females)**

Iron is found in the diet in two main forms. Haem iron is found in foods such as red meat, poultry and seafood. Liver and kidney are the richest sources. Haem iron is well absorbed by the body. Non-haem iron is found in plant foods such as fortified breakfast cereals, vegetables, dried fruit, legumes and tofu. Non-haem iron is not absorbed as efficiently by the body as haem-iron.

**Note:** Vitamin C and haem irons enhance the absorption of non-haem irons. Conversely tannins (tea), caffeine (coffee, chocolate, cola beverages) and excess fibre reduce absorption. It is extremely difficult, but not impossible, to obtain an adequate amount of dietary iron without consuming red meat. Vegetarian athletes and those who consume little red meat are advised to see a sports dietician to ensure that their diet provides sufficient iron to meet their needs.

Foods, which provide 2g of iron, include:

- 90g lean beef
- 120g dark turkey meat
- 20g liver
- 90g spring greens boiled
- 3 tablespoons of baked beans
- 30g-45g fortified cereal
- 2 boiled eggs
- 2 dried figs

## B vitamins and Zinc

Zinc levels can be low in female athletes especially if meat products are avoided. Meat, liver, eggs, are among the best sources of dietary zinc. The recommended zinc intake for women is 7 mg (excessive doses should be avoided). Adequate intake of the B vitamins is also important to ensure sufficient energy production and the building and repair of muscle tissue.

## D. SUMMARY

Although many questions relating to gender specific adaptations to training are still to be evaluated, the current body of research suggests that there is no scientific basis for restricting the participation of any healthy female athlete from any endurance, strength or power based sports. It appears that many of the physiological adaptations in response to a period of training are very similar for both sexes. This is probably unsurprising when you consider that although the human body is a complex biological system, many of the physiological, cellular and biochemical mechanisms that regulate our responses to exercise are essentially similar for men and women.

Clearly drawing comparisons between men and women in relation to sports participation and performance is problematical and are influenced by the interaction of a number of factors including opportunities, coaching, training techniques and facilities as well as lifestyle and

nutrition. Furthermore, for comparative purposes, it is extremely difficult to match males and females for fitness level, training history or performance. Although few differences exist between the sexes in relation to the physiological responses to training it is important that when prescribing exercise programmes that gender issues as well as the specific needs of the individual and sport are taken into account. Of particular note:

- All females can participate in sport and gain benefits from appropriately designed training programmes that take their individual requirements into consideration.
- Female athletes, like their male counterparts, come in a vast range of shapes and sizes and it is possible to find a sport for all body types.
- As it is unlikely that the pressures on female athlete to be thin will abate any time soon, the ability to recognise the signs and symptoms of the Female Athlete Triad is therefore paramount.
- Female athletes and their coaches should be educated about proper nutrition and safe training practises and undertake regular review of training programmes.





## REFERENCES

ACSM Position Stand on the female Athlete Triad (2007). *Medicine and Science in Sport and Exercise*. 39(10): 1867-1882.

Arendt, E and Dick R. (1995). Knee injury patterns among men and women in collegiate basketball and soccer: NCAA data and review of literature. *American Journal of Sports Medicine*; 23(6), 694-701.

Salis, R.E., Jones K., Sunshine, Smith, G and Simon, L. (2001). Comparing Sports Injuries In Men and Women. *International Journal of Sports Medicine*, 22, 420-423.

Manore M.M. (2002). Dietary Recommendations and Athlete Menstrual Dysfunction. *Sports Medicine*, 32(14) 887-901.

Thompson, R. A. and Sherman, R.T. (1993) Helping athletes with eating disorders. *Human Kinetics*, Champaign, Illinois

American Psychiatric Association. (1994). *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. Washington DC: American Psychiatric Association 539-550

Loucks, A.B. and Horvath, S.M. (1990) Effects of exercise training on the menstrual cycle: existence and mechanisms. *Medicine and Science in sport and Exercise*, 22, 275-280

Wiggins, D.L. and Wiggins, M.E. (1997). The female athlete triad. *Clinical Sports Medicine*, 16(4) 593-612

FSAI (1999) Recommended Dietary Allowances for Ireland



Sponsored by



**THE  
IRISH SPORTS  
COUNCIL**  
AN CHOMHAIRLE SPÓIRT



  
**UNIVERSITY of LIMERICK**  
OLLESCOIL LUIMNIGH

**isport**  
Northern Ireland

Coaching Ireland  
University of Limerick, Limerick, Ireland t +353 61 202 895 f +353 61 202 868  
e info@coachingireland.com www.coachingireland.com

