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The Female Athlete Triad – The role of nutrition

Summary

In response to the number of studies concluding that some female athletes are suffering from menstrual dysfunction, disordered eating, reduced bone mass and stress fractures, the American College of Sports Medicine coined the term «The Female Athlete Triad» in 1992. The Female Athlete Triad is a serious syndrome compromising three interrelated components: (i) disordered eating; (ii) amenorrhoea; and (iii) osteoporosis. Female athletes who develop one or all components of the Triad often start with dieting. Dieting behavior often leads to energy deficit, menstrual irregularities and increased risk for loss of bone mass. Severe eating disorders may cause morbidity and mortality. The Female Athlete Triad is a syndrome that can be prevented. Therefore, all individuals, including the athletes themselves, coaches, administrators and family members, who are involved in recreational and competitive sport, should be educated about these disorders, and strategies for each sport should be developed to prevent, recognize and treat the Female Athlete Triad.

Zusammenfassung

Als Folge einer grossen Anzahl Studien, welche aufzeigten, dass einige Athletinnen an Zyklusstörungen, Essstörungen, reduzierter Knochendichte und Ermüdungsbrüchen leiden, hat das American College of Sports Medicine 1992 den Begriff «Sportlerintriade» («Female Athlete Triad») kreiert. Die Female Athlete Triad ist ein ernst zu nehmendes Syndrom, welches drei ineinander verwobene Komponenten aufweist: (i) Essstörung, (ii) Amenorrhö und (iii) Osteoporose. Diäthalten ist oftmals der Auslöser bei Athletinnen, welche eine oder alle Komponente(n) der Triade entwickeln. Dieses Diäthalten führt oft zu einer ungenügenden Versorgung mit Energie, zu Zyklusstörungen und zu einem erhöhten Risiko an Knochenmasseverlust. Schwer wiegende Essstörungen können zu Krankheit und zum Tod führen. Die Female Athlete Triad ist ein Syndrom, dessen Auftreten verhindert werden kann. Deshalb sollten alle im Breiten- und Leistungssport tätigen Personen – Athletinnen und Athleten selbst, Trainer und Trainerinnen, Funktionäre und Funktionärinnen wie auch Familienangehörige – über die genannten Krankheiten aufgeklärt und für jede Sportart Strategien entwickelt werden, um die Female Athlete Triad zu verhindern, zu erkennen und zu behandeln.

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Introduction

The Female Athlete Triad refers to three interrelated conditions: disordered eating (DE), amenorrhoea and osteoporosis. Some female athletes do not consider training or exercise as sufficient to accomplish their idealized body shape or level of thinness. Therefore, a significant number of active females diet and use harmful weight-loss practices to meet their goals [1, 2, 3]. These patterns may lead to under-nutrition, menstrual dysfunction, and subsequent bone loss. Each portion of this triad increases the chance of morbidity and mortality, but the dangers of the three together are synergistic [4].

This article addresses three aspects of the Female Athlete Triad: (i) the nature of DE, menstrual dysfunction and bone health, ii) prevention of the Triad, and (iii) how to help athletes with the Triad.

Disordered eating

Definition

Disordered eating behavior is characterized by disturbances in eating behavior, body image, emotions and relations. Anorexia nervosa (AN) is the extreme of restrictive eating behavior in which an individual continues to starve and feel fat in spite of being 15% or more below an ideal body mass. Bulimic behavior refers to a cycle of food restriction or fasting followed by binging and purging. AN and bulimia nervosa (BN) are clinical eating disorders (EDs).

The Eating Disorder Not Otherwise Specified category (ED-NOS) [5] refers to disorders of eating that do not meet the criteria for any specific EDs. This category acknowledges the existence and importance of a variety of eating disturbances. The diagnostic criteria for AN, BN and ED-NOS are listed in *table 1–3*.

Athletes constitute a unique population and special diagnostic considerations should be made when working with this group [6, 7, 8]. An attempt has been made to identify the group of athletes with significant symptoms of EDs, but do not meet the DSM-IV criteria for EDs. These athletes have been classified as having a subclinical ED termed anorexia athletica (AA) [9].

Prevalence

Prevalence of DE behavior and EDs among athletes have been estimated to range from 1–62% [2]. The prevalence seems to be higher in elite athletes when compared to less active elite athletes and controls [2, 3, 9, 10, 11]. Furthermore, DE and ED are more frequent among female athletes competing in aesthetic and weight-class sports than among athletes competing in sports where leanness is considered less important [1, 3] *(table 4)*.

