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The Female Athlete Triad

A statement for health professionals from the Scientific Commission of the International Federation of Sports Medicine (FIMS)

INTRODUCTION

It is generally accepted that regular physical activity is important for health in females and males. For this reason, physical fitness programs for women should be recommended and encouraged all over the world (22). The gender-specific physiological, anatomical, psychological, and social aspects of the female athlete, however, need specific consideration in all levels of women sport.

Since the death of gymnast Christy Henrich from anorexia in 1994 at the age of 22 and a weight of 64 pounds or 29 kg, athletes, parents, coaches, medical personnel, judges, sport federations and sport governing bodies have become more aware of the medical and psychological conditions that can afflict young women participating in competition sport (35, 41). Of particular concern is the "Female Athlete Triad" of Disordered Eating, Amenorrhea and Osteoporosis.

DEFINITIONS AND BASICS OF EATING DISORDERS, MENSTRUAL DYSFUNCTION AND OSTEOPOROSIS

The "Female Athlete Triad" was described in 1992 by the Women's Task Force of the American College of Sports Medicine (53). It refers to the inter-relatedness of three discrete medical entities that can occur in the female athlete population: disordered eating, menstrual dysfunction and premature osteoporosis. Individuals with one of the triad disorders are at risk and should be screened for the others.

Eating disorders and disordered eating

Eating disorders encompasses a number of abnormal eating patterns, including Anorexia Nervosa and Bulimia Nervosa. The latter two psychological conditions have strict criteria, as defined by the American Psychiatric Association (3). These must all be satisfied in order to make the diagnosis.

Anorexia Nervosa

- Refusal to maintain body weight at or above a minimally normal weight for age and height (e.g. weight loss leading to maintenance of body weight less than 85 % of

that expected; or failure to make expected weight gain during period of growth, leading to body weight less than 85 % of that expected).

- **Intense fear of gaining weight or becoming fat, even though underweight.**

- **Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight.**

- **In post-menarchal females, amenorrhea, i.e. the absence of at least three consecutive menstrual cycles.**

Specify types

Restricting type: **During the episode of anorexia nervosa, the person does not regularly engage in binge eating or purging behaviour (i.e., self-induced vomiting or the misuse of laxatives or diuretics).**

Binge eating/purging type: **During this episode of anorexia nervosa, the person regularly engages in binge eating or purging behaviour (as defined above).**

<u>Bulimia Nervosa</u>

- **Recurrent episodes of binge eating,**

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 and under similar circumstances.**
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).**

- **Recurrent inappropriate compensatory behaviour in order to prevent weight gain, such as self-induced vomiting; misuse of laxatives, diuretics, enemas, or other medications; fasting; or excessive exercise.**

- **The binge eating and inappropriate compensatory behaviours both occur, on average, at least twice a week for 3 months.**

- **Self-evaluation is unduly influenced by body shape and weight.**

- **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 or diuretics.**

Nonpurging type: **The person uses other inappropriate compensatory behavior, such as fasting or excessive exercise, but does not regularly engage in self-induced vomiting or misuse of laxatives or diuretics.**

A separate category of Eating Disorders Not Otherwise Specified (EDNOS) covers the wider variety of conditions that do not conform completely to the above definitions of anorexia and bulimia. It is important to recognize, however, that there is a spectrum of disordered eating, ranging from preoccupation with food, body size, shape and composition, to the more severe eating disorders. At any point along the continuum, there can be serious health implications. Nutritional deficiency, i.e. insufficient caloric intake for the amount of training and competition can result in an energy deficit, which in turn can lead to the other triad conditions: amenorrhea and osteoporosis.

Prevalence of eating disorders among athletes

Female athletes have a higher risk for the development of eating disorders compared to male athletes (47). Anorexia nervosa, bulimia nervosa and eating disorders not otherwise specified occur more often in female and male athletes compared to non-athletes (47, 48). Furthermore, eating disorders occur more often in female athletes of esthetical sports and sports with weight-classes, compared to sports where weight is not thought to be important for a good result.