A. Refusal to maintain body mass at or above a minimally normal weight for age and height (e.g., weight loss leading to maintenance of body mass less than 85% of that expected; or failure to make expected weight gain during period of growth, leading to body mass less than 85% of that expected).
B. Intense fear of gaining weight or becoming fat, even though underweight.
C. Disturbance in the way in which one's body mass or shape is experienced, undue influence of body mass or shape on self-evaluation, or denial of the seriousness of the current low body mass.
D. In post-menarcheal females, amenorrhoea, i.e., the absence of at least three consecutive menstrual cycles. (A woman is considered to have amenorrhoea if her periods occur only following hormone, e.g., estrogen, administration.)
Specify types: *Restricting type:* During the episode of anorexia nervosa, the person has not regularly engaged in binge-eating or purging behavior (i.e., self-induced vomiting or the misuse of laxatives, diuretics or enemas). *Binge eating/purging type:* During the current episode of anorexia nervosa, the person has regularly engage in binge eating or purging behavior (i.e., self-induced vomiting or the misuse of laxatives, diuretics or enemas).

Table 1: Diagnostic criteria for anorexia nervosa [5].

A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following: (1) eating, in a discrete period of time (e.g., within any 2 hour period), an amount of food that is definitely larger than most people would eat during a similar period of time in similar circumstances; and, (2) a sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).
B. Recurrent inappropriate compensatory behavior in order to prevent weight gain, such as: self-induced vomiting; misuse of laxatives; diuretics or other medications; fasting; or excessive exercise.
C. The binge eating and inappropriate compensatory behaviors both occur, on average, at least twice a week for three months.
D. Self-evaluation is unduly influenced by body shape and mass.
E. The disturbance does not occur exclusively during episodes of anorexia nervosa.
Specify types: *Purging type:* The person regularly engages in self-induced vomiting or the misuse of laxatives, diuretics or enemas. *Non purging type:* The person uses other inappropriate compensatory behaviors, such as fasting or excessive exercise, but does not regularly engage in self-induced vomiting or the misuse of laxatives, diuretics or enemas.

Table 2: Diagnostic criteria for bulimia nervosa [5].

Factors associated with the development of EDs

Psychological, biological and social factors are implicated in the development of EDs [12, 13]. Because of additional stress associated with the athletic environment female elite athletes appear to be more vulnerable to ED than the general female population [7, 10]. Risk factors that have been discussed are: restrained eating and training, frequent weight-cycling, early start of sport-specific training, personality factors, injury, overtraining and the impact of coaching behavior [2, 9].

Nutritional factors

Pressure to reduce weight has been the common explanation for the increased prevalence of eating related problems among athletes. The important factor may, however, not be dieting per se, but rather the situation in which the athlete is told to lose weight, the words used and whether the athlete received guidance or not. In addition to the pressure to reduce weight, athletes are often pressed for time, and they have to lose weight rapidly to make or stay on the team. As a result they often experience frequent periods of restrictive dieting or weight cycling [9]. Weight cycling has been suggested as an important risk or trigger factor for the development of ED in athletes [9, 14].

1. For females, all of the criteria for anorexia nervosa are met except that the individual has regular menses.
2. All of the criteria for anorexia nervosa are met except that, despite significant weight-loss, the individual's current weight is in the normal range.
3. All of the criteria for bulimia nervosa are met except that the binge eating and inappropriate compensatory mechanisms occur at a frequency of less than twice a week or for duration of less than 3 months.
4. The regular use of inappropriate compensatory behavior by an individual of normal body mass after eating small amounts of food (e.g., self-induced vomiting after the consumption of two cookies).
5. Repeatedly chewing and spitting out, but not swallowing, large amounts of food.
6. Binge-eating disorder: recurrent episodes of binge eating in the absence of the regular use of inappropriate compensatory behaviors characteristic of bulimia nervosa.

Table 3: Diagnostic criteria for eating disorder not otherwise specified (ED-NOS) [5].

Sport groups (n)	*Prevalence (%)*
Technical (n=98)	13
Endurance (n=119)	20
Aesthetic (n=64)	34
Weight dependent (n=41)	27
Ball games (n=183)	11
Power (n=17)	–*
Athletes totally (n=522)	*20*
Non-Athletes (n=522)	*5*

Table 4: Prevalence (%) of eating disorders in female elite athletes representing different sport groups and non-athletes [1].
* *Only one athlete representing power sports was diagnosed with eating disorders.*

Medical consequences

EDs may cause serious medical problems and can even be fatal. Whereas most complications of AN occur as a direct or indirect result of starvation. Irregular menstrual bleeding and amenorrhoea result in suppressed estrogen levels and affect bone health and fertility [15].

Complications of BN occur as a result of binge-eating and purging [7]. The loss of fluids and electrolytes during purging can lead to serious medical problems like dehydration, acid-base abnormalities, and cardiac rhythm disturbances. Dehydration and electrolyte abnormalities decrease coordination, balance, and muscle function. Therefore, the behavior is dangerous to their health and counterproductive to improving their athletic performance.

AN patients display up to six times increase in standard mortality rate compared to the general population [16]. Death is usually attributable to fluid and electrolyte abnormalities, or suicide [17]. Mortality in BN is less well studied, but deaths do occur, usually secondary to the complications of the binge-purging cycle or suicide. Mortality rates of EDs among athletes are not known. However, a number of death cases of top level athletes representing gymnastics, running, alpine-skiing, and cycling have been reported in the media. Five (5.4%) of those diagnosed in the Norwegian study [9] reported suicide attempts.

Menstrual irregularities

Definitions

The monthly menstrual cycle is a complex interaction of the endocrine and reproductive systems. External stimuli affect the system through hormonal signals to the hypothalamus. The cessation of menses coincident with physical training has long been recognized [4].

Eumenorrhea describes a normal menstrual pattern of 10–13 menses per year [18, 19]. Menstrual dysfunction seen in athletes is characterized by a significant decrease in reproductive hormones, especially estrogen, and disruption of the normal menstrual cycle [15]. The different forms of menstrual dysfunction are shown in *table 5*.

Primary amenorrhoea (delayed menarche): Absence of menstruation by age 16 in a girl with secondary sex characteristics.
Secondary amenorrhoea: Absence of three or more consecutive menstrual cycles after menarche.
Oligomenorrhoea: Less than six cycles per year.
Anovulation: No ovulation, but bleedings may occur.
Luteal phase deficiency: Ovulation may occur, but inadequate progesterone support for endometrial development.

Table 5: Definitions of the different forms of menstrual irregularities [4, 15].

Prevalence

Exercise-induced or athletic menstrual dysfunction (amenorrhoea, oligomenorrhoea, anovulation, luteal phase deficiency, delayed menarche) is more common in active women and can significantly affect health and sport performance [15]. Studies report between 1 and 62% of athletic women experiencing menstrual irregularity [4, 15, 19, 20, 21]. The prevalence depends on the definition of menstrual irregularity and the competitive level of the athletes investigated. In a recent study [22], a significantly higher percentage of elite athletes (26%) compared to controls (14%) reported menstrual irregularity. Furthermore, a higher percentage of athletes representing aesthetic sports (31%) reported less than eight cycles the last year compared to athletes representing ball game sports (11%) and technical sports (7%).

Factors associated with menstrual irregularities

A number of factors, such as energy balance, DE behaviors, exercise intensity and training practices, body mass and composition, and physical and emotional stress, may contribute to the development of athletic menstrual dysfunction. There also appears to be a high degree of individual variation with respect to the susceptibility of the reproductive axis to exercise and diet-related stresses [15].

Nutritional factors

The energy-drain and exercise-intensity hypotheses suggest that athletic amenorrhoea or other reproductive hormone abnormalities observed in female athletes may be due in part to periods of energy deficiency, or a combination of high-energy expenditure, low energy intake, and/or high psychological and physical stress [15, 23]. In a study testing two hypotheses about the disruption of luteinizing hormone (LH), Loucks et al. [24] suggest that LH pulsatility in women depends on energy availability, and not necessarily on stress of exercise.

More research is needed to answer some of the current concerns of vegetarian athletes, especially with regard to hormonal alterations and their impact on bone health as well as the questions on protein-energy requirements for strict vegetarians who consume no animal protein.

Medical consequences

Still most athletes refer to the absence of menses as a pleasant convenience and they are unaware that the skeleton could suffer irreversible consequences. Although athletic amenorrhoea represents the most extreme form of menstrual dysfunction, other forms can also result in suppressed estrogen levels and affect bone health and fertility [15]. The loss of bone mineral density (BMD) is a silent process, and the athlete is usually unaware that a problem exists until a related injury, such as a stress fracture, occurs.