Factors associated with eating disorders in athletes

Eating disorders may have many causes. Due to the additional stresses in the surroundings of athletes, top-level sport women seem to be more susceptible to the development of eating disorders compared to female non-athletes (48, 50). The factors associated with eating disorders in athletes include:

1. **Caloric deficiency: A sudden increase in training volume might induce a caloric deficit. This deficit might be associated with biological and social consequences and end up in eating disorders (47).**

2. **Beginning of sport-specific training before puberty: Athletes with eating disorders started their career at an earlier age compared to athletes without eating disorders (47). If an athlete starts a sport-specific training**

before puberty, growth spurt and body development might lead to a body shape that is not ideal for the selected sport. This discrepancy might end in the attempt to change body shape by food restriction.

3. Traumatical experiences: Traumatical experiences for athletes may be the loss or changing of a trainer or an injury or illness, that do not allow normal training. This might lead to weight gain and, in some cases, to an irrational fear of getting fat, and subsequently in dieting behavior in order to compensate reduction of energy expenditure (50). Other traumatical experiences that are associated with the development of eating disorders in athletes are longer lasting phases of diets, a casual comment (on body shape etc.), moving away from home, failure at school or work, problems with the partner or family, death of a friend, and sexual misuse by the trainer.

4. Compulsion to weight reduction and weight fluctuations: There is increasing awareness of the influence of body composition on athletic performance. In some activities an increase in body weight can decrease performance. However, pressure to decrease body weight or body fat percentage to unrealistic levels contribute to the development of disordered eating practices. Excessive weight loss can lead to loss of fat mass, dehydration, and a decrease in performance (36). Compulsion to weight reduction is an often mentioned possible cause for eating problems in athletes. However, the problem is not the compulsion to weight reduction per se, but the personal situation and the way of communication in which an athlete is talked to loose weight, and whether he or she is guided or not. Furthermore, athletes often have to loose weight in a short time period. The consequences are phases of diets and weight fluctuations, which are very probably associated with the risk of developing eating disorders (7, 47). Very probably, trainers alone might not cause eating disorders in athletes, although the problem might be set off or intensified by unsuitable training in vulnerable persons. The role of the trainer has to be seen as part of the whole situation.

5. Attraction of sport to persons being susceptible to eating disorders: Beside food restriction, excessive physical activity is one mean to loose weight in persons suffering from eating disorders. Therefore, one might speculate, that persons with a predisposition to eating disorders are found in sports to a higher extent than in the normal population. This might be true for a normal physical activity level. If the only motivation for an athlete for sporting is to loose weight, however, this athlete very probably will not reach the top level. Therefore, a higher prevalence of persons already suffering from eating disorders, is probably seen in recreational rather than in top level sport (48).

Consequences of eating disorders for health

Eating disorders may lead to severe health problems in athletes and non-athletes. Rate of mortality is about 6 % in anorexia nervosa (34). There are many harmful effects of poor eating behaviors, including a decrease in metabolic rate, depletion of muscle glycogen stores, loss of muscle mass, hypoglycemia and dehydration. These can render the athlete more susceptible to fatigue and musculoskeletal injuries due to impaired coordination and decreased concentration. Electrolyte imbalance may lead to serious and potentially fatal cardiac arrythmias. There are changes in the endocrine and thermoregulatory systems. Bulimics in particular may suffer from severe gastrointestinal disorders. An increase in size of parotid glands, and erosion of dental enamel may also result from recurrent vomiting of acidic stomach contents.

The long-lasting effects of eating disorders are not clear in detail. They include, however, the effects of estrogen deficiency, like skeletal demineralization, osteopenia and premature osteoporosis.