Furthermore, studies report a higher incidence of injuries and stress fractures among amenorrhoeic and oligomenorrhoeic as compared to eumenorrhoeic athletes [25, 26, 27]. Also, a higher frequency of athletes displaying DE behaviors report menstrual irregularity and sustain more bone injuries during their collegiate career [25].

Osteoporosis

Definitions

Osteoporosis is a disease characterized by low bone mass and microarchitectural deterioration of bone tissue leading to enhanced skeletal fragility and increased risk of fracture [4]. The diagnostic criteria [28] are listed in *table 6*.

Normal: Bone mineral density (BMD) that is no more than 1 standard deviation (SD) below the mean of young adults.
Osteopenia: BMD between 1 and 2.5 SD below the mean of young adults.
Osteoporosis: BMD more than 2.5 SD below the mean of young adults.
Severe osteoporosis: BMD more than 2.5 SD below the mean of young adults plus one or more fragility fractures.

Table 6: Diagnostic criteria for osteoporosis [28].

Prevalence

According to O'Brien [29], about 30% of all women above 50 years are osteoporotic. The prevalence of osteopenia and osteoporosis among female athletes is not known, but a number of studies have reported a significant decrease in vertebral BMD among young female athletes with menstrual irregularities [30–36].

Whether bone loss is observed at all regional sites may depend in part on the extent of mechanical loading at specific sites in various sports. Not all amenorrhoeic athletes have low bone mass. Their skeletal status depends upon the length and severity of their menstrual irregularity, as well as factors that influence their BMD prior to the onset of amenorrhoea [37].

Factors associated with reduced bone mineral density (BMD)

Bone mineral is age, sex and race dependent. In addition, heredity is thought to explain between 60–80% of the variation in bone mineral among individuals [38]. Peak bone mass is the maximum amount of bone acquired at skeletal maturity, and those with a high peak bone mass may be at lower risk of developing osteoporosis later in life. Modifiable determinants that account for bone mineral are soft tissue composition (lean mass, fat mass), lifestyle factors (smoking, alcohol intake), medications, hormones, physical activity and nutrition. These factors may interact with one another, and their degree of influence varies depending on different stages of the life span and on different skeletal sites.

Both estradiol and progesterone contribute to the maintenance of bone density by affecting bone formation and remodeling [18, 19, 34, 39]. Therefore, any factor that contributes to menstrual dysfunction can have a direct or indirect influence on bone density and put the individual at risk for compromised bone health. Fur-

thermore, it is well known that weight-bearing activities slow or reverse bone loss and, thus, decrease a woman's chances for developing osteoporosis [40].

Together with exercise, the most important of the modifiable factors is diet (energy and nutrient intake) [41].

Nutritional factors

Insufficient nutritional intake has a detrimental effect on vertebral bone density [35, 42]. The occurrence of DE practices and low calcium intake combined with menstrual dysfunction may exacerbate bone loss [4].

ED athletes (anorectic type) have been shown to have decreased vertebral BMD [36, 43].

A nutrient worthy of consideration for supplementation to the female athlete's diet is calcium. In general, most experts agree that a calcium-rich diet is the most appropriate dietary prescription to promote and support optimal bone density. In addition, vitamin D plays an important role in maintaining calcium homeostasis and vitamin K deficiency is associated with an increased risk of hip fracture in adults [41]. Other minerals important for bone health include sodium, magnesium and zinc [41].

Medical consequences

Reduced bone mass per se does not necessarily give physical nuisance. However, elite athletes can experience bone loss that leads to osteoporosis, increased risk for fractures, pain, a reduction in training volume, frequent training breaks caused by injuries and an ended athletic career.

To date, no long-term study has shown that amenorrhoeic individuals can fully regain lost BMD, despite returning to a normal reproductive status [32]. This risk is especially critical for the adolescent or young adult athlete as peak bone mass is reached by the third decade of life [32]. However, further studies are needed to determine the long-term effects of resumption of menses on BMD.

Prevention of the Triad

Since athletes at least at the elite level, are evaluated by their coach every day, changes in behavior and physical symptoms should be easily observed. However, symptoms of the Triad in competitive and elite athletes are too often ignored or not «detected» by coaches. One reason for this is lack of knowledge about symptoms of the Triad.

Most individuals with EDs do not realize that they have a problem, and therefore do not seek treatment on their own. Athletes, however, might consider seeking help only if they experience that their performance level is leveling off. In contrast to the athletes with anorectic symptoms most athletes suffering from BN are at or near normal weight and therefore difficult to «detect». Hence, the team staff and parents must be able to recognize the physical symptoms and psychological characteristics listed in *tables 7 and 8*. It should be noted that the presence of some of these characteristics does not necessarily indicate the presence of EDs or the Triad. However, the likelihood of one or more of the components of the Triad being present increases as the number of presenting characteristics increases.

A history of menstrual dysfunction is one of the most common and obvious signs that can point to the Triad. However, it is important to identify the cause of irregular or absent menstruation. It is often found that it is not necessarily lack of energy or high training volumes that cause the hormone imbalance, but that the overall stress on the athlete is too great.

In contrast to the finding from the general adolescent population [44], talking to competitive athletes and coaches about the Triad (definitions, risk factors, consequences and preventive strategies) seems to have a preventive effect [10]. Early intervention is also important, since EDs and the Triad are more difficult to treat the longer they progress. Therefore, professionals working with

Significant weight loss beyond that necessary for adequate sport performance	Anxiety
Amenorrhoea or menstrual dysfunction	Avoidance of eating and eating situations
Dehydration	Claims of «feeling fat» despite being thin
Fatigue beyond that normally expected in training or competition	Resistance to weight gain or maintenance recommended by health care personnel
Gastrointestinal problems (i.e., constipation, diarrhea, bloating, postprandial distress)	Unusual weighing behavior (i.e., excessive weighing, refusal to weigh, negative reaction to being weighed)
Hyperactivity	Compulsiveness and rigidity, especially regarding eating and exercise
Hypothermia	Excessive or obligatory exercise beyond that required for improving performance
Bradycardia	Exercising while injured despite prohibitions by medical and training staff
Lanugo	Restlessness – relaxing is difficult or impossible
Muscle weakness	Social withdrawal
Reduced bone mineral density	Depression and insomnia
Stress fractures	

Table 7: Physical symptoms, psychological and behavioral characteristics of athletes with anorexia nervosa or anorexia athletica (modified after Thompson & Trattner-Sherman) [7].

Callus or abrasion on back of hand from inducing vomiting	Binge eating
Dehydration, especially in the absence of training or competition	Agitation when bingeing is interrupted
Dental and gum problems	Depression
Edema, complaints of bloating, or both	Dieting that is unnecessary for appearance, health, or sport performance
Electrolyte abnormalities	Evidence of vomiting unrelated to illness
Frequent and often extreme weight fluctuations (i.e., mood worsens as weight goes up)	Excessive exercise beyond that required to improve performance
Gastrointestinal problems	Excessive use of the restroom
Low weight despite eating large volumes*	Going to the restroom or «disappearing» after eating
Menstrual irregularity	Self-critical, especially concerning body, weight, and sport performance
Muscle cramps, weakness, or both	Secretive eating
Swollen parotid glands	Substance abuse – whether legal, illegal, prescribed, or over-the-counter drugs, medications, or other substances
	Use of laxatives, diuretics (or both)

Table 8: Physical symptoms, psychological and behavioral characteristics of athletes with bulimia nervosa [7].
* Usually at «normal» weight

athletes should be informed about the possible risk factors for the development, early signs and symptoms of the Triad, the medical, psychological and social consequences of the Triad, how to approach the problem if it occurs, and what treatment options are available.

Therefore, within the sport arena, coaches, trainers, administrators and parents should receive information about energy and nutrition demands, consequences of extreme weight control methods, EDs, the menstrual cycle and related issues such as growth and development and the relationship between body composition, health and performance. In addition, coaches should realize that they can strongly influence their athletes. Coaches or others involved with young athletes should not comment on an individual's body size, or require weight loss in young and still growing athletes. Without offering further guidance, dieting may result in unhealthy eating behavior or EDs in highly motivated and uninformed athletes [45].

Teammates, coaches and parents who are aware of the signs of the Triad are likely to notice them. Those who provide medical care for athletes should be alert to energy deficiency, use of ED behavior, irregular periods, fractures, fatigue, anemia, and depression as possible signs of the Triad, particularly noting unusual fractures that occur from minimal trauma [4, 45].

How to help athletes with the Triad

Women with one component of the Triad should be screened for the other components. Screening for the Triad can be done at the time of the pre-participation examination and during evaluation of the following: energy- and nutrient intake, possible ED behavior, menstrual status and history, weight change, cardiac arrhythmias including bradycardia, depression, or stress fracture [4, 46].