DELAYED MENARCHE AND MENSTRUAL DYSFUNCTION

Commonly, menstrual cycles are described as eumenorrheic, oligomenorrheic and amenorrheic, based on the occurrence of menstrual bleeding. The term eumenorrheic refer to cycles that occur at intervals of approximately 28 days, with the 10th and 90th percentile of 22 and 36 days respectively, for women between the ages of 20 to 40 years (52). The term oligomenorrhea is used to indicate menstrual cycles that occur inconsistently. Menstrual bleeding occurs at intervals greater than 36 days, or 3 to 6 periods a year. Amenorrhea is a clinical symptom that indicates a disruption of the reproductive

cycle with probable anovulation and refers to the absence of menstruation. In primary amenorrhea, a girl had no menarche (first menstrual bleeding) by the age of 16, or has not developed any secondary sexual characteristics such as breasts and pubic hair by the age of 14. Secondary amenorrhea refers to the cessation of menses after menarche, specifically the absence of menses for 3 consecutive months, or less than 3 periods a year (9).

The variability of the length of the menstrual cycle is only one factor in characterizing its normalcy. One must also consider hormonal levels that change according to follicular and luteal development. Three aberrations are identified: the short luteal phase, luteal phase insufficiency, and anovulation (9). The short luteal phase is characterized by a shortened menstrual cycle length (21 days and less), with hormonal pattern similar to a normal cycle. Luteal phase insufficiency is an ovulatory cycle, with deficient corpus luteum function and deficient progesterone production. Anovulation is a cycle without ovulation, though withdrawal bleeding may occur due to declining estrogen levels. These three aberrations in menses can be easily missed if only menstrual history data are available to the researcher (4).

Prevalence of menstrual dysfunction in athletes

Delayed menarche

The average age of menarche is about 12.8 and 13.0 years in North American and European girls, respectively, with a wide range of normal variation. In female athletes, it was previously thought that training prior to menarche might delay menarche, but more rigid analysis of the data has attempted to refute this theory (44). This remains, however, a controversial area. Retrospective studies have shown that by the age of 14, only 20 % of gymnasts had reached menarche, compared with 40 % of distance runners, 70 % of anorexics, and 95 % of the normal population (5). Other investigators have also documented a higher age of menarche (ranging from 14.3 to 16.2 years) in gymnasts relative to non-athletic controls (6, 10, 20, 40). Some experts maintain that these sports attract females who are genetically thin with a boyish stature and preprogrammed delay in puberty. Many gymnasts come from families with late maturation, where short stature is in part familial. Nevertheless, a decrease in training level or intensity, as occurs in the case of injury, will frequently precipitate a growth spurt and subsequent menarche in the prepubertal athlete, or resumption of cycles in an athlete with secondary amenorrhea. A 5 year prospective study found a delay in age of menarche in gymnasts (14.5 years) compared to a

control group (13.2 years), suggesting that physical training of more than 10 - 20 hours per week may be detrimental (28). Though a negative calorie balance and not the number of hours could be the cause. There is currently debate about the risks of impaired growth and development, and a fear that elite gymnasts, with their restrictive eating habits and intensive training practices, may not reach their genetically programmed adult height (50). Therefore, some authors have suggested that training should decrease during puberty (33). More research, however, is needed in this area.

Amenorrhea and oligomenorrhea

The prevalence of secondary amenorrhea and oligomenorrhea varies widely due to the lack of standard definitions for these symptoms. In the general adult population the prevalence of menstrual irregularities is estimated to be from 2 - 5 %. Surveys of adult athletes show 1 - 79 % (2, 36). These variations reflect methodological problems, like lacking of standard definitions, differences in age, sport modality, level of activity and performance, training prior to menarche, and others (11).

Short luteal phase and anovulation

Recent works have suggested that many of the so-called eumenorrheic athletes, i.e., those with regular menstrual cycles are actually suffering from hidden menstrual dysfunction such as anovulatory cycles or luteal phase insufficiencies. The exact prevalence of these less obvious forms of menstrual dysfunction is not known, as these athletes consider themselves perfectly regular. Short luteal phase and anovulation might represent a mild form of the athletic reproductive system dysfunction that can lead to amenorrhea under greater stress (27).

Factors associated with menstrual dysfunction in athletes

The factors associated with menstrual dysfunction in athletes may be divided into three major categories: genetic, environmental, and reproductive maturity (11).

1. *Genetic factors*: The high correlations that exists in menarcheal age between mothers and daughters in non-athletes seems to be less pronounced in athletes. In active females, there are other variables that are better predictors of menarcheal age such as leanness and intense prepubertal activity (45).

2. *Reproductive maturity*: Amenorrheic athletes have a higher prevalence of prior menstrual irregularities that athletes with regular cycles. These athletes seem to have an a priori tendency to menstrual dysfunction, and

exercise alone is not a causative factor. Therefore, menstrual dysfunction and athletic training are not cause-effect relationships but might rather be signs of hypothalamic-pituitary-gonadal axis maturation (27).

3. *Environmental factors*: **Among the factors that are associated with menstrual cycle disturbances in athletes are energy and nutrient balance, sport modality, performance level, body weight and composition, eating disorders, and mental stress.**

    - **<u>Energy and nutrient balance</u>: Energy availability is defined as nutritional energy intake minus energy expenditure in sport and other daily activities. Dietary restriction reduces LH pulse frequency in women (21). In animals, amenorrhea induced by exercise can be reversed by increased feeding without a reduction in the exercise regimen (30). Some athletes with a high energy expenditure have a relatively low energy intake and are therefore under a discrete but chronic energetical deficit (18). Furthermore, normalization of menstruation was observed in athletes who reduced training or increased caloric intake (16, 17). Altogether low energy intake seems to be the most important factor for the induction of menstrual cycle irregularities in athletes.**

    - **<u>Sport modality</u>: Athletic activities requiring thin bodies, such as ballet dancing, long-distance running, and gymnastics, and sports with weight classes tend to have a much higher prevalence of menstrual cycle irregularities and a later age of menarche, which might be due to the athletes pathological eating behavior and negative energy balance (46, 47, 48).**

    - **<u>Level of performance</u>: The better performing athletes tend to have higher prevalence of menstrual irregularities (42).**

The better the performance level, the higher is the daily energy expenditure especially in endurance sports, and the higher the risk of an energetical deficit.

- **<u>Body weight and composition</u>: In early studies, low body weight and low body fat was thought to be causal for the development of menstrual cycle irregularities in athletes (23, 24). Other authors, however, denied this hypothesis but favored other factors as possible causes (31). Nowadays is it generally believed that low body fat rather is a symptom of an energetical deficit rather than the main cause for menstrual irregularities in athletes, although body fat is an important endocrine organ for the conversion of androgens to estrogens (31, 48).**

- **<u>Eating disorders</u>: Anorectic patients suffer from amenorrhea due to low caloric intake. 50 % of bulimic women have menstrual cycle irregularities (49). Therefore, eating disorders very probably play an important causal role in the development of menstrual cycle irregularities in athletes (48).**

- **<u>Mental stress</u>: It is difficult to define and measure mental stress in athletes. In spite of these difficulties, it is generally believed that many athletes are subjected to constant psychological stress during training and competition. Stress mastering, however, shows a wide inter-personal variability. It is well established that mental stress plays an important role in the induction of hypothalamic dysfunction, including the GnRH pulse generator. Therefore, the individual stress reaction in one single athletes might be causally related to menstrual**

irregularities (11, 48).

Pathogenesis of menstrual dysfunction in athletes

The exact pathophysiological mechanisms leading to menstrual dysfunction in athletes are still unclear in detail. Causes of menstrual cycle disturbances may include dysfunction at the level of the hypothalamus, pituitary, ovaries or uterus. Exercise-associated amenorrhea is a diagnosis of exclusion. It is important to exclude other medical causes, including pregnancy (39). Normal initiation and maintenance of menstruation requires integration and function of all organs. The hypothalamus produces gonadotropin-releasing hormone (GnRH) in a regular pulsatile pattern. This has a direct effect on secretion of luteinizing hormone (LH) and follicle-stimulating hormone (FSH) from the pituitary gland, which subsequently stimulate ovary estrogen production and ovulation. After ovulation, both estrogen (estradiol) and progesterone are produced in high quantities by cells in the ovary (1).