Few have discussed the specific issue of athletes and treatment of the Triad. Therefore, this section mainly relies on the experience that the authors have from the work that we do at The Olympic Training Center in Oslo. In 1998 an Eating-Disorder Team including a medical doctor, sports nutritionist, exercise scientist specialized in EDs and a psychiatrist was established. The success of the treatment plan is based on a trusting relationship between the athlete and the care providers. This includes respecting the athlete's desire to be lean for optimal athletic performance, and expressing a willingness to help the athlete be lean and healthy.

According to Manore [15], the most common nutrition issues in athletes with DE and/or menstrual dysfunction are poor energy intake and/or poor food selection, which can lead to poor intakes of protein, carbohydrate and essential fatty acids. The most common micronutrients to be low are the bone-building nutrients, especially calcium, the B vitamins, iron and zinc. If energy drain is the primary contributing factor to athletic menstrual dysfunction, improved energy balance will improve overall nutritional status and may reverse the menstrual dysfunction, thus returning the athlete to normal reproductive function. Because bone health can be compromised in female athletes with menstrual dysfunction, intakes of bone-building nutrients are especially important. Iron and zinc are typically low in the diets of female athletes if meat products are avoided. Adequate intake of the B vitamins is also important to ensure adequate energy production and the building and repair of muscle tissue.

In addition, focus on normalizing weight, body composition, menstrual cycle, modifying unhealthy thought processes that maintain the disorder, and dealing with the emotional issues in the individual's life, is important. The younger the athlete, the more the family's involvement is recommended.

If menstrual irregularities are confirmed, the therapist should inform the athlete about the detrimental effects of loss of menses in relation to skeletal integrity. Emphasis should be placed upon both short- and long-term consequences of decreased BMD. If the athlete has experienced irregular menses for some time, a bone density assessment, via dual-energy x-ray absorptiometry (DXA) should be carried out. A diagnosis of osteopenia may be enough for the athlete to initiate a change in behavior or training regimen. Some studies report an increase in BMD in amenorrhoeic athletes resuming normal menses, but these gains seem to be limited [4]. Amenorrhoeic athletes using hormone replacement therapy in doses used for menopausal women have shown maintenance of bone mass, but no gains [4].

Health professionals should question athletes who have had stress fractures about menstruation and eating history. Presence of other symptoms such as tiredness/exhaustion, inadequate or poor nutrition, anemia, electrolyte imbalance, and depression should also lead to an evaluation of the three components.

In our opinion, suspension from training and competition for athletes is not recommended. If the athlete is suspended, she may train on her own, which in some cases may be more dangerous because no one will be monitoring her exercise. Second, preventing the athlete from participating in her sport may further reduce her self-esteem. Third, control is a key issue for the individual with an ED. She may view the suspension as an attempt by others to control. However, if the athlete is not capable to increase the energy intake to an optimal level, training volume must be reduced. At The Olympic Training Center we have established some minimal criteria to continue training and competition: (i) the athlete must agree to comply with all treatment strategies as best she can; (ii) the athlete must be closely monitored on an ongoing basis by the health care professionals handling her treatment; (iii) treatment must always take precedence over training and competition; and (iv) if any question arises at any time regarding whether the athlete is meeting or is able to meet the preceding criteria, competition is not to be considered a viable option while the athlete is in treatment.

Conclusions

Some female athletes and non-athletes do not consider training or exercise as sufficient to accomplish their idealized body shape or level of thinness. Therefore, to meet their goals, a significant number of them diet and use harmful, though ineffective weight-loss practices such as restrictive eating, vomiting, laxatives and diuretics to meet their goals. EDs is the common denominator for such behaviors. The prevalence of both EDs and menstrual dysfunction is higher among female athletes compared with the general population. The diagnosis of EDs in female athletes can easily be missed unless specifically searched for. DE may result in amenorrhoea because of energy deficit. If untreated, EDs can have long-lasting physiological and psychological effects and may even be fatal. Treating athletes with EDs should be undertaken only by qualified health care professionals. It does not seem to be a specific body fat percentage below which regular menses cease. Some athletes with amenorrhoea regain their menses after intervals of rest, even without an increase in body mass or fat, suggesting that amenorrhoea is not caused solely by low body mass or body fat.

Energy deficiency seems to be an important factor associated with menstrual dysfunction in athletes. It seems like the amount of bone loss is correlated with the severity and length of menstrual irregularity, nutritional status, and the amount of skeletal loading during activity. Due to the severe consequences of EDs, menstrual irregularities and osteoporosis, it is obviously important to identify athletes who are at risk for the Female Athlete Triad as early as possible.

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