Excessive exercise and/or emotional stress can affect many hormones including neurohormones like dopamine, serotonine, melatonin, endorphins, and catecholamines. Endogenous opioids, the hormones of the "runner's high", can suppress the frequency and amplitude of GnRH pulses. Melatonin and dopamine can decrease GnRH secretion. The chronic stimulation of the adrenal axis under physical and/or mental stress also has an inhibitory action on GnRH pulsatiliy (27). An imbalance between energy expenditure due to the demands of the sport, and caloric intake can cause the body to perceive inadequate net energy stores to support development of a fetus. The reproductive system effectively "shuts down" as a self-protective mechanism (32).

Consequences of menstrual irregularities for health

Amenorrhea is neither desirable nor a "normal" result of physical training. It is a symptom of an underlying problem that requires medical evaluation within the first three month of occurrence. Exercise associated amenorrhea is a diagnosis of exclusion, and all other possible causes of amenorrhea must be excluded by a thorough medical evaluation (36). Low estrogen levels may have many consequences for the female organism. Ovulation and reversal of amenorrhea are unpredictable in amenorrheic women. Because ovulation precedes menstruation, all sexually active amenorrheic women should be tested for pregnancy as part of their medical evaluation and receive contraception counseling (36). Amenorrhea, once felt to be a benign, reversible condition, has been linked to premature loss of

bone mineral density since 1984 (13). In order to assure to calcium balance, amenorrheic athletes should be encouraged to ingest at least 1500 mg of elemental calcium per day (36, 48). Beside the effects on the skeleton, menstrual dysfunction has some other complications for health. Data indicate that the beneficial effects of habitual physical activity on serum lipoprotein profiles are reversed by exercise-induced hypoestrogenic amenorrhea (11). Furthermore, the risk of endometrial hyperplasia and adenocarcinoma due to a chronic, unopposed estrogen level, which might occur in luteal phase deficiency, has been raised, but so far not been reported (8). The effects of chronically reduced estrogen levels on performance are not clear so far. However, as estrogen appears to enhance lipid oxidation and lessen glycogen depletion, a hypoestrogenic state in an athletic female might have effects on performance (8).

OSTEOPOROSIS

Definition

Osteoporosis is defined as "a systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture risk" (26).
The following diagnostic criteria have been established (26):

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

Peak bone mass

Peak bone mass or maximal bone density is reached at the third decade and possibly even earlier, with a gradual decline until menopause when more rapid bone loss occurs. At least 60 - 70 % of peak bone mass is laid down during the adolescent growth spurt. This critical "window of opportunity" for children must not be missed. Inadequate training regimens in combination with other negative factors like eating problems during childhood can delay menarche and the onset of puberty. Growth can be stunted, and as a consequence optimal bone density may not be realized.

Factors affecting bone in athletes with menstrual dysfunction

Estrogens and progesterone are important endocrine factors for maintenance of bone health by influencing remodeling processes

(19, 37). Therefore, each factor associated with menstrual dysfunction in athletes might be directly or indirectly related to loss of bone mineral density. The principle causes of premenopausal osteoporosis in athletic women are menstrual cycle irregularities according to the associated hypoestrogenemia (14, 36). Other causes include inappropriate nutritional calcium intake and vitamin D deficiency.

Bone mineral density in athletes with eating disorders and menstrual dysfunction

Hypoestrogenism in female athletes is associated with reduced bone mass and increased rates of bone loss. This loss is similar to bone loss in postmenopausal women or in women with a pathological hypoestrogenic condition such as premature ovarian failure (36). In earlier studies on female athletes with menstrual dysfunction, decreased BMD was reported only for the lumbar spine. Newer studies, however, indicate the deficit appears to be generalized throughout the skeleton (36). Whether bone loss is observed at all regional sites may depend in part on the extend of mechanical loading at specific sites in various sports (43).

Loss of BMD in athletes with menstrual cycle disturbances may be irreversible, as no changes or only slight gains in BMD could be achieved with a return of normal menstrual cycles, and/or hormonal replacement therapy (15, 25).

The combination of disordered eating practices and low calcium intake combined with menstrual dysfunction may exacerbate bone loss. Not all amenorrheic athletes, however, 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 amenorrhea: the type of skeletal loading during activity, their nutritional status, and a genetic component (12, 36). A recent study could demonstrate that weight-bearing exercise can prevent or attenuate bone loss at specific skeletal sites in normal weight bulimic patients, but not in anorectics (49).

Other consequences for the skeleton

As a consequence to the decline in BMD, athletes with menstrual dysfunction have an increased susceptibility to stress fractures, and other musculoskeletal injuries during the competitive years (29). However, amenorrheic athletes might have a pathological mental drive to do their sport, and therefore might ignore minor injuries unless they exaggerate. In these athletes, a higher prevalence of injuries is rather a consequence of overtraining than of low BMD (38).

DIAGNOSTIC CLUES

Eating disorders and disordered eating

As a trainer has close contact to his/her athlete, changes in behavior and physical symptoms should easily be recognized. However, symptoms of disordered eating in competition athletes are often ignored, not seen or realized. One explanation is a lack of knowledge about this problem. Most persons with eating disorders do not realize their health problems by themselves. They only see that something is going wrong when they get injured or loose performance (48).

Athletes suffering from bulimia nervosa often have a normal or nearly normal body weight and are therefore difficult to be diagnosed. Therefore, trainers, parents, and the people around the athlete should be able to see and realize the symptoms of disordered eating patterns.

Signs and symptoms of disordered eating may include weight loss, a decrease in athletic ability and skill, a preoccupation with calories, fat intake and weight, and increasing self-criticism. The athlete may have wide fluctuations in her weight, and avoid eating in the presence of others. Other suspicious behavior may include frequent visits to the bathroom after meals, laxative packages in lockers, and excessive physical activity over and above what is required for training.

Delayed puberty and menstrual dysfunction

The diagnosis of exercise-associated menstrual disorders is still one of exclusion and it is important to first rule out other common causes of amenorrhea. Menstrual dysfunction is obvious by the time frank amenorrhea occurs. Earlier disturbances of the hypothalamic pituitary axis, however, often initially go unrecognized. In moderation, ovulatory symptoms such as breast tenderness, food cravings, fluid retention and mood changes in the week or so before menstruation, signal that all of the interdependent hormonal systems are working correctly. If the athlete does not have any of these symptoms, she may be suffering from short luteal phase or anovulatory cycles, despite the presence of "regular" menstrual bleeding.

A full history should be taken with special emphasis on type of activity and competitive level, energy output, nutrition, eating behavior, changes in weight, and fractures history. Signs and symptoms of androgen excess, galactorrhea, and hot flushes should be looked for. Physical and pelvic examinations and measurements of blood concentrations of prolactin, thyroid function tests, FSH, LH, testosterone, DHEA-S, E2, and ßHCG should be done. A

progestin challenge test might be indicated to induce withdrawl bleeding (11).

Osteoporosis

Osteoporosis does not become evident on radiographs until approximately 20 - 30 % of bone density is lost. As definition of osteoporosis or osteopenia is based on bone mineral density, measurement of BMD is the standard method for the determination of a beginning osteopenia or more severe osteoporosis. Newer techniques of measuring BMD, specifically dual energy x-ray absorptiometry (DXA) can identify individuals with low BMD and, if done serially, can assess those who are rapidly loosing bone and monitor their response to therapy (36). In athletes with eating disorders or menstrual irregularities, who are at risk for osteoporosis or osteopenia, measurement of BMD should be performed as early as possible in order to start intervention and therapy immediately. Decreased bone density should especially be suspected in women presenting with recurrent stress fractures, or fractures associated with minimal trauma.

INTERVENTION AND TREATMENT OF THE TRIAD DISORDERS

Sensitivity and a respect for confidentiality are required when trying to help an athlete with disordered eating and other related health problems. The best time to intervene is as soon as the problem is suspected. A "caring confrontation" involves showing concern for the health, well-being, and feelings of the individual involved, without being judgemental about the behavior.

Treatment of these disorders depends on the specific medical presentation. There should be a set mechanism for referral, and a multidisciplinary team approach, including evaluation by a trained mental health professional. Amenorrhea should ideally be diagnosed and managed within 3 to 6 months, to avoid compromising bone density. A slight reduction in the amount of training, or an improvement in nutrition and/or body weight may be sufficient to allow menstrual cycles to resume. Athletes with the triad disorders should consume at least 1500 mg of elemental calcium daily. Hormonal replacement in the form of supplemental estrogen or birth control pill may be required for hypoestrogenic amenorrhea that does not respond to other therapy. If necessary, this therapy may be safely used in adolescents over the age of 16, or three years post puberty (2).

PREVENTIVE MEASURES

Prevention of the triad disorders and the accompanying medical problems remains the most efficacious and cost-effective treatment. Efforts in this area fall under the basic domains of education and enforcement.

Education

It is critical to develop a positive sporting environment that does not encourage eating disorders. Educational materials and/or seminars for athletes, parents, coaches, trainers and administrators should focus on the physiologic and psychological effects of disordered eating, amenorrhea and osteoporosis. The media, specifically that which target the high risk groups, can be utilized in a positive way to spread accurate information about healthy training methods, as well as the potential for development of the triad disorders.

Athletes should be educated early on in their career or season. There should be positive peer pressure to maintain good nutrition. An adequate support network at all levels should be developed. A nutritionist can supervise dieting if it is needed, and provide professional advice on sound, effective and safe nutritional practices. An effective referral mechanism should be in place, and should also include the availability of individual psychiatric counselling.

It is critical to have well-established coaching and/or training standards. Certification of coaches must include education regarding the Female Athlete Triad, normal child development, and safe training practices. Standards of conduct should be strictly enforced through the various licensing agencies. Coaches must be taught to recognize athletes with disordered eating patterns, and to promote sensitivity to weight issues. The setting of goals for body weight, and body fat percentage, the linking of performance to weight loss, and practices such as public weighing should be discouraged. Coaches and parents should promote healthy eating and training behaviors, with the emphasis on athletic performance and the development of lean body mass. They should reinforce specific achievements, rather than weight loss. A range of age-appropriate acceptable weights and body composition can be determined with the help of scientists such as exercise physiologists.

Parents should also be educated about normal child growth and development. Girls between 6 and 10 years of age should gain, on average, approximately 5 to 7.5 cm (2 to 3 inches) per year and about 2.5 to 3.5 kg (5 to 8 pounds) per year. Parents are advised to monitor the environment of the gymnasium or sport hall where their daughter trains. An administrative policy of "open practices" will facilitate this. Parents must be careful of over-involvement to avoid "achievement by proxy" (51).

Physicians and scientists who can address lay and professional audiences should be identified, and given opportunities to

educate these groups about health risks of the Triad disorders. Specific clinical guidelines will help primary care and team physicians to prevent, identify and treat the Triad disorders. Medical specialty groups and researchers need to address and develop preventative measures, including pre-participation screening protocols.

Important initiatives have already been undertaken by many different groups and organizations throughout the world, but much work still remains to be done.

Enforcement

Some risk sports, like gymnastics itself requires a review of rules and judging practices that may encourage unhealthy behavior. Athleticism and skill, rather than an athlete's appearance should be emphasized. Rule changes need to be initiated at the international level, and strictly enforced.

The Fédération Internationale de Gymnastics (FIG) has recently moved to increase the age requirement for senior international competition from 15 to 16 years, effective January 1, 1997. Junior international age eligibility was also increased from 12 to 13 years. The hope is that this may help to limit the amount and intensity of prepubertal training, and to create a more realistic ideal body image for gymnasts.

Alternatively, this new rule may only create further problems. Accepting a gymnast for competition at an international level one year later may cause an even greater effort to delay puberty through intense dieting and training practices. Exclusion of underweight gymnasts according to age or height could be another alternative, though, exclusion criteria have not been defined.

CONCLUSIONS

Finally, societal influences to "be thin" and "to win at any cost", should be somehow moderated. Sport for women should be promoted for the physical, social and psychological benefits that it can offer to participants of all ages and at all levels.

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